सत्यमेव जयते

Department of Science & Technology
Ministry of Science & Technology
Technology Bhawan, New Mehrauli Road
New Delhi – 110016, INDIA

Printed at: Western Printing Group, Survey of India

Annual Report 2024-25

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Government of India
Department of Science & Technology
Ministry of Science & Technology
New Delhi

Department of science and technology and its various institutions made some sincere efforts for strengthening the Science, Technology and Innovation ecosystem across the country and contributed immensely to address the R&D and innovation related challenges. The product depicted here represent some of the significant outcomes of indigenization of technology, product development, high performance computing, clean coal technology, start-up based innovations, products in various sectors, and so on.

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OVERVIEW

The Department of Science & Technology (DST) is the nodal agency in the country responsible for strengthening science, technology, and innovation. It identifies gaps in S&T sectors and promotes new areas of S&T to meet future demands. DST also connects the science and technology sectors with various government departments, academia, R&D labs/institutions, and industries. It provides extramural research and development support to scientists across institutions and disciplines through a competitive process, thereby reinforcing the education system, scientific and industrial R&D, and the overall Science, Technology, and Innovation landscape of the country.

The Department has been consistently working towards strengthening the national STI ecosystem to become a leader in science and technology, driving positive transformations for a safe, secure, and better society, and preparing the nation for future disruptions. Some key success stories from the year 2024-25 are as follows:

- **India's ranking in global S&T indices continues to rise** India ranked at 39th position in Global Innovation Index among the top innovative economies globally as per Global Innovation Index (GII) 2024. As per WIPO Report 2023, India is ranked at 6th position in terms of Patent Filing activity in the world. India improves its ranking to 49th position (2024) from 79th position (2019) as per Network Readiness Index (NRI) 2024 report. NRI is one of the leading global indices on the application and impact of information and communication technology (ICT) in 133 economies around the world.

- **Anusandhan National Research Foundation (ANRF)** has been established by ANRF act 2023 and the provisions of the ANRF Act, 2023 came into force on 5th February, 2024. ANRF represents India's pioneering efforts to unleash Indian research and innovation talent to achieve global scientific and technological excellence. The first meeting of the Executive Council of ANRF was held under the Chairmanship of Prof. Ajay K. Sood, Principal Scientific Adviser to the Government of India on August 22, 2024. Afterwards, Prime Minister Shri Narendra Modi chaired the first meeting of the Governing Board of Anusandhan National Research Foundation on 10th September, 2024. The meeting focused on discussion about India's Science and Technology landscape and redesigning of research and development programmes.

- The Union Cabinet, approved the **National Quantum Mission (NQM)** on 19th April 2023 at a total cost of Rs.6003.65 crore for a period of eight years, aiming to seed, nurture and scale up scientific and industrial R&D and create a vibrant & innovative ecosystem in Quantum Technology (QT). So far, four Thematic Hubs have been established under

NQM, each dedicated to a specific technology vertical; (i) Quantum Computing at IISc. Bengaluru, (ii) Quantum Communication at IIT Madras in association with C-DOT, New Delhi, (iii) Quantum Sensing & Metrology at IIT Bombay; and (iv) Quantum Materials & Devices at IIT Delhi.

- **The Union Cabinet, chaired by Prime Minister Shri Narendra Modi, approved the merger of DST's three umbrella schemes** viz. (i) Science and Technology (S&T) Institutional and Human Capacity Building, (ii) Research and Development and (iii) Innovation, Technology Development and Deployment into a single scheme namely **'Vigyan Dhara'** to improve the flexibility of funds flow among the programmes.

- **Geospatial Data, Infrastructure and Technology Leading to Improved Citizen Services** Government of India established the Geospatial Data Promotion and Development Committee (GDPDC), an apex body tasked with formulating strategies, guidelines, and programs to promote the geospatial sector and drive the development of the geospatial ecosystem. Operation Dronagiri was launched on November 13, 2024, at FITT, IIT Delhi, as a flagship pilot initiative in view of the National Geospatial Policy 2022. The program aims to showcase the transformative potential of geospatial technologies in Agriculture, Livelihoods & Skilling, and Transportation & Infrastructure. In its first phase, the program will focus on the districts of Varanasi in Uttar Pradesh, Sonipat in Haryana, Kamrup Metropolitan and Rural in Assam, Vijayanagaram in Andhra Pradesh, and Washim in Maharashtra.

- **National Mission on Interdisciplinary Cyber Physical System (NM-ICPS)** The NM-ICPS aims to develop the technology platforms to carry out R&D, Translational Research, Product Development, Incubating & Supporting Start-ups as well as Commercialization. 25 Technology Innovation Hubs (TIHs) have been established in several areas of advanced technologies. Initiative on Large Language Modelling (LLM)/ Generative AI entitled BharatGen Launched under NM-ICPS at TIH Foundation for IoT & IoE, IIT Bombay. BharatGen is a multimodal multilingual large language model initiative, that will develop advanced generative AI models tailored to India's linguistic, cultural, and socio-economic diversity.

While a detailed activities under each programme during the year are presented in relevant chapters, some of the key highlights of respective programmes are briefly summarized as follows;

- **Fund for Improvement of S&T Infrastructure (FIST)** in **Universities and Higher Educational Institutions** is supported in competitive mode. During the year, 108 projects, recommended from previous call, have been financially supported and a total of 138 new proposals against the fresh advertisement have been approved by the FIST Advisory Board for funding, with a total budget allocation of approximately Rs. 273 crore over five years.

- **Promotion of University Research and Scientific Excellence (PURSE**) programme is aiming to strengthen the research capacity of performing Indian Universities. During the year, nine new universities were selected under DST-PURSE to foster mission-oriented research aligned with national priorities. The scheme now includes new features such as *Scientific Social Responsibility (SSR)* and *industry collaboration*, ongoing projects actively progressing in 32 universities.

- **Sophisticated Analytical & Technical Help Institutes (SATHI)** set up shared, professionally managed science and technology infrastructure facilities across India. In April 2024, Secretary DST inaugurated the SATHI facility at IIT Kharagpur, showcasing advanced R&D infrastructure, including Time-of-Flight Secondary Ion Mass Spectrometry (TOF-SIMS) and High-Resolution TEM.

- **Policy Research Cell (PRC)** focuses on evidence based STI policy research in the identified thematic areas. In the current year, 9 Centres for Policy Research **(CPRs)** are being supported under the programme.

- **National Science & Technology Management Information System (NSTMIS)** primarily entrusted with the task of collection, collation, analysis and dissemination of vital S&T information at national level. A number of national S&T reports providing vital information on national R&D indicators are published which serves as an evidence-base for S&T assessment and policy formulation. The National S&T Survey 2024-25 on Resources Devoted to S&T Activities has been initiated with target to collect data for three years, 2021-22, 2022-23 and 2023-24. Data collection from more than 8000 R&D organizations comprising of public sector, private sector, MNCs, higher education, SIROs and NGOs spread across the country is in progress. Based on the outcome of the survey, the next issue of national publication “Research and Development Statistics” is likely to be published next year.

- **WISE-KIRAN (Knowledge Involvement in Research Advancement through Nurturing)** programmes provide different opportunities to women in the Science & Technology domain with the ultimate goal to bring gender parity in the S&T ecosystem. Department has launched the program, Women in Space and Allied Science Leadership Program (WiSLP), in collaboration with British Council (BC) to provide leadership training to early and mid-career level women scientists.

- **Cognitive Science Research Initiative (CSRI)** encourages research in highly interdisciplinary area of cognitive science that trying to address various questions through combining ideas, principles and methods of psychology, computer science, linguistics, philosophy, neuroscience etc. During 2024-25, the Department has received 1270 proposals in different sub areas of Cognitive Science. Financial support has been extended for 14 new projects and 38 ongoing projects.

- **Innovation in Science Pursuit for Inspired Research (INSPIRE)** is a flagship programme of DST to attract meritorious youth to study basic and natural sciences at the college and university level, pursue research careers in both basic and applied science areas including engineering, medicine, agriculture and veterinary sciences and thus, build the required critical human resource pool for strengthening and expanding the Science & Technology system and R & D base of the country. 653 applicants were offered INSPIRE Fellowship (for carrying out doctoral degree). Out of which 65% are female and 35% are male. Of the total awarded/offered INSPIRE Fellows, about 31% are SHE Scholars (to pursue their career in basic and natural science areas in higher academic qualifications) who have joined doctoral degree program in science and technology after availing 5 years INSPIRE Scholarship. 2944 applications were received against the 2024 call of INSPIRE Faculty Fellowship for award of INSPIRE Faculty Fellowship. INSPIRE Faculty Fellowship selection process is in progress.

- **INSPIRE-(MANAK) Million Minds Augmenting National Aspirations and Knowledge** is a flagship initiative aimed at fostering a spirit of innovation among school students. Targeting students from Classes VI to X, the program encourages young minds to conceptualize innovative ideas, providing them with opportunities to translate their concepts into tangible solutions. received 8.54 lakh ideas from middle and high schools across the country. A total of 46,926 students have been shortlisted for financial assistance of Rs. 10,000/- each under the programme. For FY 2023-24, district and state-level exhibitions (D/SLEPCs) are being conducted for 46,926 shortlisted ideas. As of December 2024, 24 DLEPCs and two SLEPCs have been organized in Jharkhand, Punjab, and Dadra and Nagar Haveli and Daman and Diu, respectively.

- **International Cooperation** programme deals the S&T related activities, strategies, planning, diplomacy at global level through the muti- & bi-lateral cooperation, being a member of different types of international forums/bodies/agencies, and participating in global missions to strengthen the India's position worldwide. The first ASEAN-India Scale Hub 2024 was hosted in Bali, Indonesia during 3-5, July 2024. India joined as the channel partner in the scaling of startup activities in 2024. About 311 participants including 100 startups from Indian (60) and ASEAN (40) regions participated in the event. The ASEAN-India ScaleHub event served as a platform to promote the sustained startups to grow further, reaching out the international market, strengthening and expanding their business networks. So far, three ASEAN companies have tied up with Indian startups to take their products in ASEAN market. The new India Science and Research Fellowship (ISRF) Programmme Call 2024-25 was launched in March 2024 for researchers of Afghanistan, Thailand, Bangladesh, Bhutan, Maldives, Myanmar, Nepal and Sri Lanka, in the themes such as Life Sciences, Veterinary Science, Fisheries, Medicine, Agriculture, Geology, Chemistry, Mathematics, Computer Science, and Engineering etc. A total number of 104 applications have been received under this call.

- **Mega Facility for Basic Research** programme aims to enable participation of Indian researchers in state-of-the-art research facilities, especially from academic and scientific sectors, and to create such facilities in and out of the country. Indian researchers are participating in experiments at Large Hadron Collider (LHC), European Organization for Nuclear Research (CERN), Geneva, Brookhaven National Laboratory (BNL), USA, Elettra Synchrotron, Italy, Fermi National Accelerator Laboratory (Fermilab), USA. Also, India is partner in establishment of international facilities like Facility for Antiproton and Ion Research (FAIR) in Germany, Thirty Meter Telescope (TMT) in USA and Square Kilometer Array (SKA) in Australia and South Africa.

- **Nano and Advanced Materials** a call for pre-proposals on "Advanced Materials" to promote the basic and applied research activities on the thrust research areas of advanced materials was launched during September-October 2024, which is in line with Vision of Vikshit Bharat 2047. Total 3,235 pre-proposals were received against the call which are being scrutinized for financial support.

- **Climate Change Programme (CCP)** is coordinating two national missions under National Action Plan for Climate Change (NAPCC) viz. National Mission for Sustaining the Himalayan Ecosystem (NMSHE) and National Mission for Strategic Knowledge on Climate Change (NMSKCC) are being implemented. During the year four Centre of Excellence (CoE) were established to work on different aspects of CC science and adaptation and established new State Climate Change Cells (SCCCs) in the UT of Ladakh.

- **National Supercomputing Mission (NSM)** jointly implemented with MeitY envisages to empower our national academic and R&D institutions by enabling the High-Performance Computing (HPC) infrastructures of various capacities. During the year, ~5 PF of computing power has been created using the indigenously developed Rudra server. with this the total capacity is increased to 32 PF.

- **Technology Development Programme (TDP)** supports R&D for development of innovative technologies in identified areas. It consists of Advanced Manufacturing Technologies (AMT), Waste Management Technologies (WMT), Technology Development Program (TDP), Biomedical Device and Technology Development Program (BDTD), Therapeutics Chemicals Program (TCP), Technology Enabling Centres (TEC). During the year, new projects in different thematic areas such as Advanced Materials and Processing, Agro Tech and Food Processing, Construction/ Infrastructure and Low-cost Building Materials and Spectroscopy/Sensors/ Devices/ Environmental Technology Solutions.

- **Clean Energy Research Initiative (CERI)** is to nurture S&T led breakthroughs to make clean energy affordable and accessible through strengthening Research and Innovation Eco-System for Clean Energy. The initiatives include Mission Innovation, a global initiative of 23 countries and the European Commission, Materials for Energy

Storage, Carbon Capture Utilisation and Storage (CCUS), Hydrogen Initiative, Solar Energy Research and Development Program, Research & Development on Clean Coal Technologies, Smart Grids Research Initiative, Building Energy Research Initiative, Electric Vehicle, and Alternative Fuels. DST has supported two Technology Deployment Test Beds under Industry-Research Consortia for Methanol and DME production in coal gasification plants. The IIT Delhi–Thermax Ltd Consortia is developing CCU technology for pre- and post-combustion, integrated with a 1.4 TPD coal-to-methanol pilot plant in Pune. CSIR-IICT Hyderabad–BHEL Consortia is erecting a facility to capture CO_2 (0.5 TPD) and convert it to Dimethyl Ether (0.18 TPD) in Hyderabad. These efforts align with Atmanirbhar Bharat and Vikshit Bharat missions, fostering self-reliance and supporting India's net-zero goals through DST-developed CCU technologies.

- **Water Technology Initiative (WTI)** initiative's goal is to promote R&D for sustainable water sourcing, quality augmentation, and recycling and reuse of water. Three Indo-Dutch Water Disaster Management projects were launched on 15th –16th October 2024.

- **National Geospatial Programme (NGP)** aims to promote R&D and science & technology in emerging areas of Geospatial technologies, policy, solution, capacity building, entrepreneurship and international cooperation for sustainable socio-economic development. Development of an Integrated Geospatial Data-Sharing Interface (GDI) was initiated as pilot in November 2023. By seamlessly integrating over 400 datasets from 27 providers, GDI platform aims to provide seamless access to geospatial data for developers in startups, government, and academia using open standards. It also serves as the technical backbone for Operation Dronagiri, a pilot project under the National Geospatial Policy 2022.

- **National Initiative for Developing and Harnessing Innovations (NIDHI)** focuses on promoting, nurturing start-ups, individual innovators, and entrepreneurship in technology. Hon'ble Minister of State (Independent Charge) of the Ministry of Science and Technology, on 6th Sept 2024 virtually inaugurated 8 new NIDHI iTBIs (Inclusive-Technology Business Incubator). During this period, 100+ startups benefited under NIDHI- Seed Support Program (SSP).

- **National Council for Science and Technology Communication (NCSTC)** largely aims at communicating and popularizing science and technology (S&T) to masses and stimulate scientific temper in interesting, informative and innovative formats at various platforms to enable delivery even up to the remote corners of India. Several activities related to low cost teaching aids, science communication through folk media, science exhibition, visit to industries, mathematics day celebration etc have been carried out during the year**.**

- **Science for Equity for Empowerment and Development (SEED)** Programme supports a variety of schemes towards the socio-economic empowerment and development of

the disadvantage sections of the society through appropriate interventions of Science, Technology, and Innovation (STI). During the period, around 10, 37 and 27 new projects were supported under the Technology Interventions for Disabled and Elderly (TIDE), Scheme for Young Scientists and Technologists (SYST) programmes, and S&T for Women (STW) programme respectively.

- **Scheduled Caste Sub Plan (SCSP) & Tribal Sub Plan (TSP)** The department has been implementing two programmes, viz Tribal Sub Plan (TSP) and Scheduled Castes Sub Plan (SCSP), since 1991-92 and 1992-93 respectively, to empower SC/ST communities through Science and Technology. During 2024, around 50 new projects have been supported in sectors such as agriculture, health, energy, and sanitation. The ongoing People and Protected Areas (PPA) program benefits around 30,000 tribal individuals in forest fringe areas through the efforts of 16 NGOs.

- **Good Laboratory Practice (GLP)** a Compliance Monitoring Programme for certification of Indian Test Facilities (TFs)/ Laboratories currently there are 60 GLP certified TFs in the country including four government laboratories. India is a full adherent to OECD Council Acts related to Mutual Acceptance of Data (MAD) since March 3, 2011, which ensures that the data generated by the GLP certified Test facilities in India is acceptable in the 39 member-countries of the OECD and other countries, thus removing the technical barriers to trade. During the financial year, 3 new TFs were certified as GLP compliant after thorough inspection and review of their facilities and GLP studies conducted therein.

- **Technical Research Centres (TRCs)** promote translational research by translating scientific discoveries and technological inventions into products and services of societal and industrial relevance. 5 TRCs were established in 5 Autonomous Institutions. Technology for the production of battery grade Lithium Iron phosphate (LFP) as a cathode material for Li-ion batteries was transferred to M/s. Altmin Pvt Ltd., Hyderabad on non-exclusive rights within India on 03/05/2024.

- **National Spatial Data Infrastructure (NSDI)** established with a mandate to “acquire, process, store, distribute and improve utilization of geospatial data”. A proof-of-concept (PoC) of Cloud-based Geospatial Platform, Geo-platform has been made operational at Survey of India, Hyderabad for high resolution (1:2,000 scale) data life cycle management of Varanasi City, Uttar Pradesh under National Urban Information System (NUIS).

- Department nurtures 25 Autonomous Bodies (ABs). These include 16 research institutions, 05 professional bodies, and 04 specialized knowledge and S&T service organizations. These institutions, with long proven history occupy a very important place in the S&T eco-system of the country. Following is a glimpse of the some of the key achievements:

- **Indian Institute of Astrophysics (IIA), Bengaluru** The first 1.44-m mirror segment for the international Thirty Meter Telescope was successfully fabricated and verified at the India-TMT Optics Fabrication Facility at IIA's CREST campus. Fabrication and testing of the first set of 5 Segment Support Assemblies and first 12 Actuators and shipment of the latter were done with industry partners**.**

- **Raman Research Institute (RRI), Bengaluru** POLIX, launched onboard XPoSat mission by ISRO on January 01, 2024, is the world's first instrument designed to operate in the medium X-ray band of 8 to 30 kilo electron Volt (keV) energy. It was conceived, designed and built at RRI. POLIX is designed to detect the scattered X-rays, enabling X-ray polarisation measurements. After initial calibrations and tests, the first light was obtained in early February and since then, the instrument has been making scientific observations.

- **Sree Chitra Tirunal Institute for Medical Sciences and Technology (SCTIMST), Trivandrum** SCTIMST launched a new innovative open isothermal amplification kit for the early diagnosis of pulmonary tuberculosis. The ***AG Chitra TB diagnostic kit*** was developed with funding received through the Technical Research Centre Scheme of DST.

- **North East Centre for Technology Application & Reach (NECTAR), Shillong** During the financial year 2024-2025, NECTAR implemented various technology application projects on pilot and demonstrative basis and skill-based capacity building trainings across various sectors such food processing, Agri and allied sectors, bamboo and handicrafts, waste management, geospatial-drone technology, communication etc. which provided benefits to more than 5000 individuals with predominantly from the Scheduled Tribe and Scheduled Caste category with significant number of female beneficiaries.

❖ **Survey of India and NATMO** continued efforts for Strengthening Survey and Mapping activity and have made some significant contributions with several geospatial solutions catering to various domains services. Government of India established the Geospatial Data Promotion and Development Committee (GDPDC), an apex body tasked with formulating strategies, guidelines, and programs to promote the geospatial sector and drive the development of the geospatial ecosystem. Operation Dronagiri was launched on November 13, 2024, at FITT, IIT Delhi, as a flagship pilot initiative under the National Geospatial Policy 2022.

❖ **Technology Development Board (TDB)** provides financial assistance to the industrial concerns and other agencies attempting development and commercial applications of indigenous technology or adapting imported technology for wider domestic application. It accepts applications for financial assistance throughout the year from all sectors

of economy such as Health & Medical, Engineering, IT, Chemical, Agriculture, Telecommunications, Road Transport, Energy & Waste Utilization, Electronics, Defence, Civil Aviation, Textile, etc. During the year 2023-24, TDB has signed five (5) national agreements and three (15) International Bilateral Projects for providing financial support to various industrial concerns. Organised the National Technology Week 2024 at INSA, Delhi.

The Department has made sincere efforts to utilize the allocated budget fruitfully to implement its planned activities and programmes during the year. DST and its autonomous institutions have contributed to overall development of the nation with meaningful S&T interventions.

CHAPTER 1

SCIENCE AND TECHNOLOGY (S&T) INSTITUTIONAL & HUMAN CAPACITY BUILDING

1.1 Research and Development Infrastructure

The scheme aims to elevate the nation's Science and Technology (S&T) ecosystem by establishing scientific research and development facilities within academic institutions and universities. These facilities play a pivotal role in enhancing the scientific capabilities of universities and research institutes while fostering a dynamic environment for collaborative research endeavors. To realize this vision, a strong focus on promoting research collaboration, building synergies among institutions, and encouraging interdisciplinary cooperation is being given. The details of the different programmemes implemented under this scheme and respective key achievements are given below;

1.1.1 Fund for Improvement of S&T Infrastructure in Universities and Higher Educational Institutions (FIST)

The Fund for Improvement of S&T Infrastructure in Universities and Higher Educational Institutions (FIST) is a flagship programme by the Government of India dedicated to strengthening scientific infrastructure at the departmental level. Recognized as a unique initiative among all S&T funding agencies, FIST exclusively supports STEM (Science, Technology, Engineering and Mathematics) departments in universities and postgraduate (PG) colleges. The programme aims to enhance the quality of research by modernizing laboratories, acquiring essential and advanced research facilities, and establishing specialized infrastructure to foster cutting-edge, globally competitive research.

FIST Programme encompasses seven broad subject areas: Life Sciences, Physical Sciences, Chemical Sciences, Engineering Sciences, Earth & Atmospheric Sciences, Mathematical Sciences**,** and PG Colleges. To date, the programme has supported 3,285 departments, including PG colleges, over 23 funding cycles, with a cumulative investment of approximately Rs. 3,450 crore.

During the year, 108 projects, recommended from previous call, have been financially supported and a total of 987 proposals were received against the fresh advertisement, out of which, 138 new proposals have been approved by the FIST Advisory Board for funding, with a total budget allocation of approximately Rs. 273 crore over five years. In addition, completion reports of 135 projects have been received which were reviewed by the respective Subject Expert Committees.

Figure: First-ever support through FIST funding granted to the Hypersonic Experimental Aerodynamics Laboratory in the Department of Aerospace Engineering, IIT Kanpur

1.1.2 Promotion of University Research and Scientific Excellence (PURSE)

Promotion of University Research and Scientific Excellence (PURSE) programmeme is a dedicated initiative aiming to strengthen the research capacity of performing Indian Universities and provide support for nurturing the research ecosystem and strengthening the R&D base of the Universities in the country. Key focus areas include achieving self-reliance through sustainable and high-yield technologies and processes. Research efforts are also directed towards understanding the molecular basis of prevalent gastrointestinal cancers, climate change studies, and the development of novel materials to combat water pollution. In addition, emphasis is placed on additive manufacturing to promote transdisciplinary research, pioneering work on theranostic agents for cancer treatment, sensor systems for rapid disease diagnosis through exhaled breath analysis, and waste-to-energy technologies. Other notable initiatives include research on molecular therapeutics and health-improving devices, materials for energy harvesting and organic synthesis, and the establishment of a comprehensive electric mobility infrastructure to drive research and foster startups in this emerging field.

To date, DST has supported 82 universities under PURSE, with a total investment of Rs. 1227 crores. In 2024, nine new universities were selected under DST-PURSE to foster mission-oriented research aligned with national priorities. The scheme now includes new features such as *Scientific Social Responsibility (SSR)* and *industry collaboration*, ongoing projects actively progressing in 32 universities. Additionally, the scheme emphasizes special drives to support under represented states. Ongoing projects across universities span a wide array of scientific themes, reflecting a strong commitment to addressing critical challenges through interdisciplinary research.

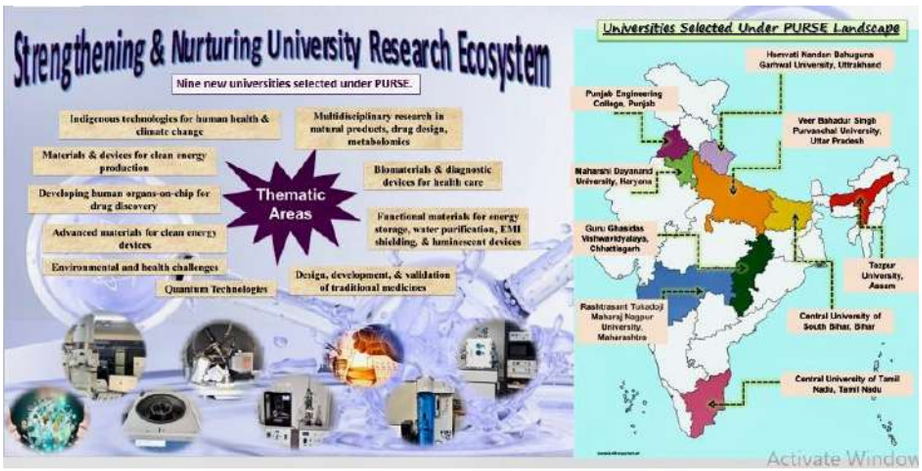


Figure: Nine new Universities supported under PURSE 2024 initiative

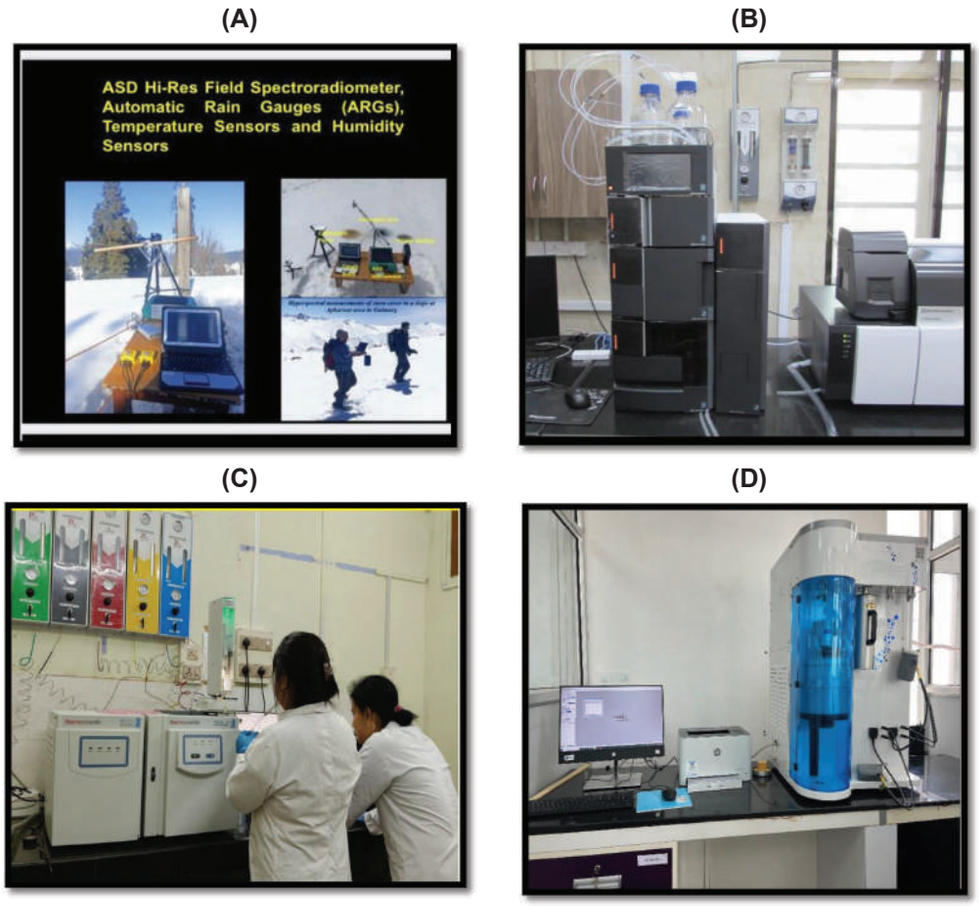


Figure: Research infrastructure developed under the DST-PURSE Scheme: a) ASD Hi-Res Field Spectroradiometer at University of Kashmir, b) Advanced Characterization Facility PF-3 at ICT, Mumbai, c) GC-MS at Dibrugarh University, and d) BET-Autosorb iQ-XR at University of Ladakh

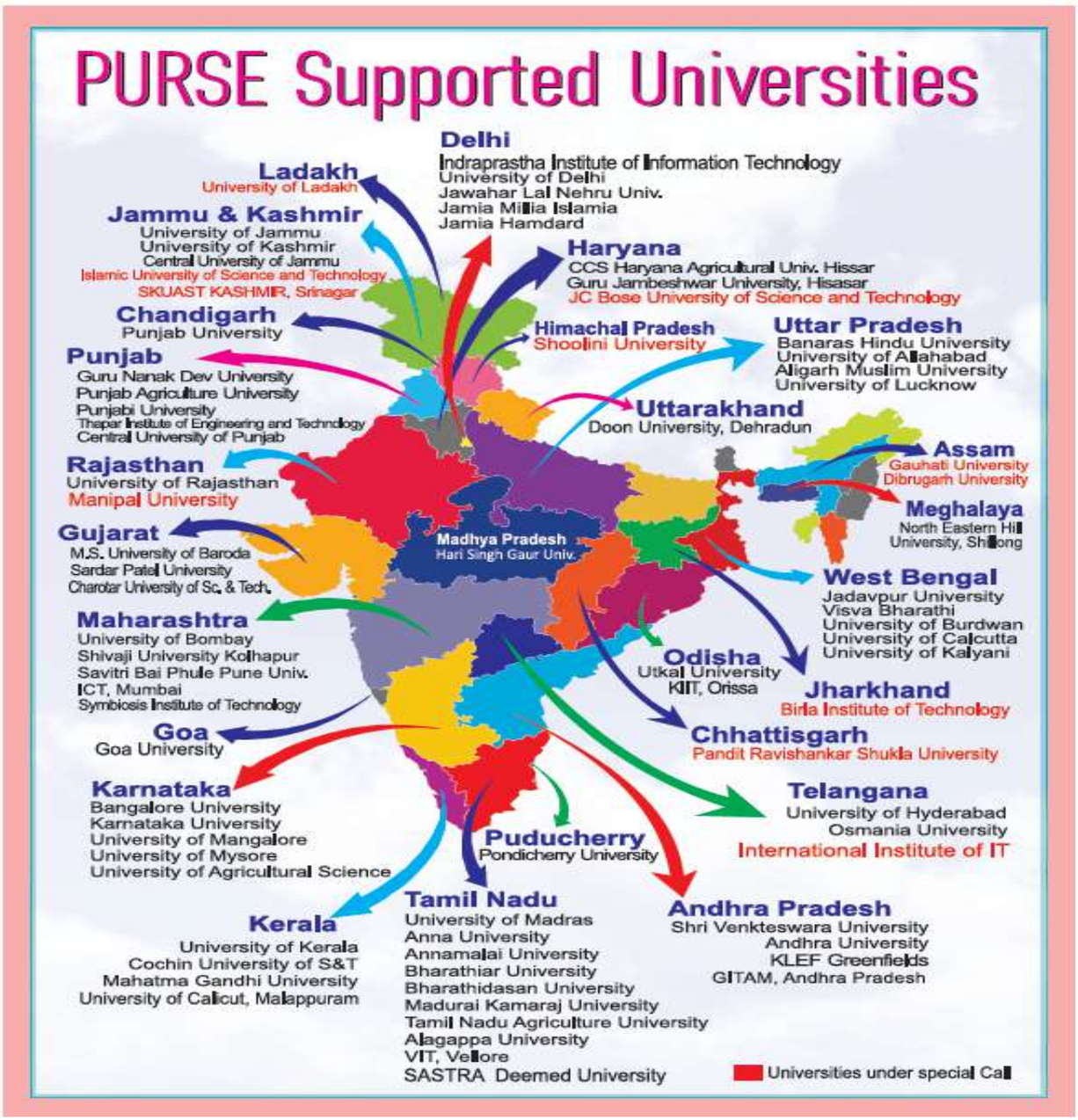


Figure: Landscape of PURSE supported universities of the Nation

1.1.3 Sophisticated Analytical Instrument Facilities (SAIF)

Sophisticated analytical instruments are crucial for advancing research across diverse fields of contemporary science and technology. Despite significant improvements in research infrastructure over the past two decades, many institutions in India still lack access to

the advanced facilities required for both fundamental and cutting-edge research. These instruments, often prohibitively expensive, are typically unsuitable for funding through individual project mechanisms. Their interdisciplinary and multidisciplinary applications make them ideal for shared use, ensuring optimal utilization. To bridge this gap, DST established the Sophisticated Analytical Instrument Facilities (SAIF) programme, providing access to advanced instrumentation and fostering research excellence.

(A) (B)

Figure: (A) 600MhZ NMR at SAIF Centre at IISc Bangalore and (B) HR-TEM at SAIF Centre at Shivaji University Kolhapur

The SAIF centers provide high-end analytical facilities to researchers, particularly from institutions without access to such instruments, enabling them to undertake R&D activities that align with global developments. Currently, 15 SAIF centers are operational across India at IIT Chennai, IIT Mumbai, CSIR-CDRI Lucknow, Panjab University Chandigarh, NEHU Shillong, IISc Bangalore, AIIMS New Delhi, Gauhati University Guwahati, C.V.M. Vallabh Vidyanagar, STIC Kochi, Shivaji University Kolhapur, IIT Patna, IIEST Shibpur, M.G. University Kottayam, and Karnataka University Dharwad.

These centers are equipped with advanced instruments such as X-ray Diffractometers, Thermal Analysis Systems, Transmission Electron Microscopes, Mass Spectrometers, Nuclear Magnetic Resonance (NMR) spectrometers, Inductively Coupled Plasma (ICP) instruments, Small Angle X-ray Scattering (SAXS), Focused Ion Beam -Scanning Electron Microscope (FIB-SEM) Facility, and more. SAIF facilities are accessible to all users, including those from academic institutions, R&D laboratories, industries, and start-ups, regardless of their affiliation with the host institute.

Some of the key activities/outcomes of the programmeme during the year are as follows;

- **Facility Management Committee Meetings & SAIF Center Visits:** Facility Management Committee (FMC) meetings were held for SAIF centers at M.G. University Kottayam, STIC Kochi, IIT Madras, etc. These meetings provided a platform for centers to present their requirements, achievements, and performance. Additionally, expert committees conducted physical visits to oversee the functioning of these centers. FMC meetings for the remaining centers are underway.

- **Analytical Services and Usage:** The SAIF centers cater to the analytical needs of researchers, scientists, and industries for a wide range of applications, including material characterization, qualitative and quantitative analysis, structural determination, and surface topography studies. During 2024-25, approximately 2,200 research papers were published with the support of SAIF centers, around 30,000 users across India benefited from the facilities, with 70% of users coming from institutions outside the host centers, and over 90,000 samples were analyzed by the 15 SAIF centers.
- **Workshops and Training Programmes:** To promote awareness and enhance technical proficiency, SAIF centers organized approximately 70 workshops and training programmes during the year. These events focused on the operation, application, and maintenance of sophisticated instruments and analytical techniques. Around 300 participants, including researchers and technicians, benefited from these programmes.

1.1.4 Sophisticated Analytical & Technical Help Institute (SATHI)

DST-SATHI scheme is one of the Department's key initiatives to set up shared, professionally managed science and technology infrastructure facilities across India. To date, five national-level Sophisticated Analytical & Technical Help Institute (SATHI) centers, equipped with advanced analytical instruments, have been established. These centers are located at IIT Delhi, IIT Kharagpur, BHU Varanasi, IIT Hyderabad, and BITS Pilani. Operating under a unified framework and one roof establishment, the SATHI centers are recognized as Section-8 entities, with each bearing the acronym of its host institute followed by "SATHI Foundation."

In April 2024, Secretary DST inaugurated the SATHI facility at IIT Kharagpur, showcasing advanced R&D infrastructure, including Time-of-Flight Secondary Ion Mass Spectrometry (TOF-SIMS) and High-Resolution TEM, in the presence of Prof. V. K. Tewari, Director -IIT Kharagpur.

Figure: Glimpses of inauguration of SATHI facility at Indian Institute of Technology Kharagpur

IIT Hyderabad was awarded this prestigious grant in recognition of its outstanding research performance and commitment to innovation. The Centre for In-Situ and Correlative Microscopy (CISCoM) facility, established at IIT Hyderabad, aims to tackle both local and global challenges by developing indigenous solutions, with technical and financial backing from over 17 academic, research, and industrial organisations. SATHI promotes Centre for In-Situ and Correlative Microscopy (CISCoM) which is professionally designed as well as aligned to provide cutting-edge microscopy capabilities for real-time characterisation across multiple length scales, supporting both fundamental and industrial R&D. By bringing together expertise from a wide range of scientific disciplines including physical sciences, chemistry, biology, geology, metallurgy and pharmaceutical studies, the centre will enable researchers to address complex scientific problems that require sophisticated microscopy techniques. Over the years, microscopy, a cornerstone of both physical, chemical and life sciences research has evolved substantially. While techniques such as optical, surface probe, and electron microscopy have provided valuable insights, the potential to combine and complement these methods is still emerging.

Figure: Glimpses of inauguration of Centre for In-Situ & Correlative Microscopy (CISCoM), at SATHI centre at Indian Institute of Technology Hyderabad (IITH), which equipped with nine state-of-the-art facilities, including the LEAP 6000 XR - a 3D Atom Probe Tomography system

The SATHI-CISCoM facility enables researchers to obtain unprecedented data from materials under various external stimuli, making it the first facility in India to offer advanced sample analysis in real-time across multiple length scales. The centre is set to play a critical role in sectors like defence, materials science, microfabrication, and pharmaceuticals. Notably, it will foster collaboration with several prominent organisations, including IITH, Defence Metallurgical Research Laboratory (DMRL), Mishra Dhatu Nigam Limited (MIDHANI), Indian Institute of Chemical Technology (IICT), Centre for Cellular and Molecular Biology (CCMB), Dr. Reddy's Labs, and Bharat Biotech, among others. By housing these advanced microscopy platforms

under one roof, CISCoM will accelerate the development of new products and the optimisation of existing processes. SATHI IIT Hyderabad is equipped with nine state-of-the-art facilities, including the LEAP 6000 XR - a 3D Atom Probe Tomography system valued at 27.5 crores. As one of only six such instruments worldwide, it enables precise atomic-scale reconstruction with exceptional spatial resolution. Other advanced tools include a micro-FTIR with mapping capabilities and an optical rheometer, all housed in a Class 100,000 cleanroom environment.

1.2 State Science and Technology Programmeme (SSTP)

State Science and Technology Programmeme (SSTP) nurtures Centre-State S&T cooperation through budgetary support to 28 State/Union Territory Science & Technology Councils. The role of the supported State/UT S&T Councils is evolving to catalyse the Science Technology and Innovation (STI) ecosystem at their State/UT level through systemic interventions under the six components of the STI ecosystem viz. R&D; Institutional & Human Capacity Building; Innovation; Technology deployment for socio-economic development; Science communication and popularization & State policies. The programme also extends support to Patent Information Centres established at the State S&T Councils to facilitate Intellectual Property Rights (IPR) related activities. Some of the significant achievements of S&T Councils during the year are summarised as below:

- **Karnataka State Council for Science and Technology (KSCST)** facilitated the establishment of a 'Fortified Energy Food Products Production Center', Yadgir, Karnataka and successfully completed the trial production of four variants of fortified foods (Children food, Adolescent food, adult food, and Family food) through Self Help Group (SHG) and obtained the Food Safety and Standards Authority of India (FSSAI) certificates for all four variants of fortified food produce. Additionally, KSCST facilitated the establishment of a 1000 kg capacity honey processing and packaging plant at the Karnataka State LAMPS Co-operative Federation in Mysuru.

Figure: Fortified Energy Food Products Production Centre, Yadgir

Figure: Honey processing and bottling plant at Karnataka State LAMPS Cooperative Federation building, Mysuru

- **Punjab State Council for Science & Technology (PSCST)** assisted International Centre of Integrated Mountain Development (ICIMOD), Nepal as technology partner for replicating the state's paddy straw palletisation initiative in the South Asian countries. Additionally, PSCST designed & demonstrated an effective air pollution control system in Plywood Industrial Sector to tackle the problem of black smoke emissions and ensure compliance with the new standards of Ministry of Environment, Forests & Climate Change. The demonstrated technology reduced particulate matter (PM) emissions by 75-80%, achieved the emission standards, and captures over 7 tons of dust per unit annually.

Figure: Visit of brick Industry by Government Officials & ICIMOD team, Nepal

Figure: Demonstration of air pollution control system

- **Rajiv Gandhi Science and Technology Commission, Maharashtra** facilitated the development of 'Krush Capsule' to address Kidney stones. This technology was developed by Department of Biotechnology, Amravati University and has been transferred to M/S Appropriate Diet Ayurveda, Nagpur for the development of a polyherbal formulation against urolithiatic (calculi or stones that form the urinary tract) conditions.

Figure: Krush Capsule, Maharashtra

- **Gujarat Council on Science and Technology (GUJCOST)** organized the 4th edition of ROBOFEST-Gujarat 4.0 to foster robotics innovation with participation across the nation. A remarkable success was achieved through attracting 1,284 registrations and showcasing 169 projects at the Proof-of-Concept (PoC) stage.

Figure: ROBOFEST Gujarat 40

- **Sikkim State Council of Science and Technology (SSCST)** conducted the 'Glacial Lake Outburst Flood (GLOF)' susceptibility analysis of 9 high risk glacier lakes and identified the potential sites for flood retention structures in the Dolma Sampa region. Additionally, SSCST conducted two field expeditions to the East Rathong Glacier (ERG) to monitor glacier dynamics. During the expedition, significant surface melting was observed in the ablation season, highlighting the glacier's sensitivity to climate changes.

- **Mizoram Science, Technology & Innovation Council (MISTIC)** facilitated the pilot scale deployment of AMPRICARE - Instantaneous hypochlorite generator using kitchen salt, in collaboration with Council for Scientific and Industrial Research – Advanced Material Processing Research Institute, Bhopal (CSIR-AMPRI) at various hospitals, sub-centres and public places in and around Aizawl city. The device is portable and user-friendly electro-chlorination device that can produce an effective 100-250 ml disinfectant solution instantaneously using kitchen salt and mobile charger, providing fresh hypochlorite solution with high disinfection efficacy.

Figure: Demonstration of AMPRICARE

- **Manipur Science and Technology Council (MASTEC)** developed a 'Bamboo Reinforced Polymer made Manipuri Mridanga' (another percussion instrument) replacing the wooden body of the Mridanga with Bamboo Reinforced Polymer body, which is lightweight, and environmentally friendly, making it ideal for Dholak crafting. It can be fabricated within hours and requires no seasoning for strength, ensuring efficiency and durability. A Patent has been granted for this instrument. Additionally, MASTEC facilitated the registration of 02 Trademarks and 01 Copyright.
- **Uttarakhand State Council for Science and Technology** initiated "Lab on Wheels" programmeme in four districts of the state namely Almora, Champawat, Dehradun and Pauri for science communication & popularization in rural areas. The programmeme was flagged off by the Hon'ble Chief Minister of Uttarakhand Shri Pushkar Singh Dhami.

Figure: Lab on Wheels" programmeme flagged off by Hon'ble Chief Minister of Uttarakhand Shri Pushkar Singh Dhami

1.3 Policy Research Cell (PRC)

Department of Science and Technology (DST) has a mandate to develop and deliver the public policy support to strengthen the science, technology and innovations in the country. Building a robust institutional mechanism for evidence-driven policy and programme planning had been identified as an important policy objective in the fourth national STI policy, STIP-2013. To realize this, DST has been implementing the Policy Research Cell. The programmeme is being implemented in two broad components: establishment of Centres for Policy Research (CPR) and supporting STI Policy Fellows to pursue research in different domains of the STI policy research. During the year, 9 CPRs are running. Among these, two; at IISc Bangalore and Panjab University were last financially supported on a new mode of funding with commitment for five years. However, other 6 CPRs; at IIT Bombay, IIT Indore, NISER Bhubaneswar, Central University of Gujarat, Central University of Rajasthan, University of Hyderabad were newly established and initially supported for 1 year. Based on the work progress, two CPRs

at IIT Indore and NISER Bhubaneswar have been recommended for the next two years, however, others only for next one year. Recently, one new CPR at INSA has also been established. In addition to establishing the CPRs, an initiative has been taken up to expand the DST STI research network by setting up of Satellite centres for Policy Research (SPRs) in few academic institutions wherein some research in STI policy areas is already under progress. The primary objective behind the SPRs is to provide institutions with opportunities to develop a better understanding of Science, Technology, and Innovation (STI) policies. As an implementation, few Satellite centres for Policy Research (SPRs) have also been identified to broaden policy research network. Initially, 10 SPRs were identified, however, during the year 6 SPRs are running. So far, five cohorts under the DST-STI policy fellowship programmeme have been completed and currently, the 6th Cohort of Policy Research Fellows are working. During the year, followings are the key highlights from the CPRs;

1.3.1 DST-CPR at Punjab University, Chandigarh

DST-CPR at Punjab University, Chandigarh is mainly focussing on STI policy and governance, promoting the private sector's incentivization in R&D, and Intellectual Property Ecosystem and other regulatory issues. During the year, CPR has undertaken various activities in these domains which are as follows;

- **Mapping the intellectual property ecosystem of Higher Educational Institutes (HEIs) of India:** There has been a significant growth and evolution in the patent landscape of India particularly in the case of Higher Educational Institutes (HEIs). In the present context, the key trends and patterns observed from the year 2000-2023 have been discussed in terms of patent filings and grants.

- The analysis of patent trends among Indian HEIs revealed that institutions from Northern India are the leaders in filings (30,114) and grants (9,034) of patents, followed by South, West, and East. State wise analysis revealed that Tamil Nadu is at forefront in patent filings (11,129), followed by New Delhi, Punjab, and Uttar Pradesh.

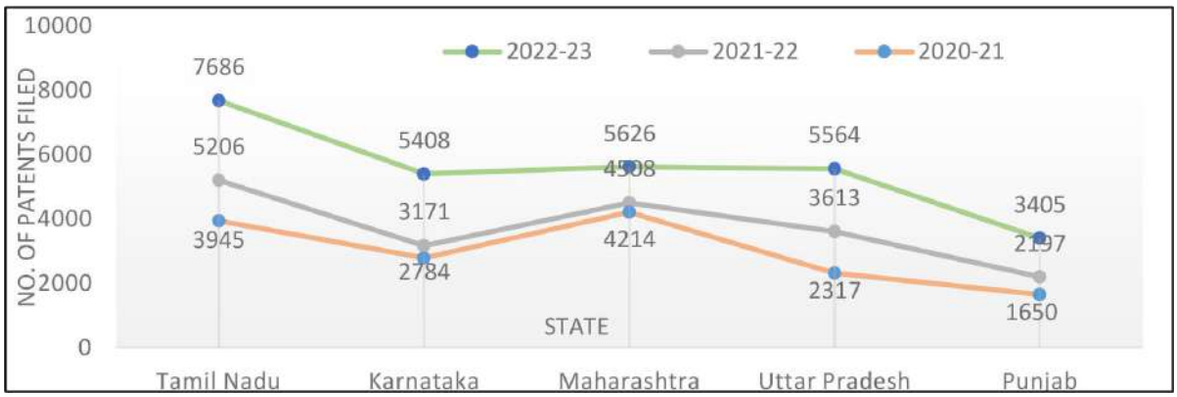


Figure: State-wise patent filing trend of Indian Nationals in the three consecutive years

- While analysing legal status it was clear that out of 66,287 patent applications, 46,976 remain pending.

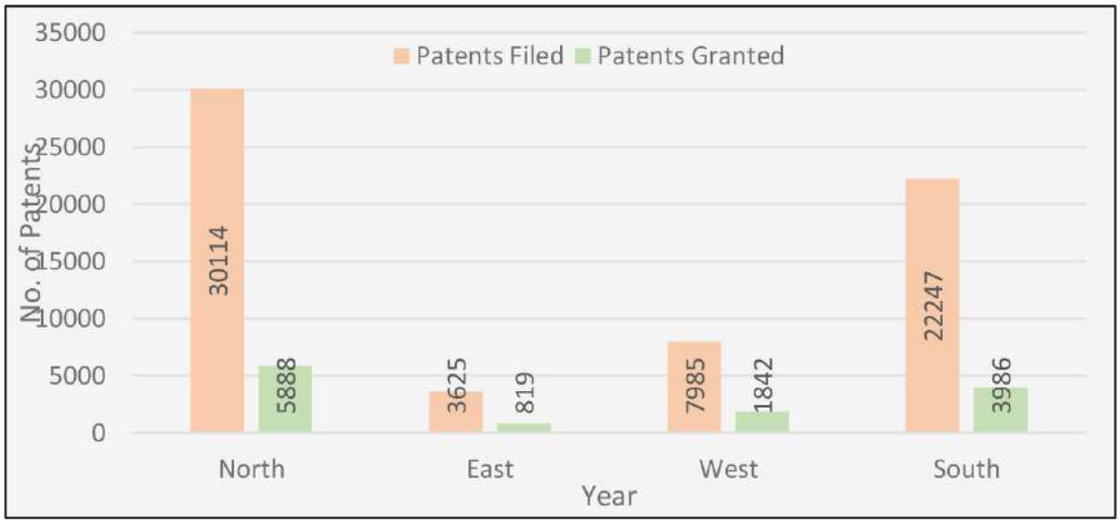


Figure: The illustration depicts patents filed and granted by the HEIs and Research Organizations in Northern, Eastern, Western, and Southern regions of India for 23 years

Institute wise analysis revealed that CSIR-funded labs led in filings (5,177), followed by Lovely Professional University (3,688). CSIR also led in patent grants (3,251), with DRDO, IIT-Bombay, and IIT-Madras following. Mechanical Engineering saw the highest grants, followed by Chemistry and Biotechnology. Followings key points have been captured based on the study analysis;

I. There is a huge gap in the number of subject-specific patent examiners appointed at the Indian Patent Office during 2022-2023 (n=593) compared to USA (n=8234) and Japan (n=1662). This calls for increasing the examiner strength at IP Offices. This will reduce the pendency timeline in the patent approvals.

II. The patent search portal INPASS should be more comprehensive and updated to allow more exhaustive and efficient prior art and other patent related searches.

III. A review of the “Annual IP Report, 2022-2023” published by IPO showed that among the top Indian applicants, private-sector organizations emerged as the leaders. Similar to this trend, the study carried out by DST-CPR for a span of 23 years (2000 to 2023) also projected that private universities and to some extent national research organizations lead the race of patent filing while government aided universities at the state and central levels are poor in patent performance.

IV. More industry focused research should be promoted in Indian academic institutions which will not only lead to increase in the number of patents over publications, but also promote commercialization as the research output will be of industrial application.

V. Also, to overcome the big gap in the patents filed and patents granted to the academic and research institutions, ranking platforms such as NIRF and others need to emphasize on the quality patents compared to the quantity patents with good commercial value.

VI. Govt. of India has recently introduced several funding schemes and allocated huge budget to improve the R&D segment of the country, despite which the budgetary inflow still seems insufficient. For this, impact assessment studies can be initiated as followed in Germany, South Korea and UK, wherein, patenting is the major criteria for faculty promotion and academic and research institutions are required to submit "Research & Impact case studies" that demonstrate the societal and economic benefits of their research project.

- **Mapping innovation dynamics and Patent Landscape of Quantum Technologies of India**

  There is a substantial increase from year 2000 to 2023 in annual patent published and grant in the field of quantum technologies (Figure)

  From year 2009 to 2016 approximately three-fold increase in number of QT patents published was observed, where a sudden increase in 2016 (n=206) was observed.

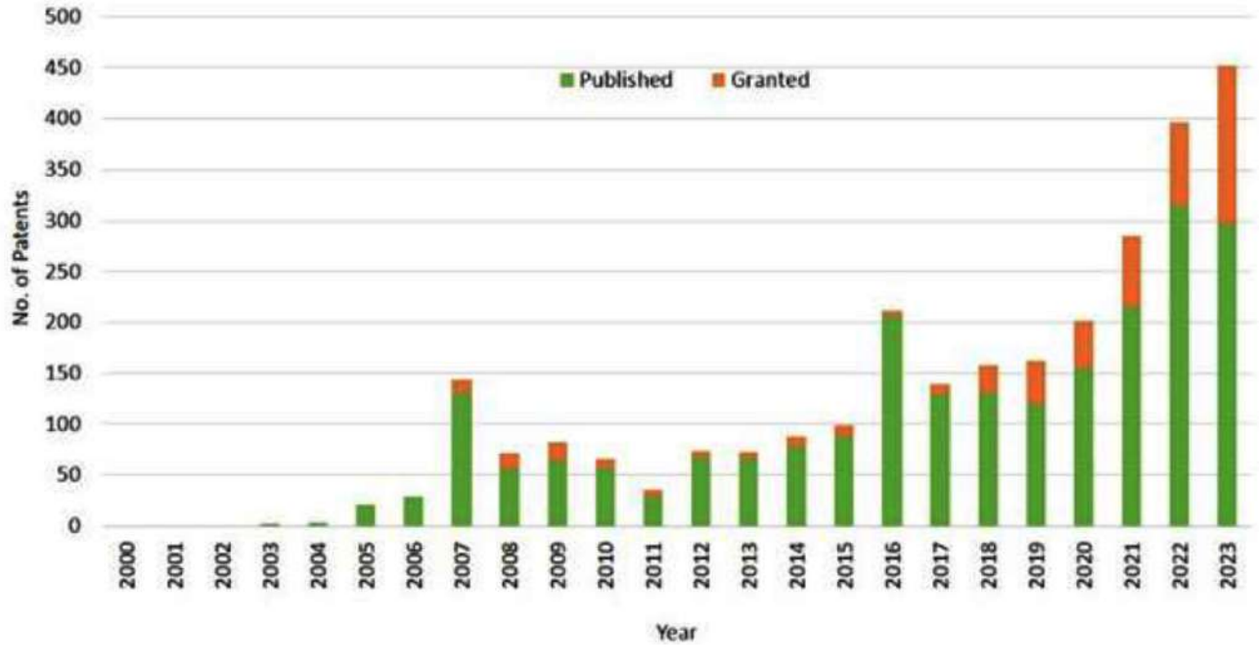


Figure: Year-wise patenting activity with respect to patents published and granted for the time period 2000 to 2023

In Quantum technology, large number of patents falls under the pending category 60% (1,366) while only 22% (493) patents come under granted category (Figure).

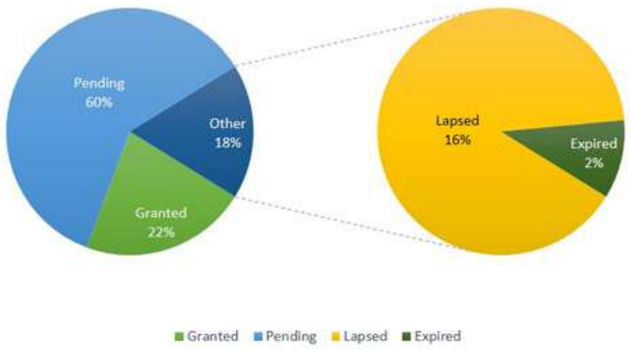


Figure: Legal status of quantum technology patents published from 2000-223

Quantum Devices lead innovation with 500 published patents and 117 grants, showing steady growth since 2006 and a sharp rise after 2021. Quantum Computing has 171 published and 6 granted patents, with significant progress after year 2019.

Quantum innovations are mainly focused in six main categories, namely, Quantum devices, Nanostructure/Q. optics, Q Information processing, Quantum Computing, Quantum cryptography, Quantum computing and Quantum communication, these innovations were further related to other key areas.

Major patent assignees include SEL (Japan), SEC (Korea), IBM, Google, IIT Bombay, and CSIR. In India, leaders in innovation are TSSOT (Assam University) and JNU (New Delhi)

Followings key points have been captured based on the study;

- A dedicated National quantum innovation fund may be set up apart from National Quantum mission fund to support startups, entrepreneurs or private player to provide seed funding. This can work like QED-C, US that brings together industry, academia, startups, and government to collectively advance quantum technologies
- A effective an equitable governance framework may be constituted to take maximum benefits of quantum innovations as well as to address future challenges.
- A targeted incentivization programme can be introduced to enhance collaborations of state and central universities with other organizations or industry.

- **Public private partnership in R&D ecosystem in India:** Initiatives such as policy advocacy, existing innovation practices, funding programmemes, and collaborative frameworks were mapped to stimulate private sector participation through Public Private Partnerships (PPPs) in the R&D ecosystem of India. Followings outcomes have been drawn based on the study;

  - Recommendations were drawn in the form of a white paper which can set a background for charting a road map to strengthen India's knowledge-based economy through PPPs led R&D.
  - Driver, Opportunities, Challenges, and Capabilities were identified to develop a framework to nurture the PPPs led R&D in India for STI.
  - In addition, global practices were also mapped and a comparison is presented based on indicators to identify which vertical India needs to put effort in.
  - A focused study was conducted to increase PPP engagement in disaster management at the national and regional levels.

- **Fostering Industry-Academia linkages to boost innovation and Technology Transfer**

  DST-CPR, PU gave evidence-based recommendations for fostering IA interlinkages through a questionnaire-based study to pitch the gap between Industry and academia. PHD Chamber (10.0 Point Scale) & DSIR Studies are referred for this study. Further, various IA models & best practices are being studied to propose a new comprehensive model for Indian HEIs.

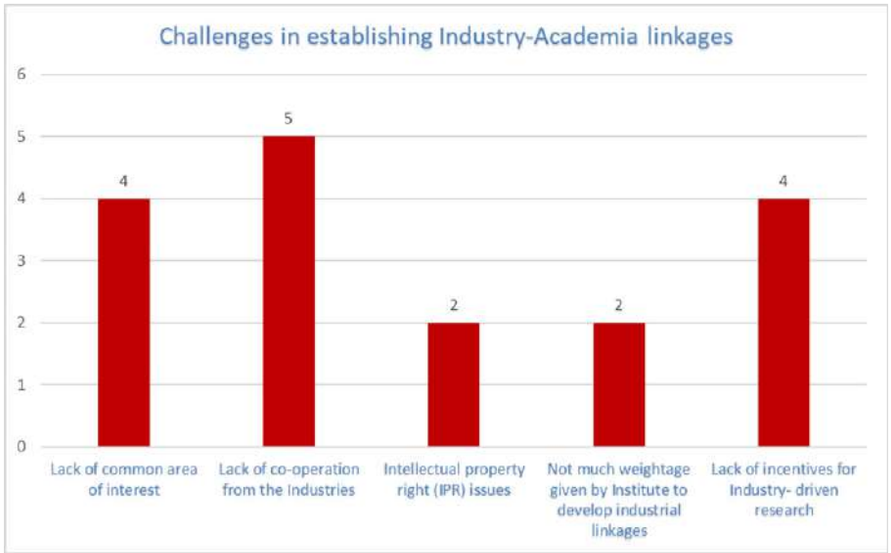
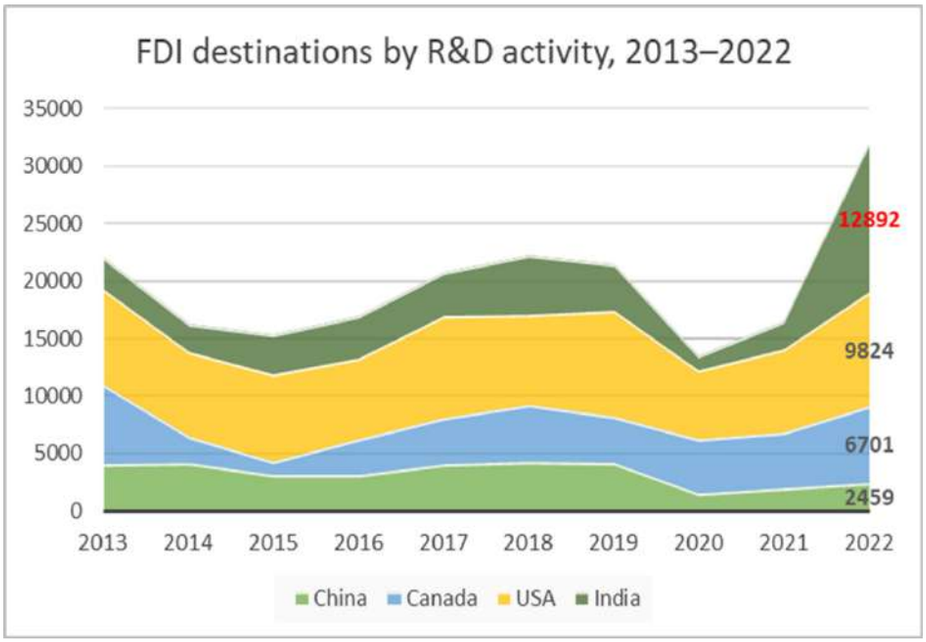


Figure: Challenges in establishing Industry-Academia Interlinkages

Followings outcomes have been drawn based on the study;

- The study highlights the development and strengthening of the industry-academia ecosystem in India by focusing on the best-performing states Gujarat, Karnataka, and Kerala known for their high University-Industry Linkages (UIL) scores based on PHD Chamber study.
- It is inferred that the Interlinkage of IA is not properly investigated in Northern and NE region-based HEIs.
- It is recommended that IA chairs must be established in universities to attract Industry partnership with HEIs.

- **STI financing in R&D:** To identify the areas of policy gaps for stimulating the private sector's investment in R&D, a study on understanding FDI's contribution to India's R&D ecosystem (2013–2023) was conducted. FDI data across 17 sectors at national and international levels was analysed.



Data source: *FDI Markets database*

Figure: FDI destinations by R&D activity, 2013-2022

Followings outcomes have been drawn based on the study;

- The results revealed that despite an improvement in the innovation quotient, India's R&D investment stands at a meagre 0.7% of the GDP.

- The private sector contributes 37% to GERD but there is limited FDI contribution to R&D. The policy measures:
- Make in India and liberalized FDI norms have been put in place so that FDI into R&D may grow which have raised FDI inflow to a great level.
- To sustain growth, innovation-driven ecosystems may be fostered, raised GERD to 2.5%, and better leverage MNCs' R&D contributions, as highlighted in the NEP 2020.

A study to leverage CSR to boost private sector's involvement in R&D is underway. For the same, the Business Responsibility and Sustainability Report (BRSR), a mandate from SEBI is being analyzed. Insights include regional contributions, industry performance, government collaboration, expenditures, revenue allocation, innovations, CSR projects, academic partnerships, and intellectual property outcomes in CSR-linked R&D. The goal chart a course to aid investments of CSR into an STI ecosystem.

1.3.2 DST-CPR at Indian Institute of Science, Bangalore

DST-Centre for Policy Research (DST-CPR) at the Indian Institute of Science (IISc) is dedicatedly working on variety of topics under the broad themes of Scientometrics (metrics of STI activity through a quantitative study of publications, collaborations, and R&D expenditure), Emerging Technologies (urban transport and mobility, ideas for modernizing rural health infrastructure, biosecurity and science diplomacy), and Diversity, Equity and Inclusion (open access, open science, and responsible research assessment). The Centre's research results are widely shared through research publications, opinion articles in news media, and conference and seminar presentations. The Centre engages closely with different government bodies, private organizations and academic institutions of national and international repute to provide pragmatic and evidence-based recommendations for enhancing decision-making processes in Science, Technology and Innovation (STI). In addition to collaborative projects, research publications and reports, the Centre is actively involved in various outreach, capacity-building, and training activities. It has contributed to the preparation of the draft 5th National Science, Technology and Innovation Policy (STIP), Scientific Research Infrastructure for Maintenance and Networks (SRIMAN) policy, Scientific Social Responsibility (SSR) guidelines, and management of the DST STI Policy Fellowship. Followings are the theme-wise details of key activities carried out by the centre during the year;

- **Scientometrics:** DST-CPR is working with Scientometrics and focuses on understanding how best we can measure the progress in science and technology in India. The Center's work on a more accurate understanding of the country's spending on R&D, and on developing new indicators to assess the research and development contexts, is a crucial

contribution. The current work in this area is focused on the contribution of industrial R&D to overall R&D spending in the country.

- The Center's work on scientometric analysis of publications from India's higher education institutions offers valuable insights into the performance of the country's research ecosystem. By evaluating trends such as journal impact, citation patterns, and field-specific outputs, DST-CPR supports evidence-based policymaking in science, technology, and innovation. The Center is now expanding into advanced scientometric studies using machine learning, paving the way for deeper analyses of India's research landscape.

- **Emerging Technologies and Diplomacy:** The focus of the Centre's research on Urban Transport Systems is on: (1) analysis, planning, and operations of multimodal mass transit systems, (2) multimodal accessibility-based metrics to shift the focus of transport planning away from predominantly easing vehicular movement to enhancing mobility and accessibility for people via a variety of modes, including non-motorized modes.

  At the interface of Biosecurity & Science Diplomacy, DST-CPR examines emerging risks at the intersection of science and technology, including synthetic biology, genome editing, and AI. Its research aims to address regulatory gaps and propose solutions for biosecurity challenges. The Centre's work in this field has received recognition through projects with independent funding.

- In the field of Rural Healthcare Infrastructure (RHI), the Centre's research delves into lifecycle management issues related to incorporating modern / novel technologies. The RHI in India comprises Primary Health Centres (PHCs) and Mobile Health Units (MHUs), which together with healthcare workers, equipment, health finance and telehealth services form the core of the rural healthcare delivery system. While there has been significant focus and advancements in telemedicine and health services, there are notable gaps in the functioning and operations of PHCs as well as the MHUs. Hence, we adopt a systemic macro-level perspective on the design and operations of the RHI, exploring a systemic integration between PHCs and MHUs. The research is based on empirical studies, conceptual design and what-if studies using computational models.

- **Access and Inclusion in S&T:** A major focus area is Open Science, which is central to the Center's metascience efforts. By advocating for accessible and transparent research, DST-CPR aims to eliminate barriers to knowledge access. The Center's work on open access policies in India is a notable contribution to the open access landscape. In 2022, the Center hosted the first Open Science South Asia Network Conference, fostering regional collaboration on Open Science practices. Funded by the Code for Science and Society, DST-CPR also explores how Open Science can increase India's research competitiveness, advocating for a shift from traditional metrics to societal impact indicators and enhanced data sharing. These efforts have raised awareness of

Open Science in India, leading to its inclusion as a key component in the draft Science, Technology, and Innovation Policy (STIP) 2020.

In the area of responsible research assessment, DST-CPR works to move Indian academia away from metrics such as journal impact factors and toward more meaningful evaluations. Funded by the San Francisco Declaration on Research Assessment (DORA), the Center has organized workshops to address the gaps in current assessment practices. Building on this, DST-CPR is a key partner in the AGORRA initiative, a global consortium advancing research assessment reforms, with support from the Research on Research Institute (RoRI), UK. By engaging stakeholders at various levels, the Center aims to align India's practices with global best practices, focusing on the quality, relevance, and societal impact of research.

DST-CPR also addresses critical gaps in research prioritization, ethics, and integrity. Its Retraction Dashboard, funded by the Open Research Funders Group, tracks retractions of publications from Indian institutions, fostering greater accountability. Additionally, its research on health priorities revealed significant misalignments between India's disease burden and research focus, underscoring the need for better-targeted scientific efforts. These findings have influenced policy discussions and highlighted the importance of ethical and locally relevant research.

1.3.3 DST-CPR at the Indian Institute of Bombay, Mumbai

DST-Centre for Policy Research (DST-CPR) at the Indian Institute of Bombay is dedicatedly working on Data and Digital Governance for Policymaking. During the year following policy briefs have been submitted by the CPR;

- Digital Governance: A Jal Jeevan Mission Study
- JJM Database: From Monitoring to Decision Support Tool
- Transitioning Towards Digital and Data-Driven Decision Support System: The Case of JJM in Maharashtra
- Studying Failure in Aadhaar-Based Demographic Authentication for "Non-Dominant" Name Patterns Due to Portal Design: Evidence from SARAL Policy of Maharashtra
- Source Sustainability: A Critical Issue in Maharashtra's Rural Drinking Water Supply (in process)

1.3.4 DST-CPR at the Indian Institute of Indore, Madhya Pradesh

DST Centre for Policy Research (DST-CPR) at IIT Indore is dealing with two thematic areas; Sectoral STI and Intellectual Property Ecosystem in which sub areas such as Water, Environment, Climate Change (Health, Agriculture, Disaster Risk Reduction, Clean Energy, etc)

in “S&T for sectoral development” theme and IPR policies, Patent innovation/ facilitation and IPR Vs. Open Science are being dealt in Intellectual Property Ecosystem theme, respectively. During the year, key achievements included advancements in water management, climate change strategies, and intellectual property rights (IPRs). The importance of alternative mechanisms for North-South technology transfer was highlighted, with suggestions such as patent pools and compulsory licenses to facilitate the global dissemination of climate change technologies. The centre worked on enhancing regional water management through the integration of local practices with advanced technologies like AI, IoT, and big data. Research addressed critical challenges, including surface water pollution, urban water stress, and wastewater management, using historical and predictive analyses. Patent landscape reports provided valuable insights into green technologies such as solar and bioplastic production, emphasizing the role of corporate inventors and the potential of clean energy innovations. Workshops brought together scientists, policymakers, and stakeholders to discuss sustainable water practices, restoration of traditional water bodies, and aligning technological innovation with environmental resilience. These efforts collectively aimed to improve decision-making, foster environmental sustainability, and address pressing challenges like urban drought and extreme precipitation events.

Figure: Adaptation strategies and policy responses while addressing the climate change impact on water policy and management

Under the DST-CPR project, a series of workshops were conducted to foster knowledge exchange and collaboration among stakeholders.

Facilitation of Sustainable Transition through Comprehensive Analysis and Promotion of IPRs
Patent landscape reports on green technologies, open access, and other relevant intellectual property rights (IPRs), including agriculture and geographical indications, provide valuable insights into the current state and emerging trends. For instance, the Patent Landscape Report on solar technologies reveals a significant rise in the number of patents registered over the past decade, with a total of 10,312 patents identified, underscoring its potential as a cleaner energy source. Corporate inventors lead in Solar Energy Technologies, followed by

individual inventors and government or academic institutions. Similarly, in bioplastic production technology, corporate assignees dominate over their government, academic, and individual counterparts. Notably, Amity University and Sulur Subramaniam Vanangamudi stand out as major patent holders in India, highlighting the need for greater private sector involvement to foster innovation and commercialization. In parallel, waste management for bioenergy and biofuel production in Central India has emerged as a critical area of focus. Research in this domain emphasizes the potential of converting agricultural, industrial, and municipal waste into bioenergy and biofuels, aligning with sustainability goals such as reducing carbon emissions and enhancing energy security. While promising, the implementation of waste-to-energy solutions faces challenges, including insufficient infrastructure, financial constraints, and a lack of public awareness. Overcoming these barriers demands coordinated efforts from government, industry, and academia, along with innovative financial models and incentive-based policies. These integrated approaches not only address immediate challenges but also pave the way for a circular economy and support India's broader transition toward sustainable energy systems.

Under the DST-CPR initiative, significant contributions to academic research and knowledge dissemination have been made through the publication of a book, research papers, and conference engagements. The book, Technological Innovation and Intellectual Property, examines the intersection of innovation, intellectual property rights (IPRs), and sustainable development, offering strategies to address environmental and societal challenges. Notable research papers include Water Metering in Managing Urban Water Stress and Policy Recommendation, focusing on urban water usage efficiency; AI and ML in Modernizing Water and Wastewater Treatment Processes, highlighting advanced wastewater technologies; Next-Gen Wastewater Management Policies: A Global Perspective and Roadmap for India, proposing actionable strategies for India's wastewater issues; and Regional Disparities and Evolving Trends in Water Policy across India, analyzing policy gaps and governance trends. Additionally, the paper Does the Presence of Foreign Firms Help Technological Upgradation in Indian Firms? was published in the Economic and Political Weekly, alongside a book chapter, Patent Policy Changes in India and their Implications, featured in the Handbook of Innovation and Intellectual Property Rights. Further, insights were shared in a conference talk titled Emerging Issues in Innovation Policy in India. These contributions collectively advance knowledge and support evidence-based policymaking.

1.3.5 DST-CPR at National Institute of Science Education and Research, Bhubaneswar

DST Centre for Policy Research (DST-CPR) at National Institute of Science Education and Research, Bhubaneswar is mainly focussing on two areas; Energy Transition and Tribal Education, Innovations for Tribal Education. During the year CPR has carried out research activities on 1) Status of Energy Transition in Odisha, Jharkhand, Bihar, 2) Barriers and Facilitators to Education for Tribal Populations in India, and 3) upscaling Solar PV Technology

in India addressing the potential, challenges and policy measures. Additionally, CPR has conducted some seminar and trainings in the working areas.

1.3.6 DST-CPR at University of Hyderabad, Telangana

DST Centre for Policy Research (DST-CPR) at University of Hyderabad, Telangana is dedicatedly working on Innovation & Start-up Ecosystem, and S&T Communication. CPR has organized few workshops related to Start-up ecosystem. These workshops aimed at highlighting career opportunities associated with entrepreneurship, understanding benefits of intellectual property for academia and start-ups, assessing technological readiness in R and D institutions and identifying the role the National Innovation and Start-up Policy will play for start-ups and academia. The learnings derived from the workshops aided in enhancing the university level policies for research, innovation, start-ups establishments, innovation facilitation and patenting.

Several field visits to different formal and informal institutions were performed towards the study related to Science Technology and Innovations Policy and Governance (Mainstreaming Grassroots Innovations & Traditional Knowledge Practices in India). Symposium on "Science, technology and Innovations in India" was organised. The event saw participation of distinguished scholars in the fields of science, technology, and innovation studies, alongside grassroots innovators from across India. The CPR-UoH will map the efforts of eminent research institutions and universities in India to develop a framework/model for promoting a vibrant innovation culture across higher education and research institutions in the country. The centre will identify prominent institutions in terms of domains of strong research and innovation contribution and suggest a policy document for the next twenty years of STI research in India. It will also propose guidelines for promoting grassroots innovations and mechanisms for mainstreaming these innovations in India. Furthermore, the centre will suggest policy recommendations for integrating grassroots innovations with formal institutions of research education in the country.

CPR has also planned to build science communication capacity across levels in the knowledge chain (scientists, researchers, civil society groups, and media) to map efforts in public engagement and policy advocacy in India. In line with these objectives, a series of round table discussions with stakeholders were conducted to identify about the need for and possible approaches to capacity building in science communication among scientists and science graduates. Additionally, review of published literature on 1) public engagement initiatives and science policy dialogue in BRICS democracies and (2) curricula and design of existing science communication courses (both long and short-term) across India is being performed. Future work aims at developing a toolkit for R&D units and short-term science communication workshop modules for scientists at different career stages. Based on ongoing discussions with key stakeholders such as scientists, science educators, and communicators, they will also develop and trial a draft curriculum in post-graduate STEM programmes.

1.3.7 DST-CPR at Central University of Gujarat

DST Centre for Policy Research (DST-CPR) at Central University of Gujarat is having a primary mandate to develop indicators for assessing and advancing equity and inclusion in Science, Technology, and Innovation (STI) across Western India, encompassing the states of Rajasthan, Gujarat, Maharashtra, Goa, and the Union Territory of Daman and Diu. The centre's research spans both formal and informal sectors of STI.Since January 2024, DST-CPR has gathered data from 29 higher education and research institutes, extensively examining marginalization on the basis of gender, caste, disability, linguistic proficiency, regionalism and economic access.

The centre's investigation has challenged the traditional notion of science being value-neutral revealing several systemic barriers within the STI sector, including entry-level obstacles, vertical segregation patterns, institutional climate concerns and career progression challenges. The methodology follows an intersectional framework for both data collection and analysis processes, instrumental in understanding how multiple forms of marginalization create unique experiences of discrimination.

Along with formal institutions, the centre has conducted research in the informal sector, including a case study of the *Agariyas* in the Little Rann of Kutch, Gujarat. The research has also been expanded to include verticals addressing LGBTQIA+ representation and challenges in higher education, as well as ageism related discrimination in the STI sector. The centre has completed a draft of policy brief on disability and ensuing marginalization in the STI sector and is currently developing additional policy briefs addressing gender and caste marginalization.

In addition, a National Brainstorming Workshop on "Transforming Science, Technology and Innovation Ecosystem of India" was conducted at INSA, Delhi on May 22, 2024 in which a report on "Science, Technology and Innovation Mapping of Indian States and Union Territories" was launched by Secretary, DST.

Figure: Glimpse National Brainstorming workshop on Transforming Science, Technology and Innovation Ecosystem of India

1.4 National Science and Technology Management Information System (NSTMIS)

The National Science and Technology Management Information System (NSTMIS) programmeme being implemented since inception of the department, is responsible for assessment and benchmarking of S&T potential of the country. NSTMIS is primarily entrusted with the task of collection, collation, analysis and dissemination of vital S&T information at national level. A number of national S&T reports providing vital information on national R&D indicators are published which serves as an evidence-base for S&T assessment and policy formulation. These publications are acclaimed both nationally and internationally and are widely referred to by scientists, funding agencies, planners, policy makers, scholars and academicians.

1.4.1 S&T Resources Studies

The **National S&T Survey 2024-25** on Resources Devoted to S&T Activities has been initiated with target to collect data for three years, 2021-22, 2022-23 and 2023-24. The survey questionnaires and the population of R&D institutions to be covered under the survey have been finalized. The survey has been launched both in print and online mode. Data collection from more than 8000 R&D organizations comprising of public sector, private sector, MNCs, higher education, SIROs and NGOs spread across the country is in progress. Based on the outcome of the survey, the next issue of national publication **"Research and Development Statistics"** is likely to be published next year which would serve as an evidence base for the policy formulation in the S&T sector.

A spin-off publication of the National S&T Survey entitled **'Directory of R&D Institutions 2025'** is also being brought out under NSTMIS. This directory will be the thirteenth in series containing a list of 8252 R&D organizations with complete addresses arranged alphabetically by S&T sectors. Details on various communication modes such as phone, email, website addresses, wherever possible, have also been included. The Directory is widely used by wide range of stakeholders engaged in policy making, science planning, administration, industry, teaching and research apart from other stakeholders. Some glimpses of the upcoming directory are as under:

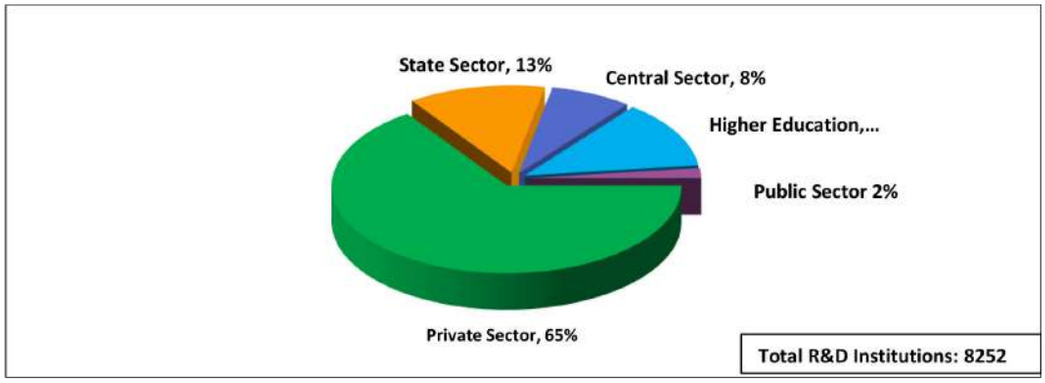


Figure: Sector-wise Distribution of R&D Institutions, 2025

Source: NSTMIS, Department of Science & Technology, Government of India

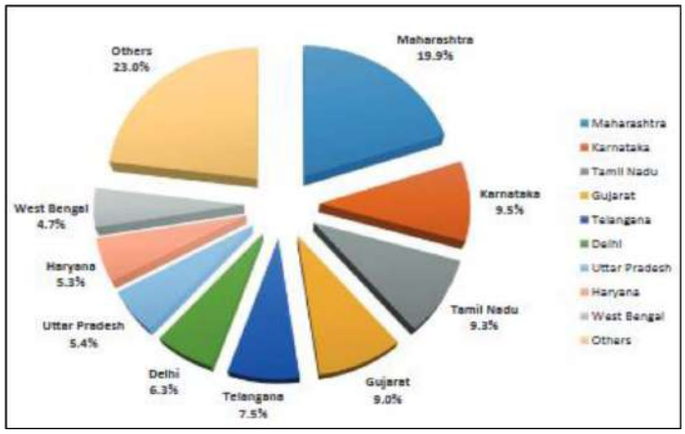


Figure: State-wise Distribution of R&D Institutions, 2025

Source: NSTMIS, Department of Science & Technology, Government of India

1.4.2 Information System/Database Activities

With a view to disseminate information on sponsored research and development (R&D) projects for the benefit of different stakeholders, NSTMIS since 1990-91, has been continuously engaged in compiling information on extramural R&D projects funded by various central S&T agencies and publishing an annual ***Directory of Extramural R&D Projects***. The latest directories "**Directory of Extramural R&D Projects"** for the years **2021-22, 2022-23 and 2023-24** are being compiled and would be published during next year.

1.4.3 NSTMIS Sponsored Studies

As a part of its outreach research programmeme, NSTMIS has sponsored several research studies/projects to various stakeholders viz. research institutions, universities, colleges, NGOs and consultancy organizations spread across the country. At present, there are around 20 ongoing projects being implemented under the programmeme. The reports/study findings from the completed projects are available in public domain through the web-based digital repository (http://www.nstmis-dst.org/NSTDRepository.aspx). A new call for inviting proposals 2024-25 under the NSTMIS programmeme has been launched. The themes for the call have been identified upon extensive discussions with expert members. The main theme areas for call for proposal are Technology Studies, STI intervention for Viksit Bharat 2047, S&T Policy Studies and Research Assessment through bibliometric & impact studies.

1.4.4 International engagements in STI data

The department has participated in the OECD Working Party of National Experts on Science and Technology Indicators (NESTI) and Management and Analysis of R&D and Innovation Administrative Data (MARIAD) meetings during 14-18, October 2024 in Paris,

France. Participation of DST-NSTMIS in the OECD-NESTI platform is significant in terms of mutual learnings that can contribute to development of the national STI data framework in India and abroad.

Department has also actively participated and contributed to the UNESCO Institutes of Statistics (UIS) and other OECD meetings for the development and revision of standards/concepts/ definitions used for collection of Science Statistics and development of Science, Technology and Innovation Indicators. The department also provided information for the country on Science & Technology Indicators to UNESCO Institute for Statistics for the Global database on S&T Indicators and other related publications such as UNESCO Science Report etc.

1.5 Training of Scientists and Technologists Working in Government Sector

Department of Science & Technology (DST), in consultation with DoPT, other Scientific Departments and various organizations initiated an ambitious project of Human Resource Development namely "National Programmeme for Training of Scientists & Technologists working in Government Sector for scientific and Technical personnel during the Xth five-year plan to meet the challenges of national development and international competitiveness in S&T area. Considering the efficacy of the Scheme, the Department decided to continue it in the XIth five-year plan, XIIth five-year plan and for financial years 2017-18, 2018-19, 2019-20, 2020-21, 2021-22, 2022-23, 2023-24 & 2024-25 as well. Training imparted to Scientists & Technologists strives to achieve better understanding of professional requirements, enhancing professional knowledge and skills needed for better performance of individuals and organizations in the profession of science and technology, creating awareness of latest technological, economic and social developments and infusion of scientific temper in the society, generating responsiveness to the challenging needs of the democratic system and expectations of the citizens from the scientific and technological developments, providing structured forum for peer to peer interaction, experience sharing and exchange of views among the scientific community for better networking and synergy.

Target groups for the training are "Scientists/ Technologists holding scientific posts/ working in scientific ministries/ departments of Govt. of India and State Governments, Autonomous Institutions/ Public Sector Undertakings of Central/State Governments, Research and Development Institutions/ Research Laboratories of Central/ State Governments, Central/ State Universities, State Science & Technology Councils." 33 training programmemes were approved in the FY 2024-25 under this scheme and 780 scientists benefited from the training programmemes.

Government of India launched the National Programmeme for Civil Services Capacity Building ('NPCSCB') – "Mission Karmayogi" in September 2020 with the objective of enhancing governance through Civil Service Capacity Building. Capacity Building Commission (CBC) has developed Annual Capacity Building Plan (ACBP) in consultation with Capacity Building Unit (CBU) of DST.

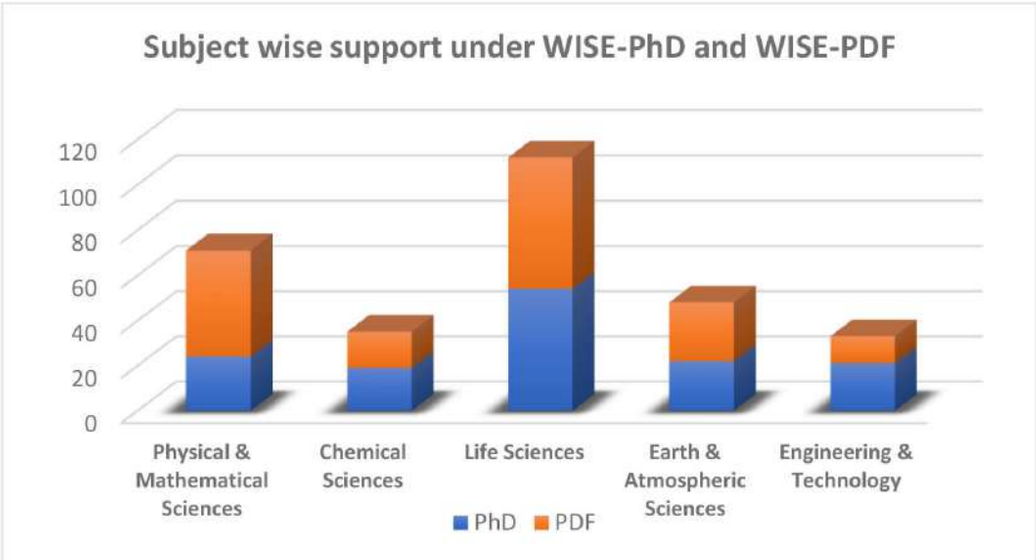
1.6 Women in Science and Engineering-KIRAN (WISE-KIRAN)

The Women in Science and Engineering-KIRAN (WISE-KIRAN) Scheme implements various programmemes to provide different opportunities to women in the Science & Technology domain with the ultimate goal to bring gender parity in the S&T ecosystem. The scheme is being implemented in two modes; 1) fellowship and 2) institutional mode. The achievements through the implementation of different programmemes under the WISE-KIRAN (Knowledge Involvement in Research Advancement for Nurturing) scheme during 2024-25 are as follows:

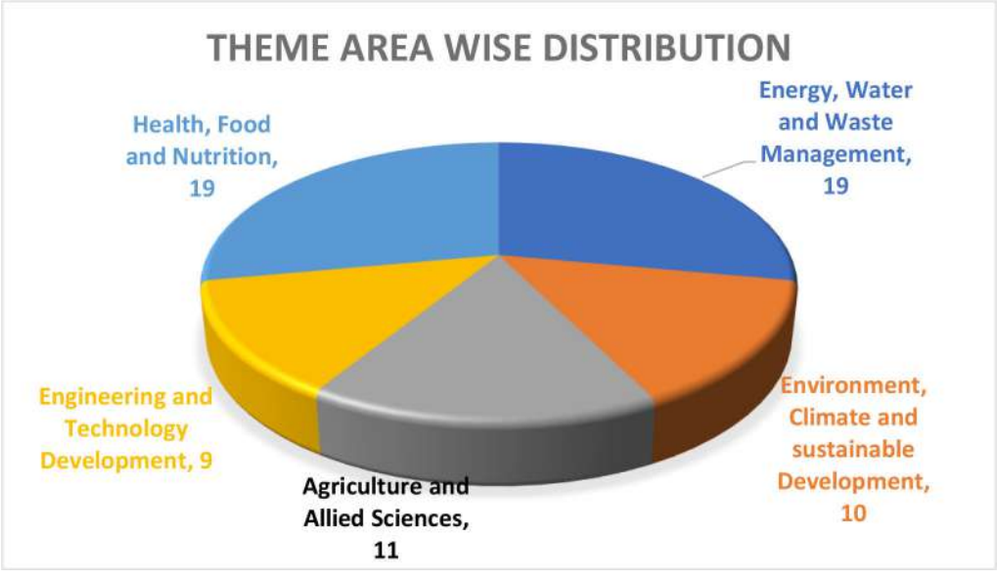
1.6.1 Fellowship Programmemes

1.6.1.1 WISE Fellowship for Ph.D. (WISE-PhD): The WISE-PhD Programmeme aims to provide the opportunity to pursue Ph.D. in Basic and Applied Sciences to women of the age group of 27-45 years. During the year more than 1600 proposals received in five subjects, out of which, the Subject Expert Committees recommended 140 projects for financial support (*viz*. 24 in Physical & Mathematical Sciences, 19 in Chemical Sciences, 54 in Life Sciences, 22 in Earth & Atmospheric Sciences, and 21 in Engineering & Technology). A total of 108 institutions/universities of 25 States/UTs are facilitating WISE-PhD fellows.

1.6.1.2 WISE Post-Doctoral Fellowship (WISE-PDF): The WISE-PDF programmeme provides support to carry out research in five (5) subject areas of Basic and Applied Sciences to the women scientists of age group of 27-60 years. The Subject Expert Committees have evaluated 504 proposals and recommended 159 projects (47 in Physical & Mathematical Sciences, 16 in Chemical Sciences, 58 in Life Sciences, 26 in Earth & Atmospheric Sciences and 12 in Engineering & Technology) for budgetary support. This year, 134 WISE-PDF projects have been sanctioned in 90 institutions/universities covering 21 States/UTs.



1.6.1.3 WISE-Societal Challenges with Opportunities (WISE-SCOPE): The WISE-SCOPE programme aims to provide opportunities for translational research (Lab to Land) to women scientists in 5 thematic areas of applied sciences viz. i) Energy, Water and Waste Management, ii) Health, Food and Nutrition, iii) Environment, Climate Change and Sustainable Development, iv) Agriculture and Allied Sciences, v) Engineering and Technology Development. Under this programme, women scientists of the age group of 27-60 years can pursue Post-Doctoral research and can provide scientific solutions for societal challenges. A total of 271 proposals have been evaluated by the Subject Expert Committees and 68 projects were recommended for budgetary support.



1.6.1.4 WIDUSHI (Women's Instinct for Developing and Ushering Scientific Heights and Innovation): The WIDUSHI programmeme supports senior women scientists aged 45-62 years to conduct impactful research in interdisciplinary domains of Science and Technology under two (2) categories *viz*. retired women scientists (Category-A) and senior women scientists who are not in regular employment (Category-B). WIDUSHI supports research in six scientific disciplines: Physical and Mathematical Sciences, Chemical Sciences, Life Sciences, Earth and Atmospheric Sciences, Engineering & Technology, and S&T-based Societal Research. DST has received 134 proposals under WIDUSHI since its inception. This year 2 meetings of the Programmeme Advisory Committee were organized wherein 82 women scientists were invited for presentation. The PAC recommended 24 projects for financial support under WIDUSHI.

1.6.1.5 WISE Internship in Intellectual Property Rights (WISE-IPR): The WISE-IPR programmeme was launched in 2023 to train women in the field of Intellectual Property Rights (IPRs). This initiative seeks to enhance their knowledge and skills in this important field and foster various professional opportunities. During 2024, 100 women scientists of 1st batch

were engaged in on-job training in various organizations and law firms through 5 coordination centres in Delhi, Bengaluru, Kharagpur, Pune and Guwahati. Further, this year a total of 6 Workshops have been conducted for the beneficiaries of 1st batch of WISE-IPR at different coordination centres. These workshops have covered different aspects of patent drafting, design registration, industrial design protection, fundamentals of trademarks, copyrights and digital copyrights, etc. and facilitated women scientists Patent Agent Exam. The call has been announced for online application submission for the 2nd batch of WISE-IPR.

1.6.1.6 Women Scientists Scheme: The Women Scientists Scheme provides opportunities to women scientists who had a break in their careers to pursue research. This year financial support has been extended for 226 ongoing/completed projects under WOS-A and 57 ongoing/completed projects under WOS-B. Progress has also been evaluated of 202 ongoing/completed projects under WOS-A by different Subject Expert Committees.

1.6.1.7 Women in International Grant Support (WINGS): The DST has conceptualized and started this new programme to provide the opportunity to women researchers to work in advanced International R&D labs in their areas of interest which would enhance their scientific capacity in their research career. The Indian National Academy of Sciences is implementing partner of WINGS. There are 3 Modules in WINGS Programmeme viz. Module I: WINGS Internship, Module II: WINGS Fellowship and Module III: WINGS for Scientific Visit.

1.6.2 Programmemes at Institute/University/College/School Level

1.6.2.1 Vigyan Jyoti: The Vigyan Jyoti Programmeme aims to inspire and encourage girls to pursue careers in Science, Technology, Engineering, and Mathematics (STEM) fields, addressing the underrepresentation of women in these areas. In 2024, the programmeme expanded to Phase V, covering 300 Districts across 34 States and Union Territories. Through this phase, Vigyan Jyoti supports more than 29000 meritorious girls from Classes IX to XII studying in Jawahar Navodaya Vidyalayas (JNVs), Kendriya Vidyalayas (KVs), Army schools, and other government schools, offering various interventions to nurture their interest and potential in STEM.

The Department of Science and Technology (DST) has partnered with over 250 prestigious national institutions, including universities, science and technology institutes, engineering colleges, CSIR labs, R&D industries, and other renowned organizations. These institutions serve as Knowledge Partners and exposure hubs, providing invaluable opportunities for hands-on learning and professional engagement. The DST and NVS headquarters organized periodic meetings with different stakeholders like Knowledge Partners, regional officers, JNV principals and teacher coordinators to foster collaboration and address concerns for effective implementation and monitoring of the Vigyan Jyoti Programme.

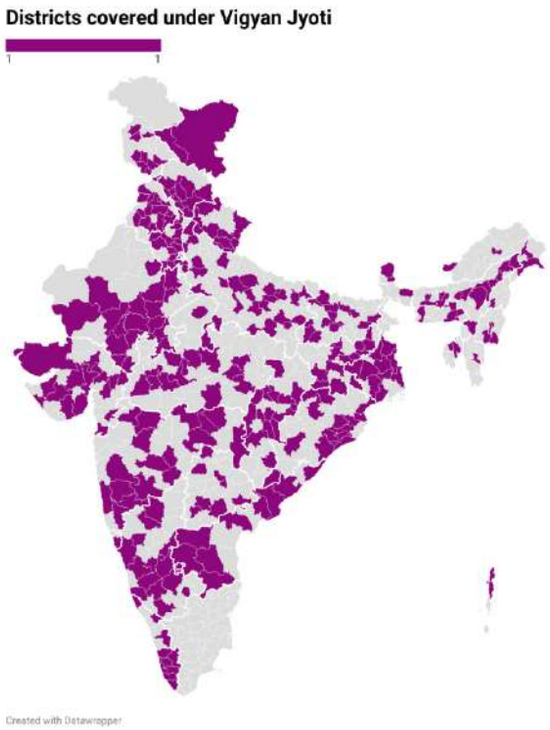


Figure: Spread of Vigyan Jyoti Programmeme

Vigyan Jyoti (VJ) scholars enrolled in the programmeme have gained significant benefits through a wide array of activities designed to nurture their STEM interests and skills. These include science camps, specialized lectures, academic support sessions, student-parent counselling, interactions with inspiring role models, tinkering activities, C-STEM sessions, and workshops on robotics and aerodynamics. Scholars also participated in career counselling sessions and preparatory sessions for JEE and NEET 2025. Visits to Knowledge Partners (KPs), research labs, industries, and NGOs have significantly enhanced the learning experiences of the scholars.

Figure: Glimpses of various activities under Vigyan Jyoti

An e-Summer Learning Camp 2024 for 45 knowledge centres in the Hyderabad Region organized for Class X students. The key focus areas were experiential learning in Mathematics, Physics, Chemistry, and Biology. The camp also includes Life Skills, Career Counselling, and sessions on environment & sustainable development.

Figure: Glimpses of Vigyan Jyoti Conclaves

This year, eight regional Conclaves have been organized in Vigyan Jyoti to foster collaboration and promote STEM learning among girl students. These conclaves provided a platform for Vigyan Jyoti (VJ) scholars to interact with STEM experts, igniting curiosity and encouraging greater participation in STEM fields. Over 2,000 VJ scholars accompanied by teacher coordinators, participated in activities such as science exhibitions, seminars, presentations, and quiz competitions. The conclaves featured motivational talks by distinguished personalities, lab visits, experiential workshops, and interactions with scientists and technologists from prestigious STEM institutes. Key highlights included interactive sessions on drone technology, LED making, robotics, and 3D pen science demonstrations, along with activities such as sky-watching, space exhibitions, and science film screenings.

1.6.2.2 CURIE (Consolidation of University Research for Innovation & Excellence):

The CURIE programme continues to play a pivotal role in strengthening the research infrastructure of women-centric educational institutions, promoting innovation and excellence. In 2024, total 68 proposals have been received against the 3rd call of CURIE PG Component and finally, PAC recommended 22 Women Post-Graduate Colleges for DST support to advance their infrastructure and research facilities. This programmeme is not only fostering research and innovation but also empowering girls with quality education.

A mid-term review of the ongoing projects of CURIE-funded women PG colleges was organized to assess their progress and performance. The PAC provided various suggestions to the PIs for further improvement. The PAC also visited labs of 2 CURIE-supported Women PG Colleges in Hyderabad namely, University College for Women and St. Francis College

for Women. Further, it was also decided that CURIE members will physically visit the CURIE supported Women PG Colleges and interact with faculty and students.

Figure: Review of CURIE Projects at Women Universities

1.6.2.3 Gender Advancement for Transforming Institutions (GATI):

After completing the pilot, a comprehensive analysis report on Self-Assessment Applications have been prepared. DST also announced 'Leadership Development Programme' for women in collaboration with British Council as one of the next steps under GATI Programmeme.

Department of Science and Technology (DST) has launched the programme, **Women in Space and Allied Science Leadership Programme (WiSLP),** in collaboration with British Council (BC) to provide leadership training to early and mid-career level women scientists. Coventry University UK is the delivery partner under the programme. In this regard, the DST and BC first organized a UK-India Education and Research Initiative (UKIERI-4) - Design Workshop - Leadership Development for Women in Space and Allied Sciences in DST. The design workshop was aimed to understand about the requirement of type of training materials and resources to be developed for the leadership training programmeme. Stakeholders from different types of institutions specially working in the domain area were invited to participate in the discussion. DST announced the call and invited applications from early and mid-career level women Scientists of age range 35-50 years to participate in the training programme.

Figure: Design Workshop under WiSLP @Technology Bhawan

1.7 Cognitive Science Research Initiative (CSRI)

The Cognitive Science Research Initiative (CSRI) of the Department of Science and Technology is fostering research in highly interdisciplinary areas of cognitive science to address various questions by combining ideas, principles and methods of psychology, computer science, linguistics, philosophy, neuroscience etc. During 2024-25, the Department has received 1270 proposals in different sub areas of Cognitive Science. Further, the Division has extended financial support for 14 new projects and 38 ongoing projects.

1.7.1 Key highlights of the work carried out under CSRI projects are as follows;

***(a) Neurocognitive Correlates of Childhood and Adolescent Obesity- Search for Potential Biomarkers and Interventions*:** Obesity has been linked to poorer neurocognitive functioning in adults but much less is known about this relationship in children and adolescents. It has been established that adolescence is a critical period for the development of obesity and obesity related cognitive impairments. The current study conducted at Guru Nanak Dev University, Amritsar was aimed to establish a link between adolescent overweight/obesity and neurocognitive functioning specifically executive functioning which have far-reaching implications for their neurodevelopment. It is the first study to assess the Three Factor Eating Questionnaire (TFEQ), and its subscales on an adolescent population of both sexes in India.

The school children between 10 to 16 years in the state of Punjab were recruited under this study. In view of the physical, and psychological health consequences of adolescent obesity, it was observed that weight status of adolescents is directly associated with disordered eating behaviours (restrained eating, emotional eating, and uncontrolled eating), and these measures of disordered eating behaviours are further associated with self-concept. The significant role of Cognitive restraint in BMI gain in adolescents is one key finding of this study. The domain of Happiness and satisfaction (HAP) also showed a significant negative relation with BMI, which indicates that those with lower BMI i.e., healthy adolescents felt more satisfied with their life compared to those with higher BMI. Higher restraint score suggests that overweight/obese teenagers are more concerned about controlling their weight.

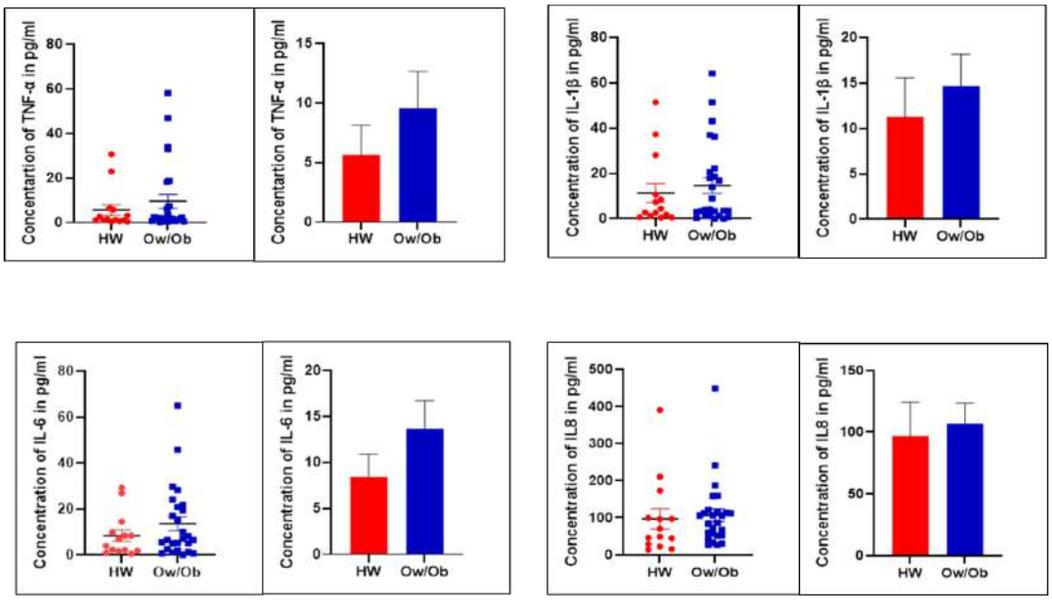


Figure: The concentration of (a) TNF-α, (b) IL-Iβ, (c) IL-6, and (d) IL-8 in saliva samples of HW and OW/OB groups *p≤005 HW versus OW/OB

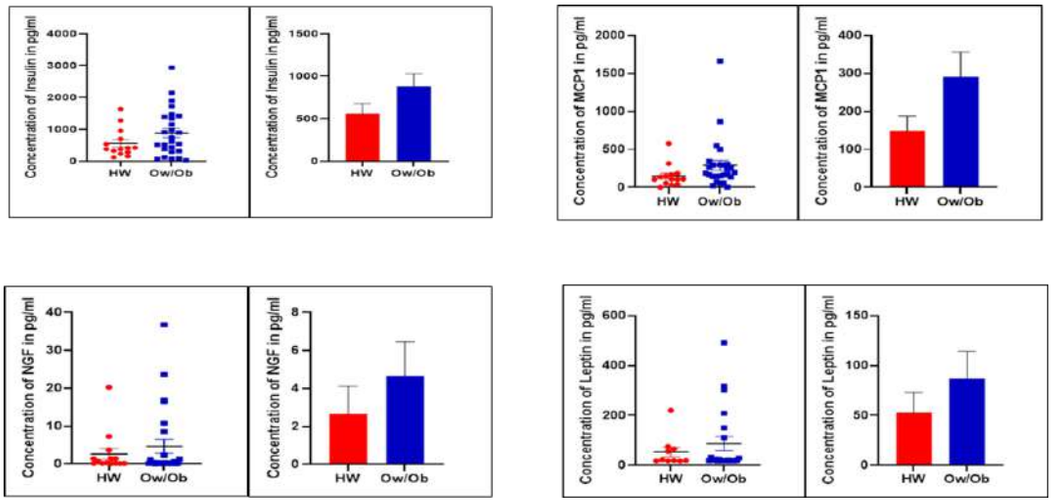


Figure: The concentration of (a) Insulin, (b) MCP-1, (c) NGF, and (d) Leptin in saliva samples of HW and OW/OB groups *p≤005 HW versus OW/OB

Moreover, the mean scores of cognitive restraints were higher in overweight/obese adolescents compared to healthy adolescents across age groups in both girls and boys. Findings also provide evidence that adolescent's perception of their intellectual and academic abilities is negatively correlated with their uncontrolled eating behavior. Overweight/obese boys showed this association with emotional eating. In healthy-weight boys and girls as well as overweight/obese girls, significant negative correlations were found between uncontrolled eating and

adolescent's perception of their academic and intellectual abilities. This indicates that both girls and boys having negative self-evaluations about not fitting well in school or having doubts about their performance on specific academic tasks tend to indulge more in uncontrolled eating.

This study will be useful to understand the risk drivers of weight gain in adolescents such as dietary habits, sleep time, screen time, physical activity etc. which is important in view of the long-term health outcome of adolescent obesity.

***(b) Association of Social Cognition and Behavioral Impairment in Persons with Epilepsy on Antiepileptic Drug Monotherapy*:** Epilepsy is a chronic condition often associated with a higher prevalence of psychiatric disorders, including mood and anxiety disorders, due to its impact on neuronal networks and social cognition abilities. Consequently, antiepileptic drugs (AEDs) are administered for extended periods, but their adverse effects can significantly impact the quality of life and lead to treatment failure. In this line, a study conducted at the All India Institute of Medical Sciences, New Delhi, sought to explore the social cognition and neurobehavioral adverse effects of AED monotherapy, particularly Levetiracetam (LEV), in individuals with epilepsy.

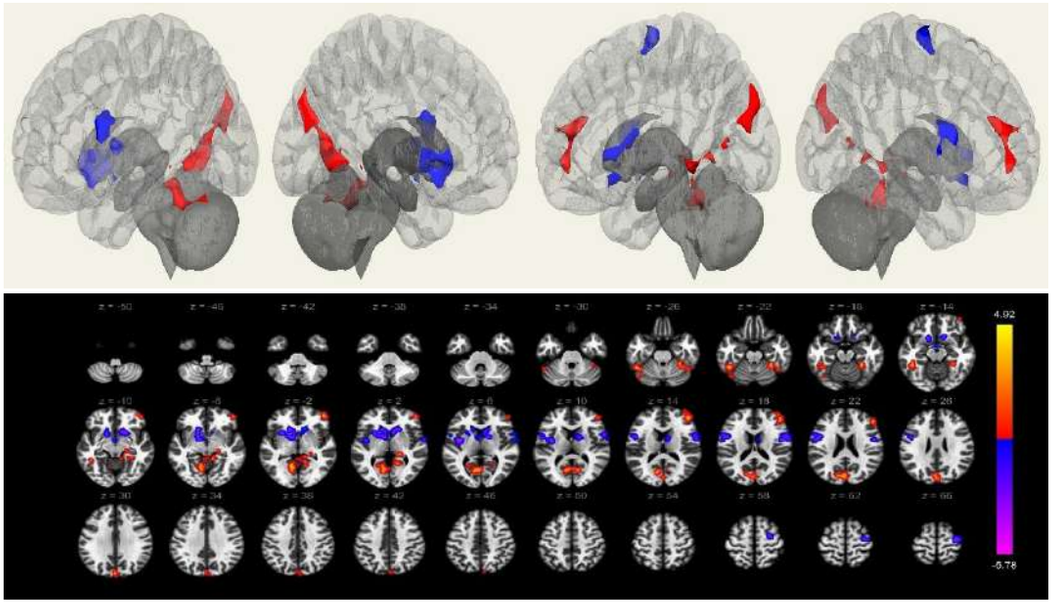


Figure: A and B: Brain images showing BOLD signal with blue and red color Blue color indicates decrease in activity and red showing increase activity of that particular region Activation maps of the components representing activation and inhibition in brain network

This study is the initial one to dig out any qualitative and quantitative association of LEV with neurobehavioral and social cognition impairment along with its correlation with biomarkers and to find out the mechanism and pathology behind neuropsychiatric adverse events associated with Anti-Seizure Medication (ASM) especially LEV through neuroimaging findings. The study correlated all these effects with neuroimaging findings obtained through high-density

EEG and resting-state fMRI. Additionally, it examined biomarkers such as S100B protein and BDNF levels, alongside trace elements like zinc (Zn) and copper (Cu).

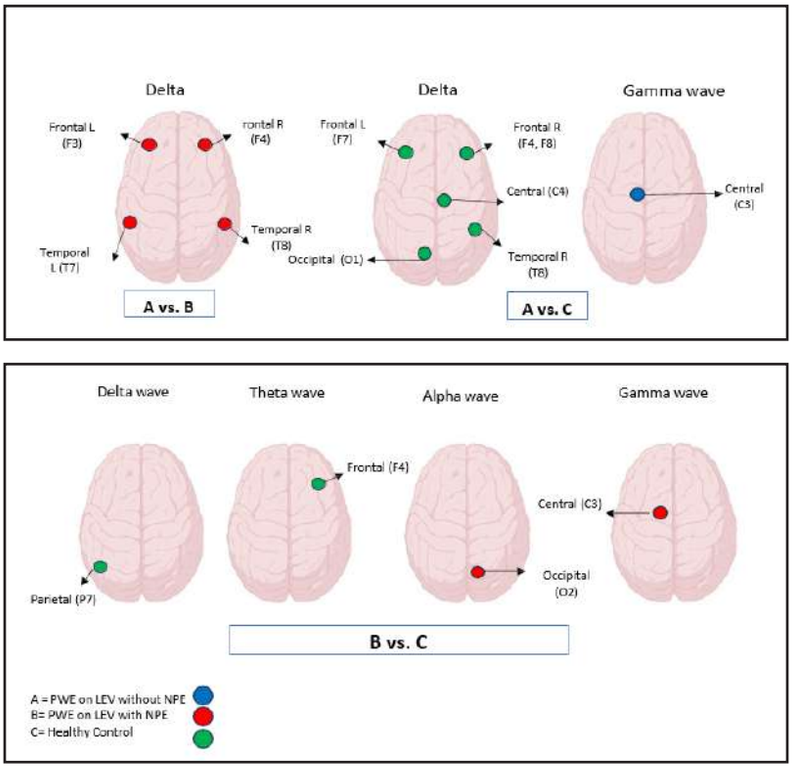


Figure: Brain areas with higher power spectra in a particular EEG frequency band among LEV-NPE+, LEV-NPE+ and healthy control

The findings revealed that 44.93% of epilepsy patients on LEV experienced neuropsychiatric adverse events, as assessed using the MINI and SOCRATIS scales, leading to impaired sleep quality and reduced overall quality of life. Significant differences in trace element levels were observed, with elevated copper and reduced zinc in the LEV monotherapy group compared to controls. These variations may play a role in the neurobehavioral outcomes among epilepsy patients. Neurocognitive impairment associated with ASM introduces some changes in brain function, similarly, there are changes in the biomarker (BDNF and S100B) levels and trace elements status (Zn and Cu) among subjects with Neuropsychiatric Events (NPE) and Patients with Epilepsy (PWE) without NPE. This study has found causal factors for neuropsychiatric impairment caused by ASM in PWE which may be observed as adverse events in some patients. These findings can help in deciding the use of ASM and could also enable the development of targeted interventions based on the identified risks associated with particular trace elements.

1.7.2 Conferences/Workshops Supported: The Division has also supported 3 outreach activities as mentioned below:

- **11th Annual Conference of the Association of Cognitive Science:** The DST supported 11th ACCS at the Indian Institute of Technology Bombay, Mumbai in Dec 2024. The conference provided a platform to young researchers for discussion on interdisciplinary research and innovations and included scientific talks, on different domains under Cognitive Sciences.
- **Bangalore Cognition Workshop (BCW2024):** BCW 2024 was organized at the Indian Institute of Science, Bangalore in June 2024 that focused on the problems and concepts in cognitive neuroscience. There were 5 modules on Sensory systems, Learning/Decision-making, Emotion Motivation & Cognitive Control, Motor Systems, and Memory. More than 50 graduate students participated in this workshop and had interactions with national and international experts along with lectures and lab sessions.
- **Behavioral Science in Management (BSIM) Track @IMRC 2024:** The Indian Management Research Conference (IMRC 2024) was organized in Dec 2024 at the Indian Institute of Management Ahmedabad (IIMA), Ahmedabad in which the BSIM Track is supported by the DST under CSRI. The BSIM Track highlighted the multifaceted applications of Behavioral Science and covered various thematic areas related to economics, decision-making, consumer behaviour, gender, neurosciences, etc.

1.8 Innovation in Science Pursuit for Inspired Research (INSPIRE)

INSPIRE is a flagship scheme of Department of Science & Technology for attraction of talent to science. The objective of INSPIRE Programmeme is to attract meritorious youth to study basic and natural sciences at the college and university level, pursue research careers in both basic and applied science areas including engineering, medicine, agriculture and veterinary sciences and thus, build the required critical human resource pool for strengthening and expanding the Science & Technology system and R & D base of the country.

“INSPIRE Scheme” is aligned with the ‘Minimum Government, Maximum Governance Model’ as it makes use of technology in its operations right from submission of application to the delivery of grants. Scheme is implemented through the on-line dynamic INSPIRE web-portal and scholarship(s)/fellowship(s) are released to the INSPIRE beneficiaries on receipt of the requisite documents through online mode. INSPIRE web-portal is also integrated with UMAANG and has its Mobile application for the INSPIRE aspirants/beneficiaries. During the year, INSPIRE scholarship(s)/fellowship(s) are released adhering to the revised fund flow mechanism. Below are the details of different components of INSPIRE scheme.

1.8.1 INSPIRE Internship component aims at providing exposure to the top 1% students at Class X Board level by organizing Science Camps and provide opportunity to them to interact with science icons from India and abroad, including Nobel Laureates, to experience the joys of scientific pursuit. These science camps nourish the curiosity of students in science, help them to think out-of-the box and attract students at an early age of 16-17 years to opt for science subjects for further studies. The internship camps are residential for a period of 5 days per camp. During the period of report, 140 INSPIRE Internship proposals were received from various academic and research institutions out of which 41 proposals covering 6955 students were recommended for support.

1.8.2 Scholarship for Higher Education (SHE) aims to attract top 1% rank holder students to pursue their career in basic and natural science areas in higher academic qualifications by providing scholarships and mentorship grants. The scheme offers 12,000 Scholarships every year @ Rs. 0.80 lakh per year (including Mentorship grant) for undertaking Bachelor and Master level qualification in natural and basic sciences for the talented youth in the age group of 17-22 years. Main feature of this component is to develop interest in scientific research among UG and PG level science students through research projects during their vacation period. Call for applications for 2023 for INSPIRE-SHE was completed and in response, 18,022 applications were received. 11284 INSPIRE scholarships were offered to the selected candidates. Also, 457 INSPIRE scholarships have been offered to the selected candidates through institutes (institute mode). Selection of students was based on their performance in class 12th examination conducted by State/Central School Education Examination Boards and competitive examinations such as JEE (Main & Advance), NEET etc. All the selected students pursue the undergraduate / post graduate levels courses in basic and natural sciences. Out of the total students who were offered INSPIRE SHE scholarship, 56% are Female.

1.8.3 INSPIRE Fellowship component offers 1000 Fellowships every year for carrying out doctoral degree in both basic and applied sciences including engineering and medicine in the age group of 22-27 years. INSPIRE Fellowship is offered to students having secured 1st Rank in Basic & Applied Sciences including engineering, medicine, agriculture, veterinary at the University/ academic institute of national importance i.e. IITs, NITs, IISERs level examination. Students who have obtained scholarship at UG and PG level under INSPIRE-SHE are eligible for INSPIRE Fellowship if they have secured 70% marks in aggregate at the M.Sc. level and taken admission to the Ph.D. Programme in any recognized university/ academic institutions in the country. The Fellowships are tenable for a maximum of five years (2 years as JRF and 3 years as SRF) period or completion of PhD, whichever is earlier to pursue full-time PhD programme. The Fellowship amount including the contingencies is equivalent to CSIR-UGC NET Fellowship and is governed by GoI norms & regulations.

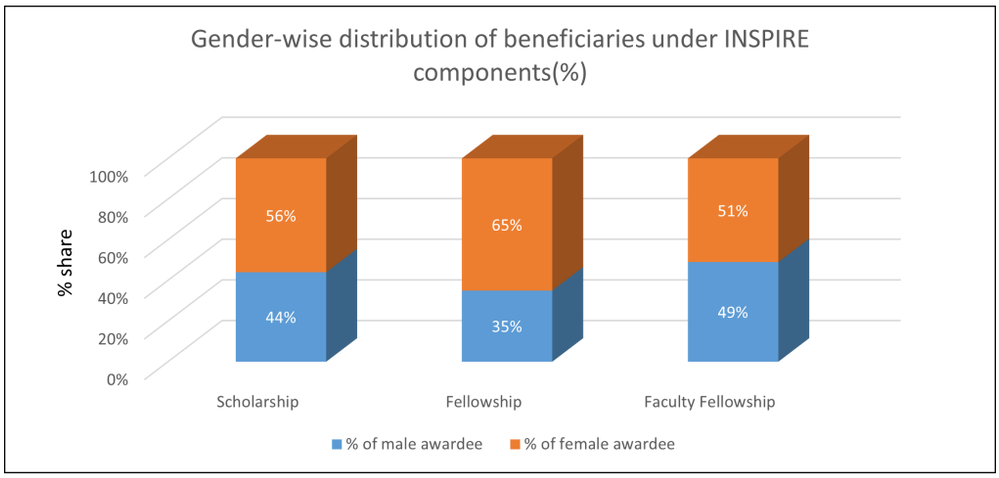
The Level-1 scrutiny of applications of INSPIRE Fellowship Call 2023 was completed and out of 2,116 received applications, 1886 applications cleared level-1 evaluation. Applications which cleared level-1 evaluation and yet are not registered for Ph.D. are given one- year time to upload the requisite documents like research proposal etc. Upon Level-2 evaluation of applications, so far, 653 INSPIRE Fellowship applicants were offered INSPIRE Fellowship. Out of the awarded/offered INSPIRE Fellows 65% are female and 35% are male. Of the total awarded/offered INSPIRE Fellows, about 31% are SHE Scholars who have joined doctoral degree programme in science and technology after availing 5 years INSPIRE Scholarship. Six Hundred and Twenty-Seven INSPIRE Fellows were promoted from Junior Research Fellowship (JRF) to Senior Research Fellowship (SRF) after evaluation of the research work carried out by them. On competitive basis nine INSPIRE Fellows have been selected for participation in 16th JSPS-HOPE meeting scheduled from 09th to 13th March 2025 in Yokohama-city, Japan.

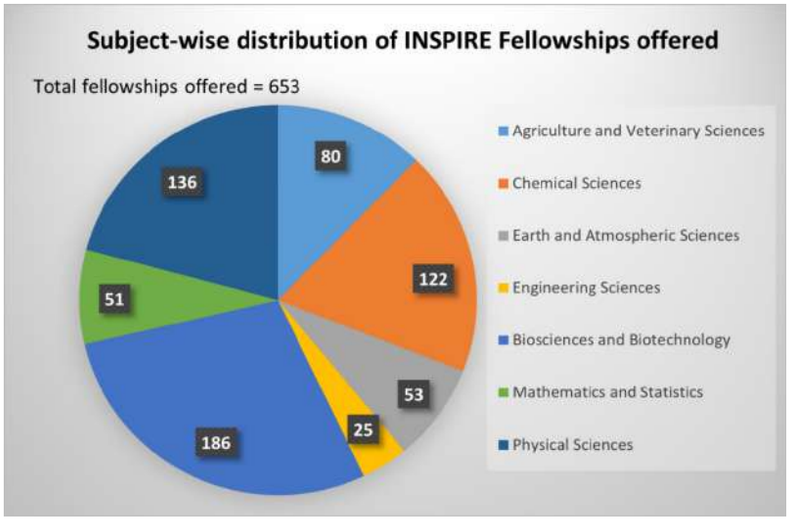
1.8.4 INSPIRE Faculty Fellowship provides opportunities to the post- doctoral researchers in the age group of 27-32 years for 5 years INSPIRE Faculty Fellowship in both basic and applied sciences area including engineering, agriculture, veterinary and medicine. Each fellow receives fellowship of Rs. 1,25,000/- per month with an annual increment of Rs. 2000/- and Research Grant of Rs. 7.0 lakh per year for 5 years. Its salient features are:

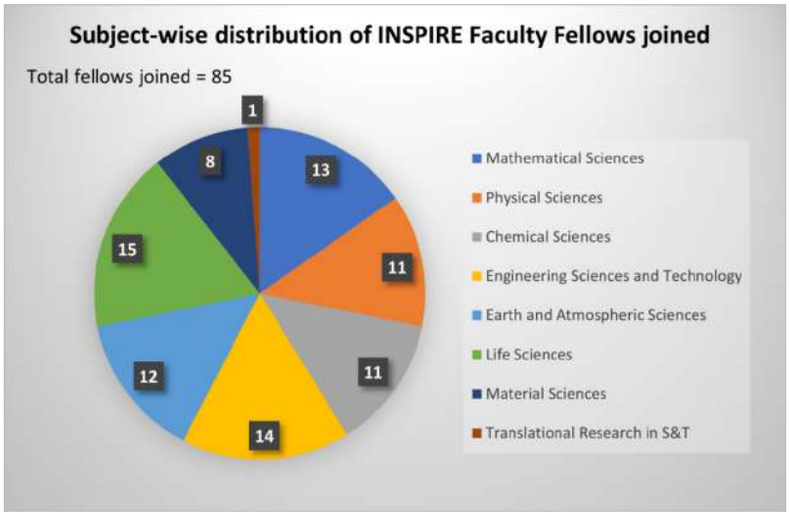
- To provide attractive opportunities to young achievers for developing independent scientific profiles and launch them in fulfilling long term careers.
- Expected to augment high quality scientific manpower for scientific and educational institutions, specially the Central and State universities.
- This component provides an independent research opportunity and not a guarantee for position beyond 5 years.

During the year, 237 INSPIRE Faculty Fellows received their fellowship and are pursuing the post- doctoral research through contractual and tenure track position for 5 years in both basic and applied science areas including engineering, agriculture, veterinary and medicine. During the year, 85 INSPIRE Faculty Fellowships were hosted in academic and research institutions. Out of the hosted INSPIRE Faculty Fellows 51% are female and 49% are male. Also, research progress of 158 INSPIRE Faculty Fellows, beneficiaries from 2019 and 2020, was reviewed with the help of Expert Committees in the areas of Chemical Sciences, Earth and Atmospheric Sciences, Engineering Sciences, Life Sciences, Material Science, Mathematical Sciences and Physical Sciences.

Moreover, 2944 applications were received against the 2024 call of INSPIRE Faculty Fellowship for award of INSPIRE Faculty Fellowship. INSPIRE Faculty Fellowship selection process is in progress.


Gender-wise distribution of beneficiaries under INSPIRE components(%)
% share
100%
80%
60%
40%
20%
0%
56%
44%
65%
35%
51%
49%
Scholarship
Fellowship
Faculty Fellowship
% of male awardee
% of female awardee


Subject-wise distribution of INSPIRE Fellowships offered
Total fellowships offered = 653
80
122
53
25
186
51
136
Agriculture and Veterinary Sciences
Chemical Sciences
Earth and Atmospheric Sciences
Engineering Sciences
Biosciences and Biotechnology
Mathematics and Statistics
Physical Sciences


Subject-wise distribution of INSPIRE Faculty Fellows joined
Total fellows joined = 85
1
13
11
11
14
12
15
8
Mathematical Sciences
Physical Sciences
Chemical Sciences
Engineering Sciences and Technology
Earth and Atmospheric Sciences
Life Sciences
Material Sciences
Translational Research in S&T

1.9 INSPIRE–Million Minds Augmenting National Aspiration and Knowledge (MANAK)

The INSPIRE–MANAK programme implemented by the Department of Science and Technology (DST), Government of India, in collaboration with the National Innovation Foundation – India (NIF) is a flagship initiative aimed at fostering a spirit of innovation among school students. Targeting students from Classes VI to X, the programme encourages young minds to conceptualize innovative ideas, providing them with opportunities to translate their concepts into tangible solutions. It aims to nurture scientific curiosity and motivate students to explore careers in science, technology, and research. Every year, the programme scouts one million ideas from eligible schools nationwide. Out of these, one lakh ideas are shortlisted based on their merit for further value addition and incubation, ensuring that the most promising innovations receive necessary support for development and implementation. This initiative aligns with India's mission to build a robust ecosystem for innovation and entrepreneurship, starting at the grassroots level.

During the financial year 2024-25, the district and state-level exhibitions for INSPIRE-MANAK of FY 2022-23 (129 DLEPCs and 19 SLEPCs) were successfully organized. Additionally, 24 mentoring workshops were conducted at premier institutions like IITs, BITS, and NITs, providing State/UT winners with an opportunity to engage in high-quality mentoring programmes at an early stage. Followings are some key highlights under the INSPIRE_MANAK during the year.

- The 11th National Level Exhibition and Project Competition (NLEPC) for FY 2022-23 took place from September 17–19, 2024, in New Delhi. The two-day exhibition at Bharat Mandapam, Delhi showcased the ideas of 350 students from 33 States/UTs, including Kendriya Vidyalaya Sangathan (KVS) and Navodaya Vidyalaya Samiti (NVS). These students were shortlisted after a series of District and State Level Exhibition and Project Competitions (7.96 lakhs nominations received during the F.Y.2022-23). The event concluded with a felicitation ceremony at Vigyan Bhawan, where the top 31 winners were honoured by Prof. Abhay Karandikar, Secretary, DST. Over 10,000 school students from Delhi-NCR visited the exhibition, inspiring the next generation of innovators.

The top three winners included:

I. **First Prize**: Mr. Deepak (Bhind, Madhya Pradesh) for "Safe Vision Distance Sensor in Smart Phone."

II. **Second Prize**: Mr. Aanay Dwivedi (Gautam Buddha Nagar, Uttar Pradesh) for "Pot-hole Repair System using Plastic Trash."

III. **Third Prize**: Ms. Amulya Hegde (Udupi, Karnataka) for "Flood Detecting Pole."

- Under the **INSPIRE–MANAK** scheme, the winners of the **National Level Exhibition and Project Competition (NLEPC)** are provided with comprehensive support to further develop their innovations. This includes assistance with **incubation activities** and **Intellectual Property Rights (IPR) protection**, ensuring that students' creative solutions are safeguarded and nurtured for real-world application. This year marked a significant milestone, with **eight patents** granted to student innovators, acknowledging their **creativity**, **ingenuity**, and **problem-solving skills**. Such achievements underscore the programme's success in fostering a culture of innovation and providing a robust platform for young minds to translate their ideas into impactful solutions.
- INSPIRE-MANAK 2024-25 witnessed a record 10,13,229 student nominations between July 1 and October 15, 2024, facilitated by over 100 awareness workshops. A State Nodal Officers' meeting on April 15, 2024, at NIF–India in Gandhinagar outlined future directions for the programme.
- For FY 2023-24, district and state-level exhibitions (D/SLEPCs) are being conducted for 46,926 shortlisted ideas. As of December 2024, 24 DLEPCs and two SLEPCs have been organized in Jharkhand, Punjab, and Dadra and Nagar Haveli and Daman and Diu, respectively.
- A new programme "Exposure visit of Japanese School Students to India" has been initiated under INSPIRE-MANAK scheme. Under this programme, a total of 10 students and 02 supervisors visited India during 27-31 August, 2024. During their stay in India, the Japanese school students are exposed to India's Science and Technology advancements through visiting India's academic and research institutes, Industry and cultural sites.

INSPIRE-MANAK continues to be a transformative initiative, fostering scientific temper and innovation among young minds. Looking ahead, the programme aims to further expand its reach and impact, contributing to India's aspirations in science and technology.

CHAPTER 2

RESEARCH AND DEVELOPMENT

2.1 International Cooperation (IC)

The International Cooperation programme of the department deals the S&T related activities, strategies, planning, diplomacy at global level through the muti- & bi-lateral cooperation, being a member of different types of international forums/bodies/agencies, and participating in global missions to strengthen the India's position worldwide. These activities performed in collaboration with the Ministry of External Affairs, Indian Missions abroad, S&T Counsellors in Germany, Japan, Russia and the USA, stakeholders in scientific, technological and academic institutions, sister scientific government departments and various industry associations in India. Some of the key highlights and achievements under different components of this programme during the year are as follows;

2.1.1 Multilateral Cooperation Programme

2.1.1.1 Association of Southeast Asian Nations (ASEAN) STI programs

Key activities during the year under this component are given below;

- The first **ASEAN-India Women Scientists Conclave** was hosted in Singapore from 24-26 April 2024 through the implementing partner Anusandhan National Research Foundation. Women scientists from India and ASEAN region participated in the event. Twenty women scientists from the Indian side along the Government officials participated in the event. Similarly, 20 participants from the ASEAN region and 20 officials from Singapore and ASEAN member states attended the conclave. This program is designed to engage the women scientists of our regions and enable collaboration among them. During the event, the participants delivered women-centric plenary talks, session talks, panel discussions, innovation pitch-in contests etc. The 1st and 2nd best women's innovator awards were secured by the Indian participants, and Malaysia won the third position.

- The first **ASEAN-India Scale Hub 2024** was hosted in Bali, Indonesia during 3-5, July 2024 through SIIC, IIT Kanpur as implementing partner. India joined as the channel partner in the scaling of startup activities in 2024. About 311 participants including 100 startups from Indian (60) and ASEAN (40) regions along with the government officials and other dignitaries participated in the event. The ASEAN-India ScaleHub event served as a platform to promote the sustained startups to grow further, reaching out the international market,strengthening and expanding their business networks. So far, three ASEAN companies have tied up with Indian startups to take their products in ASEAN market.

- The 2nd edition of **ASEAN-India Startup Festival-2024** was organized from 28 to 30 November, 2024 at New Delhi. It was attended by H.E. Mr. Satinder Singh, Deputy Secretary General to ASEAN and Secretaries of DST, DoD and also the JS of IPD-MEA. In this event, 98 startups from Indian (60) and ASEAN (38) region participated to share their values. ASEAN countries High commission officials in Delhi have also joined the festival and interacted with the participants. The event was implemented in collaboration with DPIIT as knowledge partner and SIIC, IIT Kanpur as the host on behalf of DST. This event is intended to provide a forum for startups to showcase their product and learn from each other. Various sessions like; seminar on Technology Commercialization and Innovation through the TBI's network, Talk Show on Start-Up Ecosystem Key Players, Start-Up Fair, Best product Pitch, stake-holder meet, Industry Connect and One-day visit to the prominent electronics manufacturing industry (VVDN technologies private limited) in Delhi-NCR region was arranged during the event. Nearly 500 walk-in observers from NCR educational institutions have attended and interacted with the startups.
- The **ASEAN-India Collaborative R&D program** 2024 call launched under the thematic areas focused on (1) Artificial Intelligence & High-Performance Computing (2) Materials Science and (3) Marine Science and Technology. Out of 288 proposals received, 43 of them are recommended for financial support.
- The **ASEAN-India Research and Training Fellowships** (AIRTF): The objective of AIRTF is to provide an opportunity for ASEAN researchers to conduct research under the guidance of a host scientist in India to advance their own research capabilities while fostering scientific and technological cooperation. The AIRTF fellowships are awarded to master's students/scientist/ researchers from ASEAN countries for carrying out research internship/training at any Indian research/academic institutions/universities for a period of 2-6 months. This year, a total of 29 eligible proposals from various scientific areas were received. The Composite Scientific Expert Committee (C-SEC) recommended 24 proposals for financial support.

2.1.1.2 BRICS

Key activities during the year under this component are given below;

Figure: BRICS Senior Officials and Ministerial Meetings on 26-27 September 2024 at Moscow (Russia)

- **BRICS STI Senior Officials and Ministerial Meeting:** An Indian delegation participated in the BRICS Senior Officials and Ministerial Meetings on 26-27 September 2024 at Moscow (Russia) and had detailed discussion on the overall BRICS STI activities under 13 different Working Groups in 2024. The Delegation also had insightful discussions, finalization and adoption of the BRICS STI Ministerial Moscow Declaration and the future Calendar of Activities.

- **BRICS STI Working Group activities:** An Indian delegation participated in the BRICS STI Funders Working Group Meeting at Moscow (Russia) during 26-27 September 2024 at Moscow (Russia). During the visit, they visited the research facilities in the University of Science and Technology (MISIS). Indian Delegations also participated in other BRICS STI Working Group Meetings such as Astronomy, Energy, ICT and HPC, Geospatial Technologies, Material Science and Nanotechnology, Research Infrastructure and Mega Science Projects as well as in events such as BRICS Academies Forum and BRICS Geographer's Day.

- Under the **BRICS STI Framework Programme Call 2023** on 'Climate Change Adaptation and Mitigation', four significant R&D projects have been selected under the multilateral cooperation for support by the DST.

- **9th BRICS Young Scientist Forum and 7th BRICS Young Innovator:** An Indian Delegation comprising 16 Young Scientists & Innovators along with the representatives of DST participated in the 9th BRICS Young Scientist Forum and 7th BRICS Young Innovator Prize Award events in Sochi, Russia during 25th-29th November, 2024. The themes were Nature-like & Convergent Technologies as drivers for sustainable future, Environmental & Climate Technologies, Digital Humanities and Artificial Intelligence. This Forum has served as a platform for fostering int'l collaboration among young scientists, facilitating the exchange of experiences in fostering stronger STI co-operation among young researchers & innovators of the BRICS Countries.

2.1.1.3 Bay of Bengal Initiative for Multi-Sectoral Technical and Economic Cooperation (BIMSTEC):

Key activity during the year under this component is given below;

- Indian Delegation participated in 2nd Meeting of the BIMSTEC Expert Group on Science, Technology, Innovation Cooperation (EGSTIC) in Colombo, Sri Lanka from 25-26 July 2024. Based on the topic, "Success of leveraging digital technologies in realization of SDGs and importance of building Digital Public Infrastructures (DPIs) through regional cooperation" delegates from BIMSTEC Member States presented the initiatives of their respective countries in the field of Digital Public Infrastructures. Indian Delegation highlighted the key initiatives of Govt. of India such as Aadhar, UPI, ABHA, E-Sanjeevani,

CoWIN, DigiLocker, GeM, e-Governance etc. The Expert Group reviewed the BIMSTEC Plan of Action on Science, Technology, and Innovation 2023-2024.

Figure: Group Photo of the BIMSTEC Delegation

Figure: Indian Delegation

2.1.1.4 Mekong Ganga Cooperation (MGC):

Key activity during the year under this component is given below;

- Indian delegation participated in the First Meeting of the MGC Science and Technology (S&T) Working Group held virtually on 17th December 2024 from Rangoon, Myanmar. During the Meeting, discussions were held on the proposed Plan of Action of MGC S&T (2025-2030) to foster Science, Technology and Innovation development and cooperation between MGC countries to enhance economic growth, socio-economic development, and regional integration in the areas including agriculture, transport, communication, industrial technology transfer, information and communication technology, health, energy, environment, food, materials science, nanotechnology, artificial intelligence and other related sectors.

2.1.2 Bilateral Cooperation Programme

Key activities with different countries during the year under this component are given below;

Australia: Delegates from both countries shared updates in the respective S&T policies including activities planned under ANRF, National Quantum Mission, Support for Women in STEM, Bioeconomy as well as mutual areas of cooperation in Advanced Materials and Critical Minerals. Progress in the ongoing activities under Australia-India Strategic Research Fund (AISRF) and India-Australia Biotechnology Fund (IABF) including evaluating translational potential of the research outputs from a few ongoing and recently concluded bilateral R&D projects were also assessed. There was also a discussion on pathways for current and future AISRF projects including the possibility to incorporate an innovation/startup component into the AISRF. In addition, the likely thematic areas of mutual interest for the 16th round of AISRF call were also discussed. Under the 15th round of AISRF (2023), three proposals are supported for Joint R&D Project in the areas of: Artificial Intelligence and Machine Learning, New and Renewable Energy Technologies (particularly ultra-low-cost solar and clean hydrogen) and Urban Mining and Electronic Waste Recycling.

Austria: A joint India Austria Call for bilateral exchange visits is announced on 15 September 2024 which get closed on 31 October 2024. A total of 150 proposals are received under this call and the proposals are under evaluation process.

Canada: DST and National Research council (NRC) Canada has announced a new joint call for proposals in the areas of Advanced manufacturing, Clean technologies and green technologies, Digital technologies, Health and bio-sciences, Food and agriculture technologies, Smart infrastructure. DST and NRC shall take a joint decision to fund the recommended projects.

Germany: As many as three significant Memoranda of Understanding (MoUs) were signed to further strengthen Indo-German collaboration in science and technology. The first MoU, a Joint Declaration of Intent (JDI), was signed between Prof. Abhay Karandikar, Secretary DST and Prof. Joybrato Mukherjee, President of the German Academic Exchange Service (DAAD). This agreement aims to enhance innovation and incubation ecosystems through an exchange programme, fostering knowledge sharing between policymakers, startup incubation professionals, and deep-tech startups from both countries. Another MoU was signed between the Indo-German Science and Technology Centre (IGSTC) and Bharat Petroleum Corporation Limited (BPCL). This partnership will focus on renewable energy, carbon capture, green hydrogen, and innovative technologies. Additionally, an agreement to extend the PETRA-III Phase 2 programme for two more years was signed by Prof. Eswaramoorthy M. of JNCASR and Prof. Franz X. Kaertner of DESY, furthering collaborations in photon science research. These agreements are expected to boost scientific research and technological advancement between the two nations. In addition, the International Research Training Group (IRTG), a joint initiative between India and Germany was successfully established focusing on photoluminescence in supra-molecular matrices.

Japan: Under the DST-JSPS Call 2023 17 proposals and 3 works are finally selected and are supported for grants and under the new call 2024 between DST-JSPS, 272 proposals are received and being evaluated. As a part of other activity, the 15th HOPE meeting with the Nobel Laureates held in Kyoto-city, Japan from 26 February to 1 March, 2024. DST sent the nomination of 9 Indian students who have participated the 15th HOPE meeting.

Portugal: The 4 projects have been sanctioned under the Indo-Portuguese R&D cooperation programme during 2024-25 upto December, 2024.

Russia: A new call 2024 by DST- Russian Science Foundation (RSF) was launched in the areas of New Materials; Clean energy; Smart healthcare and medicine; Safe food; Smart transport and telecommunications; Plant and Animal Bio-Technology; Artificial Intelligence; and Earth Quake and Ocean Science. 23 proposals under the call 2023 on the above themes were supported. In addition, the 13th Indo-Russia Joint Working Group on Science and Technology conducted on 18th October 2024.

Spain: Recently a Joint committee meeting was held in DST under the Indo-Spain Collaborative industrial R&D programme. Indo-Spain Industrial R&D collaborative Request for proposal 2024 has launched on 19th December 2024 and open till 31st July 2025 for submission. Indo-Spain Collaborative industrial R&D Projects under the ongoing and royalty phase from RFP 2013 and 2018 has been transferred from GITA to TDB for further necessary action. Under the Indo-Spain Collaborative industrial R&D RFP 2023 call, 3 projects have been recommended and selected jointly. The jointly selected projects from both sides will be gone through agreement signing by the project partners and funding by the respective agency, TDB on behalf of DST in India and CDTI in Spain respectively.

Sri Lanka: Two India-Sri Lanka joint calls are announced on 01 June 2024 (closed on 15 July 2024) and 01 September 2024 (closed on 15 October 2024) for R&D Project proposals and Workshop proposals, respectively. A total of 438 proposals are received under India-Sri Lanka R&D Call while 234 proposals are received under India Sri Lanka workshop call. The Proposals are under evaluation process.

Sweden: The 4 projects have been sanctioned under the Indo-Swedish R&D cooperation programme during 2024-25 upto December, 2024. Indo-Swedish Collaborative industrial R&D Projects under the ongoing and royalty phase from RFP 2019 and 2021 have been transferred from GITA to TDB for further necessary action. Under the Indo-Swedish Collaborative industrial R&D RFP 2023 call, 4 projects have been recommended and selected jointly. The jointly selected projects from both sides will be gone through agreement signing by the project partners and funding by the respective agency, TDB on behalf of DST in India and CDTI in Spain respectively.

Slovenia: Dr. Igor Papič, Minister of Higher Education, Science, and Innovation of the Republic of Slovenia with Hon'ble Minister S & T, Dr Jitendra Singh on 5th December, 2024. Both Countries will identify focused themes and open calls for each year. They discussed for the further cooperation and conducting the joint committee meeting.

United State of America: DST in partnership with NSF has created a platform for collaborative research opportunities in areas of Computer and Information Science and Engineering; Cyber-Physical Systems; and Secure and Trustworthy Cyberspace. The DST – NSF joint call sought high pitch proposals in two phases. A total of 13 proposals have been selected for

implementation. The collaboration builds upon the vision of bridging research communities of both sides and to accelerate advances in critical and emerging technologies through joint research endeavors in next generation telecommunications (e.g., 6G technology), machine learning, and autonomous vehicles. DST has also partnered with U.S. National Science Foundation (NSF) in DMREF (Designing Materials to Revolutionize and Engineer our Future) that offers an excellent opportunity into advanced areas of materials research. The program covers all materials classes and have potential for the Indian industry to gain global experience and competitiveness in high-technology areas with spin-off benefits. In addition, the **US-India S&T Endowment Fund (USISTEF)** provides grant-in-aid support for S&T driven innovations with significant societal impact. In a landmark move, IUSSTF launched a $2 million grant program under the U.S.-India Science and Technology Endowment Fund mentioned by Prime Minister Modi and President Biden in their Joint Statement in June 2023. The call for proposals was formally launched by Dr. Jitendra Singh, Hon'ble Minister of State (Independent Charge) for Science and Technology, and Mr. Eric Garcetti, U.S. Ambassador to India, on July 12, 2023. Aligned with the iCET program, this initiative has already received a robust response with 196 applications and shortlisted 17 projects for funding in Quantum Technologies and Artificial Intelligence.

2.1.3 European Union (EU)

Key activities during the year under this component are given below;

- Under India-EU Cooperation on Research and Innovation (R&I) and, in line with the EU-India Strategic Partnership: A Roadmap to 2025, DST has identified calls for proposals in the Work programmes 2023- 2024 of the EU R&I 'Horizon Europe' (HE). This considers of mutual interest and aiming to tackling global challenges jointly. The call topics earmarked by DST were in areas of AI, Data and Robotics; Hybrid electric energy storage solutions for grid support and charging infrastructure; Circular economy approaches for zero emission vehicles; in line with Mission Innovation.

- The 14th EU-India JSTCC meeting on 25 September 2024, held in Brussels in Hybrid mode. The discussions were on EU and India current STI policy context and overall contribution of R&I cooperation to the EU-India Partnership. Both sides gave their consensus on the renewal in 2025 of the current S&T Agreement. Exchanged views on values and principles for cooperation on STI on gender equality, open science and anticipatory policymaking and discussed the way forward for India-EU cooperation on STI.

2.1.4 Indo - UN:

Key activity during the year under this component is given below;

- The 9th UNSTI forum was primarily focused on science, technology and innovation for reinforcing the 2030 Agenda and eradicating poverty in times of multiple crises: the effective delivery of sustainable, resilient and innovative solutions (SDGs 1 and 2). The agenda also included climate action (SDG 13), Peace, Justice and Strong Institution (SDG 16) and Partnership for the Goals (SDG 17). Three members Indian delegation from DST side have represented at the UNSTI forum during 8th -10th May 2024 in New York, USA.

2.1.5 Vaishvik Bharatiya Vaigyanik (VAIBHAV) Research Programme

The Programme is having two modes of fellowships; 1) VAIBHAV Fellowship and 2) Distinguished VAIBHAV Fellowship. During the year 2nd cycle of 1st call of VAIBHAV Fellowships in 18 thematic research areas was announced. A total of 216 applications were received which are under evaluation. this call has been screened by Internal Screening Committee of DST followed by technical evaluation by expert review committees.

2.1.6 India Science and Research Fellowship (ISRF) Programmme: The new ISRF Call 2024-25 was launched in March 2024 for researchers of Afghanistan, Thailand, Bangladesh, Bhutan, Maldives, Myanmar, Nepal and Sri Lanka, in the themes such as Life Sciences, Veterinary Science, Fisheries, Medicine, Agriculture, Geology, Chemistry, Mathematics, Computer Science, and Engineering etc. A total number of 104 applications have been received under this call and are evaluated by the expert review committee.

2.2 Mega Facilities for Basic Research (MFBR)

Mega science projects are long-term projects which involve state-of-the-art technologies and very complex issues. These projects are manifestly multi-agency, multi-institutional and, most often with international collaborations. This program is aimed to enable participation of Indian researchers in such state-of-the-art research facilities, especially from academic and scientific sectors, and to create such facilities in and out of the country. DST and DAE partnered in many of these projects. Under this scheme, Indian researchers are participating

in experiments at Large Hadron Collider (LHC), European Organization for Nuclear Research (CERN), Geneva, Brookhaven National Laboratory (BNL), USA, Elettra Sincrotrone, Italy, Fermi National Accelerator Laboratory (Fermilab), USA. Also, India is partner in establishment of international facilities like Facility for Antiproton and Ion Research (FAIR) in Germany, Thirty Meter Telescope (TMT) in USA and Square Kilometer Array (SKA) in Australia and South Africa. During the year, lot of developments took place and the notable ones are described below project-wise.

2.2.1 Indian Participation in Research Initiatives at LHC, CERN:

Indian researchers are participating in Compact Muon Solenoid (CMS) Experiment and A Large Ion Collider Experiment (ALICE) at CERN. In addition, they are also involved in utilization of Regional Worldwide Large Hadron Collider Computing Grid (WLCG) for CMS and ALICE experiments. India is also an Associate Member State of CERN. The important achievements from these initiatives are as under.

- **Indian Participation in CMS Experiment at LHC, CERN:** Indian participation in the experiment involves 43 Indian faculty members/scientists and about 54 PhD students/ post-docs from 21 institutions. During the year, India-CMS institutes continued R&D and related developmental activities. India-CMS collaboration is involved in 4 hardware upgrade projects for the experiment, viz., Outer Tracker, Gas Electron Multiplier (GEM), High Granular Calorimeter (HGCAL) and Trigger. These hardware deliverable projects involve six Indian industries. 7 Detector Labs established earlier continued contributing for experimental activities at CERN.
- For outer tracker, different module components including stiffeners, cooling plates and baseplates, made of carbon fiber material were produced. 5 new outer tracker modules were assembled by India-CMS groups and more than 100 silicon sensors were tested.

Figure: Outer Tracker Silicon Module Detectors

GEM foils of sizes, 10 cm x 10 cm, 30 cm x 30 cm and large-size M1 foils (for GE2/1) were developed by Indian industry. Trigger boards and HGCAL readout boards were also fabricated by Indian industries.

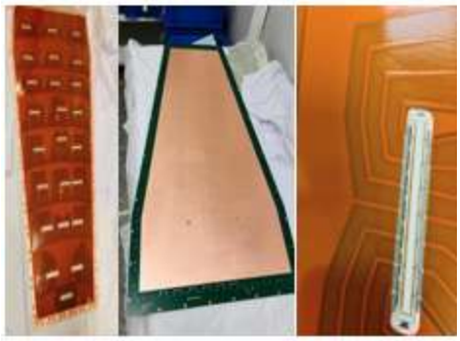


Figure: Fully fabricated Readout Board

India-CMS contributed towards Trigger Boards fabricated by Indian industries. HGCAL activities continued towards front-end and back-end readout boards.

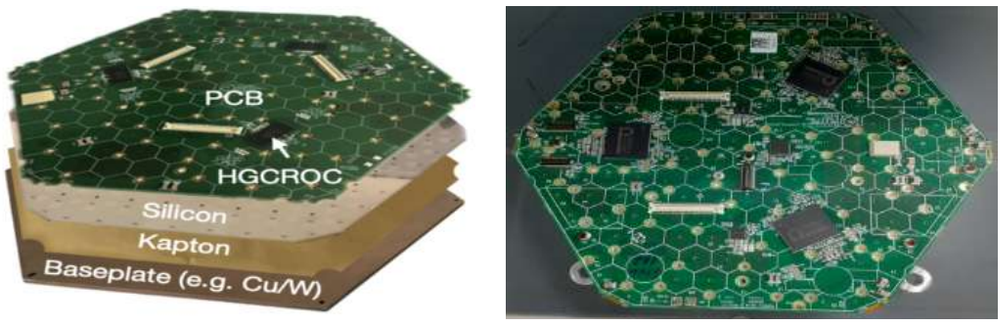


Figure: HGCAL Silicon Module

During the year, 13 research publications were produced with Indian faculties, students as the lead authors. Output from the project also includes several conference publications and 9 PhDs. Two India-CMS students/engineers received CMS Awards for contribution to CMS.

- **Indian Participation in ALICE/STAR Experiment at CERN/BNL:** 15 Indian research groups involving 31 scientists/engineers and 66 PhD students/post-docs continued their work in ALICE experiment at CERN and Solenoid Tracker at RHIC (STAR) experiment at BNL, USA. During the year, R&D work on different aspects of p-type silicon detectors continued. The developed p-type silicon detector was tested at CERN test beam facility. Indian ALICE group has indigenously designed, developed and fabricated p-type Silicon detector array of dimensions 8 x 9 on 6-inch wafer with 1 cm^2 array element. During the year, Indian researchers were joint authors in 10 collaborative research publications from ALICE and STAR experiments. Output from the project also included 9 PhDs.

- **Utilization of Regional WLCG:** During the year, the LHC experiments collected and retained an impressive 220 PB of RAW events. This unprecedented volume of information was successfully handled by WLCG sites, including two Indian Tier-2s, ensuring that the data were made available to physicists to produce new science. During the year, four

Workshops were organized at University of Delhi, TIFR Mumbai VECC Kolkata. and university o Hyderabad

- **India's Associate Membership of CERN:** India became Associate Member State of CERN in 2017 and DST is equal partner with DAE in this initiative. The initiative also enabled participation of Indian Industries in CERN procurement processes. During the year, Indian Companies continued participation in production of different components and also delivered some of them.

2.2.2 Indian Institutions-Fermilab Collaboration in Neutrino Physics

Indian researchers are participating in ongoing neutrino experiments at Fermilab, USA which includes 14 faculty members, 24 PhD students and 2 post-docs from 9 research groups across the country. During this year, 9 PhD students spent significant time (between 6 to 10 months each) stationed at Fermilab for experimental work. NOvA shifts continue to be operated by Indian participants at Fermilab and remotely from India too, using Remote Operations Centre at Chandigarh. Output from the project included 10 collaborative research publications, 15 other research publications, about 40 talks/posters, 4 PhDs and, training of more than 10 human resources.

2.2.3 Utilization of Indian Beamlines, XRD2 and Xpress, at Elettra Synchrotron, Italy

During the year, utilization of two Indo-Italian beamlines, XRD2 and Xpress, at the Elettra Synchrotron continued providing high-quality scientific output in the respective fields. Major achievements from these two beamlines are provided below.

- **XRD2:** The beamline continued to be utilized for high-end research in protein-nucleic acid interactions, membrane protein structural biology, pharmacology of drug-receptor interactions, structural biology of neurological disorders, and glycobiology. During the year, 9 experiments involving 5 institutions were carried out, with 798 high-resolution datasets collected. Nearly 50 PhD students continued utilization of the beamline for their research work. Output also included 5 research publications, 4 PhDs, and deposition of several protein structures in Protein Data Bank. 9 of the 78 protein structures deposited so far in the Protein Data Bank were released.

- **Xpress:** The beamline, currently invoking substantial interest from the user community dedicated to high-pressure diffraction, continued to be utilized for advanced research in the areas of condensed matter physics, chemistry, and material science at extreme conditions of pressures and temperatures. During the year, 27 proposals involving 15 institutions were carried out. Out of these, 24 proposals were performed in presence, and 47 participants could receive on-site hands-on training. In particular, 24 young researchers (PhD students and post-docs) utilized the beamline for their research work. The main output this year included 20 research publications and 6 PhD theses.

2.2.4 200 kV Ion Accelerator Research Facility at Kurukshetra University

Support for the facility continued. During the year, more than 32 ion beam experiments were performed with gaseous and solid ions on thin films of 8 different materials and bulk targets of polyethylene, polypropylene at ion energies of 30-200 keV with different ion fluences and at varying oblique incidences of 15^0-90^0. Research output from the project included 16 research publications, 26 conference papers, 2 book chapters, 4 M.Sc. projects, 5 invited lectures, 1 PhD awarded and 2 PhDs submitted.

2.2.5 Indian Participation in FAIR project at Darmstadt, Germany

India is participating in the construction of FAIR as a Founder-Member partner. Civil construction of the facility completed, and installation of accelerator components is in progress. At Indian end, support towards the facility continued during the year and ongoing project activities in the country gained further momentum. During the year, 35 Power Converters and were supplied to FAIR as Indian in-kind contribution. Beam Catcher prototype is also in the advanced stage of production.

India hosted 42nd FAIR Council Meeting at Bose Institute during the year. Delegates from the partner countries and FAIR/GSI Management participated in the meeting where matters related to policies, challenges and way forward towards the implementation of one of the largest multi-purpose particle accelerator projects of our times were discussed.

2.2.6 India's Participation in the Thirty Meter Telescope (TMT) project: India is participating in the construction of TMT as a Founder-Member partner country with continued support from DST and DAE. During this year, TMT project and National Science Foundation (NSF), USA made consistent efforts involving native Hawaiians to resolve the issues for ensuring access to the project site. During the year, the project underwent the NSF's Final Design Review and the review decision is awaited.

Several milestones have been met by the TMT Project in this year. National Astronomical Observatory of Japan (NAOJ), Japan and Ohara Inc. supplied 60% of quality-checked mirror roundels as part of Japan's in-kind contribution and production of remaining 227 blanks is ongoing. In June 2024, the project celebrated a major milestone of polishing 109 mirror segments including India's and Japan's share. Several of the subsystems, like, Alignment and Phasing System (APS), Secondary (M2) and tertiary (M3) mirror support systems and positioners all completed their preliminary design and are currently in the final design phase. TMT's structure that serves as the framework onto which all other subsystems like mirrors, science instruments, cables, refrigerant lines, laser guide star facility. etc., is ready for production.

In parallel, India-TMT continued design, development and prototyping activities towards its in-kind commitments to the project involving 28 Indian industries. The key components manufactured in India are listed below;

- **M1 Segment Polishing:** Segment polishing achieved a major milestone this year. Stress Mirror Polishing (SMP) of first roundel segment successfully completed at India-TMT Optics Fabrication Facility (ITOFF) and has passed Phase-I of Fabrication Readiness Review. With Phase-2 review, expected to be scheduled in early 2025, ITCC will be churning out polished mirrors for TMT soon.
- **Segment Support Assembly (SSA):** India will provide 574 SSAs. During the year, first 5 additional sets of SSA Module Assembly and testing completed successfully. Totally 10 SSA modules are ready. Mirror Rod Flexures, additional component of SSA successfully developed. BR127 primer coating process development successful.
- 10 Central Diaphragms are fabricated in this year and shipped to ITCC for PQP (Production Qualification Phase) review. Sub Aperture Station (SAS) interferometer metrology station successfully installed at ITOFF.

Figure: TMT Polished Mirror rounded on Sub Aperture Station for mid-spatial frequency measurements

In addition, a 3-axes Gantry system for positioning of SAS interferometer for scanning mirror segment was designed, developed and installed at ITOFF successfully.

- **Warping Harness Cables (WHC):** 20 sets of WHC were sent to the TMT Project Office which was reviewed successfully and passed all cable qualifications. 40 sets of WHC are under fabrication.
- **Actuators:** Totally 18 prototype P3 actuators need to be fabricated. 12 fabricated, assembled and tested. 8 shipped to TMT Project Office (TMTPO). 4 actuators are at India-TMT Coordination Centre (ITCC) for testing. Remaining 6 actuators are machined; assembly and testing are ongoing.

- **Edge Sensors:** Machining of edge sensor coupons and gold coating processes continued. 33 out of 75 edge sensor blocks are manufactured. 50-micron Chromium coating on edge sensor blocks was successful and 500-micron copper coating process developed.
- **Observatory Software (OSW):** Data Management System (DMS), one of the principal software sub-systems of TMT which is critical for the science to be realized, successfully passed the final design review.
- **Wide Field Optical Spectrograph (WFOS):** India-TMT continued work prototyping complete Grating Rotation and eXchange (GRX) system, mechanical, electronics controls and electrical and software. Phase-A completed. Rail-to-rail exchange mechanism successfully checked. Work on developing Instrument Control Software, opto-mechanical design of the calibration system, and finite element analysis of the structure of WFOS also continued.

In addition to developmental activities, the project also resulted in 2 scientific and technical publications, 4 PhDs are ongoing, 1 PhD completed. 6 India-TMT team members undertook outreach activities.

2.2.7 Indian Participation in Square Kilometer Array (SKA) project in Australia and South Africa

SKA is an upcoming next-generation global radio astronomy facility. During the year, India completed the process of signing and ratification of SKAO Treaty and India became member of SKAO council in july 2024. Funding to the project granted during the year and the project activities gained further momentum during the year.

2.2.8 Establishment of Laser Interferometer Gravitational-wave Observatory-India (LIGO-India)

LIGO-India aims to establish 3rd Detector of LIGO in Hingoli District in Maharashtra. During the year, project activities gained further momentum. Testing and Training Facility at Indore was established during the year.

2.3 Nano and Advanced Materials Divisions (NAMD)

The Department of Science and Technology had launched Nano Science and Technology Initiative (NSTI) -Nano Mission with due approval of the Cabinet as an “Umbrella Capacity Building Program”, with an allocation of Rs.1000 crores for 5 years (2007-2012) and subsequently the program was extended for another tenure of 5 years (2012-2017) in Phase II. Based on the third-party evaluation of the Phase II, Nano Mission was converted into “National Programme on Nano Science & Technology (NPNST)” in 2017. This year the program has been renamed as Nano and Advanced Materials Divisions (NAMD). The key highlights under different components of programme during the year are given below:

2.3.1 New Initiative:

Recently a call for pre-proposals on “Advanced Materials” to promote the basic and applied research activities on the thrust research areas of advanced materials was launched during September-October 2024, which is in line with Vision of Vikshit Bharat 2047. The call was focused on the following verticals:

- Affordable and sustainable materials processing
- Engineered low dimensional materials for optical and electronic applications
- Structural materials for mobility applications
- Bio-inspired materials for sensing and diagnostics
- High performance materials for energy conversion
- Theory/computational design of materials for the above verticals

Total 3,235 pre-proposals were received against the call in line with the above thematic areas which are being scrutinized for financial support.

An Expert Advisory Committee constituted under NAMD is working on Detailed Project Report document on Advanced Materials. A national level workshop was organized including a Brainstorming Session on Advanced Materials focusing on 14 thematic research areas with a participation of over 100 eminent scientists and experts from academia/Industry during 2nd – 3rd September 2024 at IIT Hyderabad.

NAMD had organized series of Expert Advisory Committee meetings at JNCASR, Bangalore, ARCI, Hyderabad and IIT Mandi to prepare the above report.

2.3.2 Completed Projects and Technology transfer

Key highlights under this component are as follows;

- **Nanoelectronics Network for Research & Applications (NNetRA) Project:** NNetRA program deals with 5 Institutes Nano Networking projects that are co-funded by Department of Science and Technology and Ministry of Electronics and Information Technology (MeitY) and being Implemented at 5 Institutes with partial financial support from host Institutes. Some of the institute-wise significant outputs under the project is given below:

i. IISc Bangalore:

- There are 16 sub-projects from IISc involving around 35 faculty members.
- Out of 16 sub-projects, six are TRL 7 and above.
- There are 5 ToTs, 162 Papers, 13 patents filed/granted under the project so far.
- Two start-ups namely AGNIT Semiconductors Pvt. Ltd. for GaN Semiconductor technology and Theranautilus for nanorobotics from lab to clinics have been incubated at IISc Bangalore.

Below table indicates the list of research projects and its transfer to technology

Research Project	Transfer of Technology to Agency
GaN Transistors	AGNIT Semiconductors Pvt. ltd
Metal Oxide Gas Sensors	SCL, Chandigarh
Portable PCR system	ShanMukha Innovations Pvt Ltd
High Power Fiber Laser Module	Bharat Electronics Ltd.
Photonic Sensor	FIRSTSENSE SAFETY PvT. LTD
Magnetic field sensors for vehicle detection and linear position sensing (TOT Initiated)	Janatics India Private Limited
Remote magnetic navigation of multifunctional nanoprobes in biological tissues: towards spatially targeted cancer theranostics (TOT Initiated)	Theranautilus Pvt. Ltd

ii. IIT Bombay:

- There are total 4 sub-projects from IIT Bombay involving 17 faculty members.
- Out of 4 sub-projects, 3 are TRL 7 and above.

- 28 papers have been published under the project so far.
- There have been 4 ToTs and four patents filed under the project.
- One start-ups namely Numelo Technologies Pvt. Ltd. has been incubated under the project.

Project	Transfer of Technology to Agency Done
OTP memory-based trimming	SCL Chandigarh
C-band GaN device fabrication	ISRO-SAC
C-band GaN based MMIC	DPSU
Soil Sensor	Proximal Soilsens Technologies Pvt, LTD

2.3.3 Other Scientific highlights

- **Photochemical and Electrochemical Processes in Assembled Molecules and Nanomaterials: Implications Field and Coherence in Photovoltaics:** PI and his team have engineered semiconductor quantum dots that are useful as components for generating single- and two photon emitters on demand and in a controllable fashion. Their investigations have shown that by modifying the dimension of II-VI semiconductor nanocrystals from zero-dimensional to one-dimensional confinement, they could alter a single-photon pure nanocrystal to a two-photon emitting nanocrystals.
- **Design and Development of a low cost, rapid and sensitive sensor for the on-site detection of Endotoxin:** PI and team developed & analysed various sensor surfaces to create a point-of-care device that is cost effective, has a hassle-free operation, may be controlled via Bluetooth. Thus, a portable, cost-effective, and technician-less electrochemical biosensor prototype of a point-of-care device was designed, built, and examined with the endotoxin.

2.3.4 International Collaboration for Indian Beamline

- **Indian Beamline at Photon Factory KEK, Japan supported during Phase-II:** On successful completion of the Phase II, Phase-III of the collaborative project “Indian Beamline at Photon Factory KEK, Japan” (a flagship India-Japan Collaborative Project) was sanctioned at a total project cost of Rs.25.33 cr for a period of 5 years (2024-2029) at Jawaharlal Nehru Centre for Advanced Scientific Research (JNCASR), Jakkur, Bangalore, Karnataka. The Photon Factory is a synchrotron light source facility, as a part of the High Energy Accelerator Research Organization (KEK), Japan. The Photon Factory provides one of the four quantum beams (photons, neutrons, muons and positrons) for the Institute of Materials Structure Science (IMSS), which reveal atomic-

level structures and electronic structures of all the materials, including living systems. First India@KEK Japan Bi-lateral Steering Committee Meeting was held online on 17th September 2024 was attended by members from both countries. Discussions were held on detailed on implementation of the project including working on draft MoU and beamline allocation timeline.

Proposed activities under Phase-III are Upgradation of Low temperature powder diffraction setup and procurement of a Liquid N_2 jet flow cryostat for the low temperature experiments up to 90K and installation at the beamline. Cyberstar point detector used extensively for almost all the experiments will be installed a new detector with better efficiency and signal-to noise ratio (SNR) performance will help to perform the experiments.

- **Assured access to all beamlines of ISIS neutron scattering facility at RAL, UK**

  ISIS has 34 neutron and muon instruments with two target stations, allowing them to be optimized for specific measurement techniques (e.g., high-energy chip irradiation facilities for component testing and certification). In addition to this, ISIS also provides well equipped laboratories for chemistry, biology, and materials characterization. A deuteration laboratory provides deuterated materials for the user community. These capabilities provide unique opportunities for materials discovery, understanding, and optimization. The most recent round of new instrumentation development at ISIS is the second phase of ISIS Target Station 2 (TS2). The seven initial instruments available on TS2 have outstanding performance in terms of brilliance, range, and signal-to-noise. Over all 100 researchers from 21 institutions in India received 180 days (80 experiments) of access to all beamlines of ISIS neutron scattering facility at RAL, UK resulting in 85+ research publications in top-ranked international journals including Nature under the present collaboration 2016-2024.

  Keeping in view the large demand from the Indian research community proposal for five years with a budget of Rs. 56.24 cr was considered for support. The proposal for the Phase II was presented during the Expert Committee meeting was held on 29th May 2024. The proposal aims to utilize 225 days of beamtime for collaboration for next five years in Indian calls and to support 50 days for Indian users in the ISIS direct calls, the latter will be selected by the ISIS panel

- **Indian Beamline for Nano Science and Technology at PETRA III at DESY Hamburg, Germany:**

  The Memorandum of Understanding MoU for 2-years extension with additional funds of Rs. 52.86cr for continuation of Indian beamline for Nano Science and Technology at PETRA-III, DESY, Germany Phase-II was signed between JNCASR and DESY Hamburg as part of the Golden Jubilee Celebration event held in New Delhi on 24th

October 2024. The signing was done in presence of Hon'ble Minister of State (IC) for Science & Technology and Earth Sciences and German Federal Minister of Education & Research (BMBF).

2.4 Climate Change Programme (CCP)

DST has been entrusted with the responsibility of coordinating two national missions on climate change as part of National Action on Climate Change (NAPCC). These are (i) National Mission for Sustaining the Himalayan Ecosystem [NMSHE] and (ii) National Mission on Strategic Knowledge for Climate Change [NMSKCC]. Both the missions aim to build human and institutional S&T capacities, generate strategic knowledge and create awareness in the key areas of climate change science, impacts and adaptation. The Climate Change Programme (CCP) is implementing these two national missions.

Figure: Unveiling of the report on 'District-level Climate Risk Assessment for India' at stakeholder's workshop organized at IIT-Delhi on December 13, 2024

Management of climate-related risks, including improved understanding and alleviation of the vulnerabilities to extreme events, is imperative to minimize their adverse impacts. Risks associated with water availability and water-related hazards are projected to rise across all regions in the mid to long term. Scientists from Indian Institute of Technology Mandi, Indian Institute of Technology Guwahati, and CSTEP Bengaluru, with the support from DST and the Swiss Agency for Development and Cooperation (SDC) have worked on two most widespread climate hazards – flood and drought and brought out a report, which can be accessed at the link https://dst.gov.in/document/reports/district-level-climate-risk-assessment-india-mapping-flood-and-drought-risks-using. This report on 'District-level Climate Risk Assessment for India: Mapping Flood and Drought Risks Using the IPCC Framework' offers district-level flood and drought hazard, exposure, and vulnerability maps,

leading to the generation of comprehensive flood and drought risk maps for India. It includes district-level flood and drought hazard, exposure, vulnerability, and risk maps for each Indian state and UTs. These maps aim to enhance the capacity of State Climate Change Cells and allied departments for climate risk assessment and adaptation planning.

The Flood Risk Assessment report reveals that 51 districts in India fall into the 'Very High' flood risk category, with 118 districts classified as 'High' risk. The Drought Risk Assessment identifies 91 districts at 'Very High' drought risk and 188 districts at 'High' risk. Additionally, 11 districts face a 'Very High' dual risk of both flood and drought, among the top 50 districts with the highest flood and drought risks. These findings emphasize the need for targeted risk mitigation strategies.

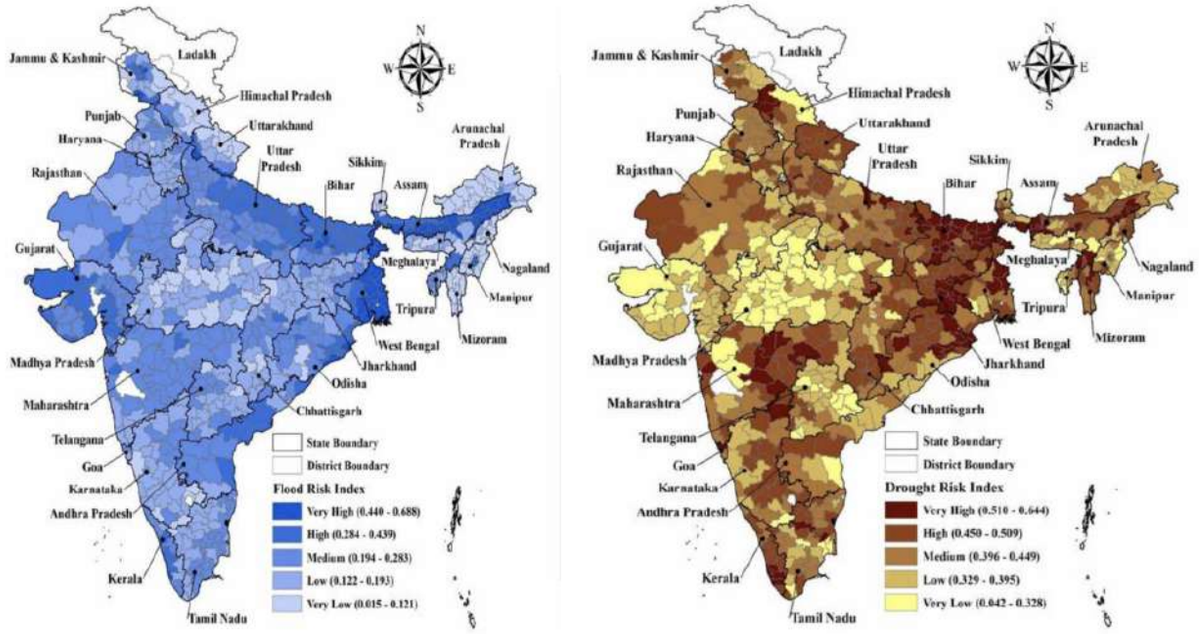


Figure: District-wise (a) Flood and (b) Drought Risk Assessment

The Climate Change Programme (CCP) organized a two-day National Climate Change Conclave (C3) –Inception, Implementation, and Impacts (I3) on 27th –28th May 2024 at IIT Delhi's Research and Innovation Park, in association with IIT Delhi, BHU, Delhi University, and IIT Bhubaneswar. The event involved ~150 climate scientists and policymakers from institutions such as IITs, BHU, DU, IISc, IMD, ICRISAT, and DST Centres of Excellence. Eminent scientists delivered talks on the evolution of climate change R&D, while panel discussions on themes like Indian monsoon, urban climate, Himalayas, and Women in Climate Change highlighted progress, challenges, and future needs.

2.4.1 Capacity Building Programmes

First of its kind 21-day Capacity Building Program in Glaciology, featuring on-field training at the Machoi Glacier in Drass, Ladakh, has been successfully conducted by the University of Kashmir this year, benefiting twenty doctoral and post-doctoral students nationwide. Participants received hands-on experience with state-of-the-art instruments essential for advanced glaciological research. These instruments enabled the collection of precise and comprehensive glaciological, hydrological, and meteorological data, which are critical for informed decision-making, effective mitigation strategies, and contributing to global climate change studies.

DST-Center of Excellence on Water resources, Cryosphere and Climate Change studies established" at the Department of Geology, Sikkim University conducted 4th "Advanced Training Program on Water Resource Management, Glacier Monitoring & Climate Change Studies" and provided advanced training to 35 young academicians, researchers and scientists working in areas of water resource management, cryosphere, and climate change studies.

2.4.2 New Initiatives

This year many new initiatives were taken up under both the missions and the details are as follows:

- Four Centre of Excellence (CoE) were established to work on different aspects of CC science and adaptation.

    a. **Disaster Risk Reduction and Sustainability** at Indian Institute of Technology (IIT) Roorkee for promoting capacities and public-policy for resilience and sustainability through policy research, action research and knowledge integration interventions.

    b. **Climate Change Research** at Banaras Hindu University, to study interlinkaging of climate extremes, sustainable practices using high resolution advanced datasets, satellite and geospatial technology, and its implementation at ground level.

    c. **Climate Information** at Indian Institute of Technology (IIT) Delhi to undertake modeling framework for the country through region specific model customization.

    d. **Climate and Disaster Resilient Agriculture** at Tamil Nadu Agricultural University (TNAU) for better understanding of climatic risk and vulnerability of agriculture sector under current and future climate.

- Established new State Climate Change Cells (SCCCs) in the UT of Ladakh to undertake vulnerability assessment, training programmes, public awareness and institutional capacity building and to carry out several activities that connect their State Action Plans on CC with NMSHE priorities of action.

2.5 National Supercomputing Mission

The mission is implemented and steered jointly by the DST and the Ministry of Electronics and Information Technology (MeitY). This Mission envisages to empower our national academic and R&D institutions spread over the country by enabling the High-Performance Computing (HPC) infrastructures of various capacities. It is being achieved in a phased manner; Initial commissioning has taken place using the procured systems, followed by assembling the system in the country. Through this route, 27 Petaflop of infrastructure has been created across 20 locations. The final and current phase of infra-creation is based on indigenous developments like Rudra server, software stacks etc. Through this Mission, GoI intends to reach the large Scientific & Technology community in the country and enable the nation with HPC capacity to solve multi-disciplinary grand challenge problems.

Below are the key objectives of the mission

- To make India one of the world leaders in Supercomputing and to enhance India's capability in solving grand challenge problems of national and global relevance.
- To empower our scientists and researchers with state-of-the-art supercomputing facilities and enable them to carry out cutting-edge research in their respective domains.
- To minimize redundancies and duplication of efforts, and optimize investments in supercomputing.
- To attain global competitiveness and ensure self-reliance in high-performance computing technology.

The Broad HPC Areas focusing in this mission are as follows;

- Astrophysics
- Bioinformatics
- Computational Material Science and Nanomaterials
- Disaster Simulations and Management
- Molecular Dynamics
- Weather Prediction
- Urban Modelling

Current Status and achievements during the year is given below;

- This year, ~5 PF of computing power has been created using the indigenously developed Rudra server. The details are given below, with this the total capacity is increased to 32 PF. Three of the systems have been inaugurated remotely by Hon'ble Prime Minister Narendra Modi on 26th September 2024.

S. No.	States	Name of institution	Name of Supercomputer	Compute Capacity
1	Delhi	Inter-University Accelerator Centre(IUAC), Delhi	PARAM Rudra-1	3 PF
2	Maharashtra	Giant Meterwave Radio Telescope (GMRT) - National Centre for Radio Astrophysics, (NCRA), Pune	PARAM Rudra-2	**1.0 PF**
3	West Bengal	S. N. Bose National Centre for Basic Sciences, Kolkata	PARAM Rudra-3	838 TF
4	Delhi	C-DAC, Delhi	PARAM Rudra-4	200 TF
Total computing capacity				**~5 PF**

Figure: Unveiling of three "Param Rudra" supercomputers at IUAC New Delhi, GMRT-TIFR Pune and SNBNCBS, Kolkata

- Data centre for 20 PF national facility is currently in progress.
- Agreement signed with AICTE to consider HPC in the educational syllabus, and also to provide tabletop unit HPC systems to the educational institutions under them.
- Indigenous processor design partner and chip tap-out partner have been identified and a MoU was signed.
- As of 2024, 20000 researchers and college students have been trained through the HPC awareness program.
- 10,712 expert users are currently using the facility and 1,06,21,942 computing queries have been solved so far using the NSM infrastructures.

CHAPTER 3

INNOVATION TECHNOLOGY DEVELOPMENT AND DEPLOYMENT

3.1 Technology Development Programs

Technology Development Programme (TDP) has been promoting and supporting activities related to indigenous development of innovative technologies in identified areas at various R&D laboratories/ institutions. Under this Programme, project proposals are supported to convert proof-of- concept for technologies/ techniques/ processes/products into advanced prototypes for validation and demonstration in actual field settings. Feasibility of fresh ideas/ concepts are also assessed for their potential conversion into useful technology/product. This has resulted in development and deployment of technologies both in the advanced/ emerging areas and in traditional sectors/areas with subsequent transfer of know-how for their commercial production. The components of TDP consists of Advanced Manufacturing Technologies (AMT), Waste Management Technologies (WMT), Technology Development Program (TDP), Biomedical Device and Technology Development Program (BDTD), Therapeutics Chemicals Program (TCP), Technology Enabling Centres (TEC).

During the financial year 2024-25, 26 new projects by different project investigators were supported across the country under the TDP program. These projects were supported in different thematic areas such as Advanced Materials and Processing, Agro Tech and Food Processing, Construction/ Infrastructure and Low-cost Building Materials and Spectroscopy/ Sensors/ Devices/ Environmental Technology Solutions.

For the review of ongoing/completed projects funded under the Programme, two meetings of Program Advisory Committee (PAC) were conducted wherein final evaluation of ~45 projects were completed and as many as 50 ongoing projects were technically reviewed and also provided suggestions for midterm course correction wherever it was necessary.

A brainstorming meeting was conducted (in a virtual mode) with experts and relevant stakeholders from different institutions to identify thematic/focus areas to be given under the New Call for Proposal under the programme. Based upon deliberations and suggestions from the experts, the thematic areas were identified. A discussion on the possibility of creation of new Technology Translation Centres (TTCs) was also held and inputs for the structure, functioning, support to be extended from the DST for its establishment and scope of work of these centres were also discussed.

Through the Biomedical Device & Technology Development (BDTD) program, proposals were invited under the 6 thematic areas for medical device development. Overall 175 proposals were received for research under - 1) Healthcare and Medical Wearable Sensors/Devices; 2) Portable Medical Imaging; 3) Medical Device Development; 4) Bio Inspired Technological Solutions and Wound Care Technologies; 5) Women and Child Health Care Devices; and 6) Creation of Centre of Excellence (CoE). After a rigorous two-stage evaluation process, 15 (fifteen) proposals have been recommended for funding support. In addition, four Biomedical-hubs have been successfully established at Chandigarh, Chennai, Delhi & Karnataka which house sophisticated facilities to assist the translational platform used for technology up-scaling or prototype development or development of devices in substantial numbers for market validation. The facility is available to the members striving towards a common goal on a sharing basis.

The DST-TDP Technology Enabling Centers (TECs) across the nation are emerging as dynamic hubs for fostering innovation, driving translational research, and strengthening the linkage between academia and industry. These centers have demonstrated remarkable performance in leveraging science and technology to address real-world challenges faced by industries. By promoting collaborative projects, facilitating access to cutting-edge infrastructure, and nurturing startups, TECs are enabling industries to adopt advanced technologies and enhance their competitiveness in global markets. Their contributions span diverse sectors such as healthcare, manufacturing, agriculture, and renewable energy, exemplifying the transformative power of science-driven solutions in fostering sustainable growth and economic development.

The Technology Enabling Centre (TEC) at Panjab University has made significant strides in fostering innovation and bridging the gap between academia and industry throughout 2024. Below are the some of key achievements and initiatives undertaken during the year, including:

Successfully transferred two patented technologies to industry.

Secured multiple consultancy projects of around Rs. 60 Lakhs aligning academic expertise with industrial challenges.

The GITAM Technology Enabling Centre (G-TEC) has made significant strides in promoting innovation and advancing technology transfer. A comprehensive survey of 1260 patents was conducted to evaluate their Technology Readiness Levels (TRL), and 41 innovative technologies were identified and mined for development. 5 key technologies were successfully mapped, while two advanced technologies, including a solar dryer with integrated temperature control, were developed, with progress on five additional technologies underway. G-TEC facilitated 23 Memoranda of Understanding (MoUs) with academic institutions and 7 with industrial partners to bolster research collaborations and commercialization. Notably, two technologies were transferred - one to GAIL and another to the State of Mizoram's Ministry

of Horticulture, which will help farmers of the entire state—and eight patents were filed to safeguard innovation, with five more in progress.

G-TEC also strengthened partnerships with key government bodies such as MSME, APPCB, AMTZ, and CIFT to ensure alignment with regulatory frameworks. GTEC organized 19 training programs, 6 for industries and 13 for academia, focusing on skill enhancement and knowledge dissemination. The successful hosting of the International Conference on Solid Waste Management from November 27th to 30th, 2024, at the GITAM Visakhapatnam campus attracted experts across diverse fields. G-TEC published three newsletters to disseminate its achievements, providing updates and showcasing advancements, underscoring its role as a catalyst for technological progress and innovation.

Figure: Transfer of Technology to the State of Mizoram

Figure: International conference Industry/Academia and Technology Expo.

Figure: Capacity building

Figure: Health Tech Industry Academia Roundtable

Figure: Capacity building

Figure: Industry Academia Roundtable

3.1.1 Key Technologies developed through the projects supported under the Technology Development Programme are as follows;

- **Development of Spectroscopic Soil Health Analyzer using Chemometric Analysis and Cloud Services**: NIR Spectroscopy has become an essential tool in various industries, including agriculture, food processing, pharmaceuticals and environmental engineering. To address the challenge of high cost due to the requirement of sophisticated tool and analytical tools, the Centre has come up with a pay-as-use-(PAU) model.

Figure: Soil Health Analyser developed by CSIR-CEERI Pilani

- **Design and development of an intelligent extrusion device for 3D printing of concrete structures:** The innovative 3D printing system designed for the fabrication of cement-based structures using a layer-by-layer deposition technique. The printer utilizes a robotic or gantry system to control the movement of the print head, which is equipped with an extrusion mechanism capable of handling the viscous cement paste.

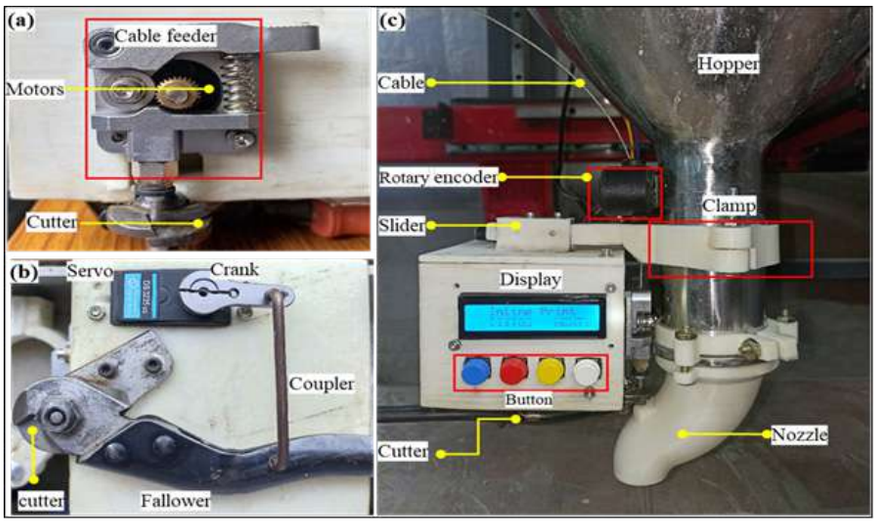


Figure: Reinforcement entraining device (a) MK8 extruder, (b) cutter and (c) reinforcement device mounted on a printer with newly designed nozzle developed at IIT Guwahati

- **Textile Based Nuclear Biological and Chemical (NBC) Decontamination Handwear:** The invention will be a single moiety that is universally capable to decontaminate NBC contaminants from the skin. The moiety is incorporated inside a delivery system

(hand-wear) made up of suitable fabric such as non-woven, spacer etc. This product is highly stable, compact, portable, self-usable and cost effective. The active ingredients used of Generally Regarded as Safe Category (GRAS) category hence safe to use on human skin. Single handwear decontaminates chemical, biological, and radiological contaminants from skin. Instant decontamination of CBRN spillage from dermal surfaces. This handwear can be used in nuclear power plants, nuclear medicine facilities where radiological agents are used and mass contamination scenarios.

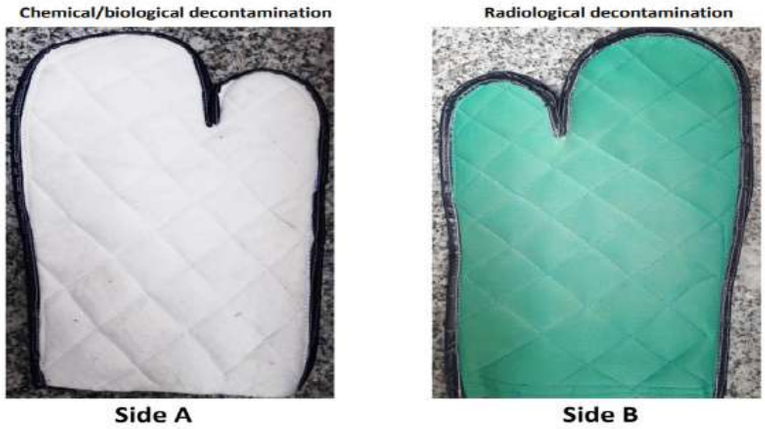


Figure: Nuclear Biological and Chemical Decontamination Handwear developed at IIT Delhi

- **Novel synthetic process and formulation development of ELIGLUSTAT tartrate by NIPER Hyderabad**

Gaucher's diseases: Gaucher disease (GD) is the lysosomal storage disorder (LSD) with an estimated global incidence of 1:40,000 to 1:60,000 live births. The exact epidemiological data on incidence and prevalence of this disease in India is not available though it said to be quite high.

Eliglustat: Medication for treating Gaucher's disease Type I(GD1). It acts as glucosylceramide synthase inhibitor. Eliglustat is a part of oral substrate reduction therapy (SRT) (Cerdelga, Sanofi Genzyme, Cambridge, MA, USA) which has been approved in many countries worldwide, including the United States, Europe, and Japan, as a first-line treatment for adults with GD1.

Introducing emerging technology such as Photocatalysis for the synthesis of C-N bond in the first step as shown in Scheme.1. Eliglustat molecule has two stereocenters on adjacent carbons in a syn fashion. Dynamic kinetic asymmetric transformations (DyKAT) are a highly valuable synthetic method for creating multiple stereocenters with complete stereoselectivity. Hence asymmetric reduction through dynamic kinetic resolution (DKR) protocol would be explored to create two adjacent stereogenic centers in a single transformation from racemic substrates to achieve eliglustat tartrate.

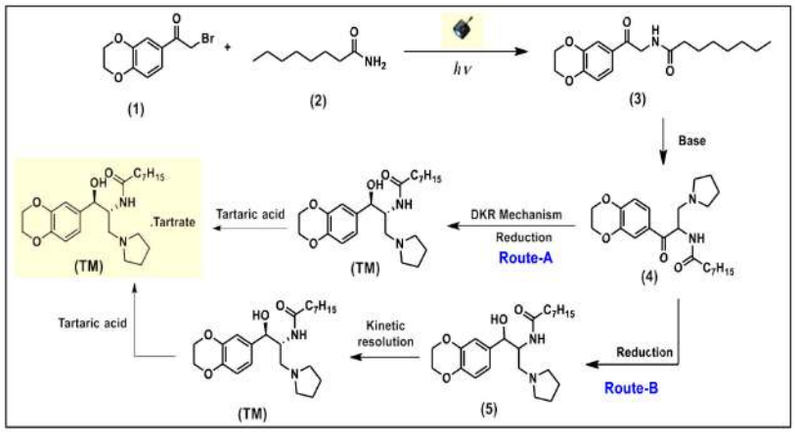


Figure: Synthetic scheme for the synthesis of Eliglustat hemitartrate

- **Advanced Wear and Corrosion Resistance Coatings Development and Commercialization in India by IIT- Patna**

The Centre of Excellence (CoE) for "Advanced Wear and Corrosion Resistance Coatings Development and Commercialization in India" has been established at IIT Patna, along with key industry partners such as Applied Materials, Tata Steel Limited, and Associated Plasmatron Pvt. Ltd. This CoE is equipped with state-of the-art thermal spray technologies, including High-Velocity Oxy-Fuel (HVOF), High-Velocity Air-Fuel (HVAF) systems, and a plasma spray system for developing advanced coatings. The facility also houses advanced characterization equipment such as a 3D optical profilometer, Electrochemical work station, micro-indentation tester, and ball-on-disc tribometer, enabling fabrication, testing, and performance evaluation of wear and corrosion-resistant coatings.

On the technical front, plasma-sprayed coatings were developed on substrates, with and without bond coats, as proposed by Applied Materials. Microstructure and phase evaluation of as fabricated coatings along with their properties, including density, adhesion strength, microhardness, elastic modulus, dielectric strength, and thermal shock resistance were evaluated.

Figure: State-of-the-art coating and characterization facilities at IIT Patan

- **Advanced Ultra-Precision Optics Manufacturing Technologies by IIT- Delhi**

  Development of critical precision optics for medical, defence, communication applications have been carried out by the Centre of Excellence (CoE) in Advanced Ultra-Precision Optics Manufacturing Technologies at IIT- Delhi, with advanced fabrication techniques, and state-of-the-art measurement tools. A brief overview of developed components has been presented in below figure:-

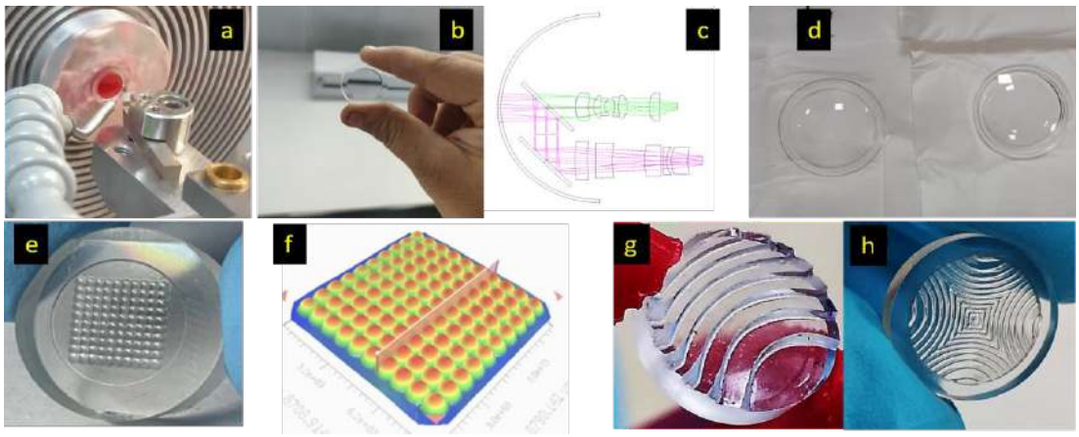


Figure: (a) diamond turned Intraocular lens (IOL) (b) SWIR optics on fluoride glasses for gun-sights (c) dual-band imaging system for defence applications (d) aspheric lenses for Li-Fi applications (e) fabricated lenslet for customized wavefront sensor (f) profilometry of fabricated lenslet (g) freeform Fresnel front-end for VLC receiver (h) diamond turned monolithic freeform Fresnel

- **Development of ultra-precision machines for development of precision optics/ opto-mechanics**

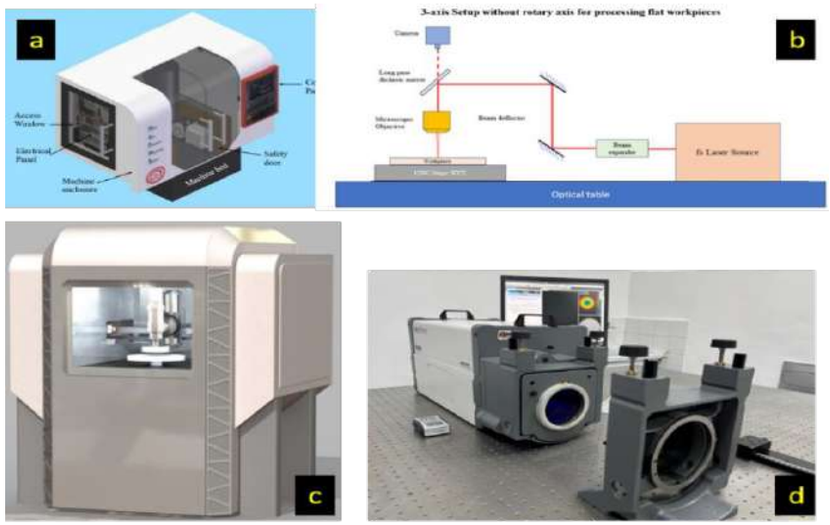


Figure: (a) Multi-axis precision machining (MAPMS) (b) Femto-based micro -machining (c) multi-axis polishing machine (d) Installed Fizeau Interferometer (Zygo Verifire)

Three ultra-precision machine design and development namely a) multi-axis precision machining (MAPMS), b) Femto Second Laser based micromachining system and c) polishing machine for super-finishing of optical surfaces are under process. Fizeau interferometer for surface form measurement has been installed. The other instructional facilities like Coordinate measuring machine (CMM) and five milling machine are under installation.

3.2 Technology Missions (Energy, Water and Others)

The programme focuses on various key verticals, including Hydrogen and Fuel Cell technology, Building Energy Efficiency, Clean Coal technologies, Smart Grids, Carbon Capture & Utilization Storage, Solar Energy Systems, Clean/Alternative Fuels, and Materials for Energy Storage and Water. By promoting innovation and research in these areas, the main aim of the programme is to foster research and innovation led clean energy transition, sustainable development to ensure a clean and green future. The different components of the programme and its detailed activities during the year are as follows;

3.2.1 Clean Energy Research Initiative (CERI)

The overarching objective of CERI is to nurture S&T led breakthroughs to make clean energy affordable and accessible through strengthening Research and Innovation Eco-System for Clean Energy. CERI aims to:

1. Support upstream end of research to generate advanced knowledge of potential application to clean energy.
2. Accelerate India centric innovations developed around user needs.
3. Promote national, bilateral and multilateral collaboration between industry, academics, utilities and other stakeholders to gain value for such connections.
4. Create national research competence in Clean Energy through human and institutional capacity development.

During the year 2024, several new dimensions were added to the CERI programme to accelerate the pace of clean innovations to meet national needs, which are as follows:

3.2.1.1 Mission Innovation (MI)

DST is the country's focal point for the multilateral Mission Innovation (MI), a global initiative of 23 countries and the European Commission (on behalf of the European Union). MI 2.0 is mandated for a decade of action spanning from 2021 to 2030, aiming to scale up the deployment of innovative clean energy technologies to ensure affordable and accessible clean energy solutions for all. The initiative focuses on maximizing the impact of research, development, and demonstration (RD&D) through collaborative efforts and partnerships with

worldwide stakeholders. India is participating in the ongoing missions focussing on Zero-Emission Shipping, Clean Hydrogen, Green Powered Future, Carbon Dioxide Removal, Urban Transition and Integrated Bio-refineries. This year, India also renewed its membership at MI Steering Committee (MISC) and Technical Advisory Group (TAG).

Figure: MI Annual Gathering (AG) and Clean Energy Ministerial (CEM) Senior Officials Meeting in Bali, Indonesia

Figure: Joint Ministerial meeting of 9th Mission Innovation Ministerial (MI9) and 15th Clean Energy Ministerial (CEM-15) in Foz do Iguaçu, Brazil

During the ministerial, the Indian delegation reiterated its commitment towards the development-led sustainable and inclusive energy transition pathways driven by clean energy including some key initiatives and notable outcomes such as PM Surya Ghar: Muft Bijli Yojana, a landmark step towards the widespread adoption of Solar Power on Roof Tops to foster inclusivity. Additionally, the BioE3 policy through accelerating advancements in biotechnology to enable economic growth, enhance environmental sustainability, support entrepreneurship and nurture employment opportunities was also informed to the global clean energy community.

3.2.1.2 Materials for Energy Storage

The Materials for Energy Storage (MES) program supports R&D activities aimed at innovative materials for energy storage, and to build energy storage device with enhanced output for

multifunctional applications. The initiative works towards the efficient use and further increase of renewable energy, demonstrating its value in terms of flexibility in the energy systems. This is expected to lead to the outputs which would substantially enhance technology readiness of the applied research for targeted application/use. Followings are the key outputs during the year;

- **Efficient Photoelectrode for Hydrogen Fuel from Water:** Researchers from the Indian Association for the Cultivation of Science, Kolkata, have developed efficient photoelectrodes (>10% efficiency) for PEC water splitting, enabling hydrogen generation. The study explored silicon-based photocathodes interfaced with GaN, Janus TMDs (MoSSe), MXenes, and doped TiO_2. Key advancements include quasi-2D $MnSe_2$ with reduced HER overpotential and Janus MoSSe achieving 58% enhanced photocurrent via Rashba spin effects. Heterostructured MoS_2-$MoSe_2$ and intercalation strategies further boosted PEC activity, addressing challenges in spin-charge transport and material engineering for energy applications.

- **Metal Hydride-Based Hydrogen Technologies:** Under DST funded project, IIT Bombay has made significant advancements in metal hydride-based hydrogen technologies to support clean energy initiatives. Developments include large-scale industrial storage systems, thermal energy applications, leveraging low-grade heat for heating and cooling purposes. Efforts in hydrogen purification and compression have led to the development of metal hydride-based systems, including multi-stage hydrogen purification and compression solutions. A metal hydride-based hydrogen storage system for vehicular applications has been successfully demonstrated. A notable milestone is the integration of a hydrogen storage system with a two-wheeler scooter as a proof of concept. Extensive trials, covering over 75 km across diverse road conditions, driving cycles, and payload scenarios, have showcased the system's robustness and viability.

Figure: Proof of concept of metal hydride-based hydrogen storage with PEMFC integrated on a Scooter

- **Vanadium Redox Flow Battery for Large-Scale Renewable Energy Storage:** To achieve India's 2030 target of 500 GW non-fossil capacity, developing reliable energy storage systems (ESS) is essential to manage renewable energy intermittency. The

Sustainable Environergy Research Laboratory (SERL), of IIT-Delhi has advanced Vanadium Redox Flow Battery (VRFB) technology with cost-efficient electrolytes, high-power electrodes, and advanced monitoring systems. The team, winners of DST's NICA 2020 grant for rural electrification, showcased prototypes at IIT R&D Fair 2022 and to Australian PM Anthony Albanese. A 2-kW VRFB for EV charging and a 5-kW system replacing diesel generators are advancing the technology to TRL-7.

3.2.1.3 Carbon Capture Utilisation and Storage (CCUS)

CCUS involves the capture of CO2, generally from large point sources like power generation or industrial facilities that use either fossil fuels or biomass as fuel. This challenge aims to enable near-zero CO2 emissions from power plants and carbon intensive industries.

DST has supported two Technology Deployment Test Beds under Industry-Research Consortia for Methanol and DME production in coal gasification plants. The IIT Delhi–Thermax Ltd Consortia is developing CCU technology for pre- and post-combustion, integrated with a 1.4 TPD coal-to-methanol pilot plant in Pune. CSIR-IICT Hyderabad–BHEL Consortia is erecting a facility to capture CO2 (0.5 TPD) and convert it to Dimethyl Ether (0.18 TPD) in Hyderabad. These efforts align with Atmanirbhar Bharat and Vikshit Bharat missions, fostering self-reliance and supporting India's net-zero goals through DST-developed CCU technologies. Followings are the key outputs during the year;

- **Foundation stone of CO_2 to Methanol Pilot Plant for advancement of CCU technology:** The foundation stone for India's first of its kind CO_2-to-Methanol pilot plant with an overall capacity of 1.4 Tons Per Day (TPD) was unveiled virtually by Prof. Abhay Karandikar, Secretary, DST, Government of India, at Thermax Limited premises in Pune, Maharashtra. The pilot plant will serve as a pioneering platform for the demonstration and advancement of indigenous Carbon Capture and Utilisation (CCU) cutting-edge technologies, marking a significant step towards India's Panchamrit declaration presented by Hon'ble Prime Minister, Shri Narendra Modi during COP 26.

Figure: Foundation stone for India's first of its kind CO_2-to-Methanol pilot plant with an overall capacity of 1.4 Tons Per Day (TPD) at Thermax Limited premises in Pune

- **CCU deployment in Cement Sector with Industry Partnership:** During the year 2024, DST had launched a national level unique and one-of-its-kind special call to mobilise proposals for deployment of CCU technologies in the Cement sector for translational R&D. The call received overwhelming response from stakeholders including both Industry and Academia/Research resulting in mobilization of 24 proposals in partnership with industry leaders such as JK Cement, Ultratech, Dalmia Cement, JSPL etc.

- **3.2.1.4 Hydrogen Initiative -** The Hydrogen Initiative aims to advance policies, programmes and projects that accelerate the commercialization and deployment of hydrogen fuels and technologies across all aspects of the economy. DST led delegation of policymakers, researchers, and startups for an interactive learning focused on hydrogen and water technologies visited Netherlands at the invitation of the Netherlands government. The Head of the CEST Division presented India's green hydrogen roadmap and explored opportunities to replicate the Netherlands' hydrogen valleys in India. The delegation visited key European projects, such as Hydrogen Backbone, HEAVENN (Europe's first hydrogen valley), and Rotterdam's hydrogen hub, gaining insights into advanced technologies like PEM fuel cells, solid-state hydrogen storage, and HyET's compression systems. The visit strengthened India-Netherlands collaboration on policy, infrastructure, and strategy development for hydrogen. Plans were initiated for new joint programs in capacity building and experiential learning. The visit also demonstrated diverse applications of hydrogen across marine, aviation, automotive, and industrial sectors, underlining its transformative potential in global energy systems.

3.2.1.5 Solar Energy Research and Development Program

The Solar Energy Research and Development program promotes the development of equipment and consumables, technology demonstration projects, affordable innovation, convergent solutions, and applied research to foster research and development in solar sector. Followings are the key outputs during the year;

- **Affordable Dust Cleaning System:**The Department of Mechanical Engineering at Thapar Institute, Patiala, under DST funded project has developed an affordable dust-cleaning system for solar panels, specifically designed for Indian conditions. Extensive testing at NTPC Bhadla confirmed its efficiency, achieving 52% water savings without compromising power output, which can decline by up to 25% due to dust deposition. The automated system effectively cleans panels at various heights and angles, with the capability to clean two rows simultaneously. Its optimized nozzle-air configuration ensures efficient operation. These advancements offer a sustainable and cost-effective solution to dust challenges in solar plants.

Figure: Demonstration of Dust Cleaning System at NTPC Bhadla

- **Convertible and Cost-Effective Mechanism for Smart-Flower type Solar Panels:** NIT-Surathkal has developed a cost-effective Smart-flower solar panel system with dual-axis sun tracking, maximizing energy generation by following the sun's path. Starting at 6:30 a.m., it generates 5676W daily, using only 277W as input, delivering 60% more electricity than flat plate PV systems and 40% more power over 11 hours. The design includes collapsible rotating panels with cleaning strips, requiring just 100W for deployment within 3 minutes. A self-locking worm drive mechanism ensures stability under 600kg weight and wind speeds up to 120 Km/h. Sensors for light, wind, and rain enhance efficiency and safety, ensuring reliable and sustainable solar energy production.

Figure: Smart Flower Solar Panel System

- **Going Remote-Solar Energy for Lighting and Hygienic Sanitation with Smart Exhaust System for Rural Applications:** A pilot project in Tripura demonstrates an integrated solar-powered hygienic running water system for rural institutional washrooms, developed by IIEST, Shibpur. Supporting both deep and shallow water pumping, it features high-efficiency smart solar exhaust systems with intelligent controllers and two-day battery autonomy. Remote monitoring via a cloud-enabled embedded server allows centralized data access, tracking water availability, and pump conditions through mobile

devices nationwide. This sustainable innovation enhances hygiene and accessibility and is poised for implementation in schools, health centers, and panchayats, addressing the challenge of running water in rural toilets.

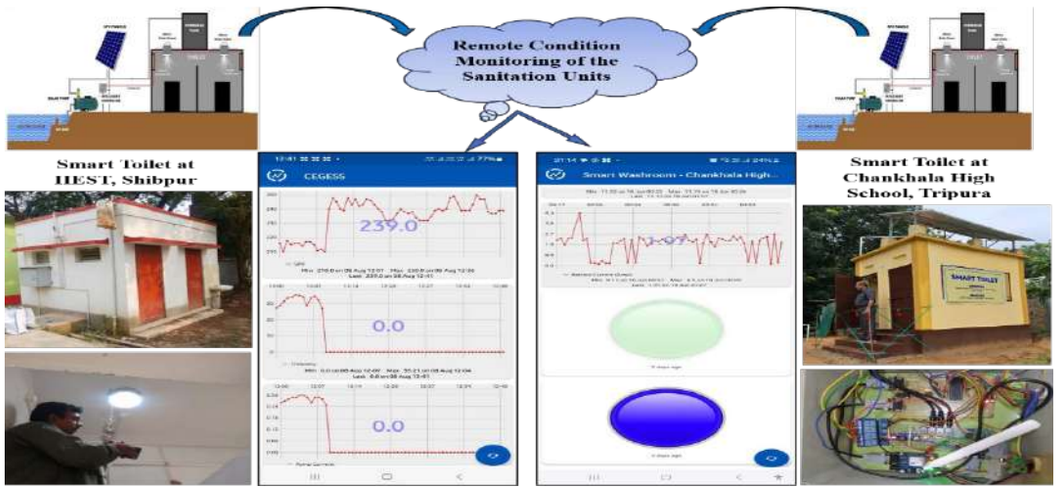


Figure: Solar Energy based Smart toilet operational at Tripura

- **Design and Fabrication of Hybrid Solar-LPG based Dryer for Geopolymer Bricks:** Geopolymer bricks, demonstrated at Chennai Institute of Technology, Kundrathur, near Chennai, provide a sustainable alternative to traditional bricks. Produced using fly ash, quarry dust, and an alkaline solution (sodium hydroxide and sodium silicate), these bricks are dried with a hybrid solar-LPG system, reducing environmental impact. The bricks exhibit compressive strength between 12–15 N/mm², a water absorption rate of just 12%, and improved shape and texture. Solar drying enhances their quality, outperforming traditional clay bricks, fly ash bricks, and other market alternatives. This innovation contributes to environmental sustainability and socio-economic progress in the construction industry.

- **Demonstration and Deployment of Community Level Integrated Autonomous Solar Energy System for Space Heating, drying and Cooking Purpose:** A sustainable lab-scale solar energy system was designed and installed at IIT Delhi to address space heating, food drying, and cooking needs. The system includes tailored solar collectors and photovoltaic-thermal (PVT) units, supporting space heating for a research scholar room (20 m²) and a large laboratory (50 m²), and drying 20 kg of apricots daily. A central control panel manages operations and energy storage, enabling simultaneous charging and discharging. The system's performance evaluations provided insights into improving thermal energy storage for applications in Ladakh. The energy storage units effectively met technical requirements for standalone and integrated operations. The findings contribute to scaling up this system for broader, sustainable use in energy-constrained areas.

Figure: Solar Energy System for Space heating, drying and cooking purpose

3.2.1.6 Research & Development on Clean Coal Technologies

Indian Institute of Technology (Indian School of Mines), Dhanbad has developed an innovative cutting drum design for surface miners to enhance coal excavation in varied geological conditions. Major achievements include designing, building, and testing a prototype cutting drum (RCR) and setting up a conical pick system to measure cutting forces. Computer models and simulations were created to study and improve the drum design, and these were tested and validated. A four-meter full-scale cutting drum is being manufactured at L&T's workshop using the improved design. Additionally, the project developed mine planning and excavation methodologies that integrate coal and inter-bedded waste rock excavation with proper waste disposal strategies, enabling cleaner and more efficient coal production.

Figure: Cutting drum design for surface miners

The Advanced Ultra Supercritical (AUSC) Test Rig evaluated the long-term behaviour (fire-side corrosion and steam-side oxidation) of Alloy 617, Super304H, Inconel 740, and Sanicro25 under high-efficiency power plant conditions. At NTPC Dadri's FSCTR facility, a Heat Transfer Test Loop (Super304H and Ni-based alloys) was introduced to achieve 710°C/720°C and 310 kg/cm² steam parameters. Operational since March 2019, the loop ran for 29,000 hours, providing critical data on fire-side corrosion, steam-side oxidation, and creep deformation. Manufacturing, welding, and NDE processes for advanced materials were established, with findings consolidated to guide AUSC technology adoption. Further tests are ongoing.

3.2.1.7 Smart Grids Research Initiative

DST-supported joint R&D projects between India and the EU focus on Integrated Local Energy Systems (ILES) to drive the transition to carbon-free, sustainable multi-energy systems. Rural pilots at Ghoramara Island, West Bengal, and Keonjhar, Odisha, feature hybrid microgrids with solar inverters and converters, equipped with communication systems. The Energy Management System (EMS) includes Load Flow Controllers (LFC), Static Synchronous Compensators (STATCOM), Field Programmable Gate Arrays (FPGA) platforms, smart meters, and dimmable streetlights. Additionally, cyclone-resilient PV panel mounting structures and a software platform for micro-grid control and protection are in place. At Keonjhar, biomass and biogas systems integrated with solar inverters are connected to the isolated grid, employing innovative approaches for enhanced energy resilience and management. IoT-based remote monitoring ensures efficient operation.

3.2.1.8 Building Energy Research Initiative

As part of the India-UK Building Energy Demand Reduction program, IIT Roorkee's team has patented a smart personal ventilation system that adapts to the local environment, improving user thermal comfort. The system features a continuous learning algorithm and a user-controlled smartphone app for personalized operation. IIIT Hyderabad's team developed IoT-based energy use profiles for residences across India, aiding energy demand benchmarking and response studies, along with a smartphone app for residential demand management. Under Mission Innovation (MI), DST developed a virtual dashboard for sustainable cooling technologies, now upgraded to include national policies and innovations from MI member countries.

3.2.1.9 Electric Vehicles - Electric Vehicles represent a significant advancement toward greener transportation. DST has brought out a White Paper on Catalyzing Technology-Led ecosystem for e-Mobility which was released on 28th February 2024 by Dr. Jitendra Singh, Hon'ble Minister for State (I/C) for Science and Technology, GoI. This was followed by release of three thematic R&D Roadmaps on EV Battery, EV Motors and Power Electronics, and EV Charging Infrastructure in the month of October 2024. These reports highlight challenges being faced by EV Industry and also suggests potential technology solutions to meet needs of

the industry. These reports led in incubating MAHA EV Mission launched under Anusandhan National Research Foundation (ANRF) under DST.

3.2.1.10 Alternative fuels - Alternative fuels are derived from sources other than petroleum. Most are produced domestically, reducing our dependence on imported oil, and some are derived from renewable sources. Often, they produce less pollution than gasoline or diesel.

DST, a key driver of innovation and technology development in India, presented several significant advancements in methanol-related technologies, all supported through various DST-funded projects, on the occasion of the International Methanol Seminar organized by NITI Aayog in partnership with the Methanol Institute (USA), in New Delhi during October 17-18, 2024. The event focused on advancing India's methanol economy and showcased methanol's potential as a cleaner and more sustainable energy source, particularly for sectors such as transportation, industry, and energy. These innovations highlighted India's leadership in the global transition to cleaner energy systems, including the conversion of high-ash coal into methanol, the development of M15 (methanol-petrol blend) technology, and the creation of engines capable of running on 100% methanol. A major highlight of the seminar was the unveiling of India's first 100% Methanol (M100) fuel-based truck and refuelling system, developed by Ashok Leyland in collaboration with IISc Bangalore and with DST's support. This initiative, the second of its kind globally, demonstrated methanol's viability as a cleaner and sustainable alternative for heavy-duty transportation, underscoring India's leadership role in the global energy transition.

Figure: 100% Methanol (M100) Fuel-Based Truck Showcased at the International Methanol Seminar by Ashok Leyland – Supported Under DST Project

3.2.2 Water Technology

The Water Technology Initiative (WTI) of the Department of Science & Technology (DST) is an India-centric 'solution science' endeavor launched to enhance R&D capabilities for addressing water challenges. Established in 2022, the Water Technology Centre (WTC) emphasizes both laboratory research and field applications. The initiative's goal is to promote R&D for sustainable water sourcing, quality augmentation, and recycling and reuse of water. Several achievements were made during FY 2024-25.

3.2.2.1 DST-NWO Joint Kick-off Meeting

The DST-NWO joint kick-off meeting on 15th –16th October 2024 marked the launch of three Indo-Dutch Water Disaster Management projects. These include:

i. "Low-cost Disaster Emergency Services for Communities at Risk LODESTAR" (IIT Guwahati & Wageningen University & Research WUR),

ii. "Resilient HydroTwin" (IIT Madras & Delft University of Technology, The Netherlands), and

iii. "Restructuring and Enhancing Strategies with a Transformative Approach for Integrated Water Disaster Management in India and the Netherlands-RESTARTIN" (Kerala State Council for Science Technology and Environment-Thiruvananthapuram KSCSTE & Wageningen University & Research WUR), fostering adaptive and transformative strategies for water resilience.

DST India, the University of Nebraska-Lincoln (UNL) and the Indo-U.S. Science and Technology Forum (IUSSTF) have partnered to foster cooperation for human resource capacity building of Water professionals from India and the United States through the Water Advanced Research and Innovation (WARI) Fellowship Program. During Phase II, 5 interns and 5 fellows has been selected for the program's first cohort in 2024.

3.2.2.2 Integrated Technology Intervention for Sustainable Environment

The Department of Science & Technology (DST), Government of India, is making significant strides towards environmental sustainability and community development by implementing green technology interventions in Aandhi Village, Rajasthan. The project titled "Transforming Aandhi Village in Rajasthan: Towards A Zero Waste Model Through Green Technology Interventions" stands as a unique and socially relevant initiative, aiming to create a zero-waste model through the integration of innovative technologies.

On September 19, 2024, the inauguration of demonstration plants in Aandhi Village at three identified locations—the Government School, Community Health Centre, and the Constructed Wetland at the Main Pond—was held. Several pioneering projects designed to tackle pressing environmental challenges through sustainable solutions: i) Organic Waste Bio-Methanation

Plant at Government School (100 Kg Capacity) ii) Constructed Wetlands at the Main Pond in Aandhi Village (20 KLD Capacity) and iii)Vermifiltration Technology at the Community Health Center (10 KLD Capacity) were launched.

Figure: Inauguration of a Zero Waste Model Through Green Technology Interventions at Aandhi Village in Rajasthan

DST supported pilot plant project titled "Implementation of a Sustainable Bioenergy-Based Model Effluent Treatment Plant for Desiccated Coconut Industries" was inaugurated at the site of M/s. Vittal Agro Industries, Kasargod on September 02, 2024. The project was executed by National Institute for Interdisciplinary Science & Technology (NIIST), Thiruvananthapuram, Kerala in collaboration with M/s. Vittal Agro Industries, Kasargod, the Coconut Development Board (CDB). This project, represents a significant milestone in sustainable industry practices.

Figure: Sustainable bioenergy-based model effluent treatment plant for desiccated coconut industries at M/s. Vittal Agro Industries, Kasargod

3.3 National Geospatial Programme (NGP)

The National Geospatial Programme (NGP) in DST aims to catalyze the National Geospatial Ecosystem with the mandate of promoting geospatial science and technology, policy, solution, capacity building, entrepreneurship and international cooperation for sustainable socio-economic development at all levels of governance.

The recent initiatives and progress across various sub-programmes, aimed at accelerating India's leadership in the global geospatial landscape are detailed as below:

3.2.1 Geospatial Science Programme

Under the programme, following key activities have bene undertaken during the year;

- **National Centre for Geodesy (NCG):** The NCG at IIT Kanpur, supported by the DST, Government of India, continues to shape the geospatial science landscape in the Country through innovative research, education, and capacity building. During the year, the Centre conducted impactful training programs on topics such as '*Regional Geoid Modeling', software training, 'Introduction to Applied Geodesy', Introduction to GNSS and its Applications'*, benefiting participants from both government and private sectors. Research at NCG has yielded significant results, including 07 peer-reviewed journal articles and 20 conference papers, reinforcing its role as a knowledge hub in Geospatial Science. Additionally, efforts are also underway for densification of CORS Network in tandem with the efforts of Survey of India.

- **Regional Geodesy Centres (RCGs):** All Six RCGs established across country, are driving transformative solutions through R&D projects of National importance focusing on geospatial science and technology. RCG at IIT Bombay not only designed and deployed a low-cost GNSS-based monitoring system for soil moisture studies using reflected GNSS signals in Nashik is advancing precision agriculture but also updated training manuals for short-term courses, covering Total Station-based surveying, GNSS-based mapping, differential GNSS, and real-time kinematic positioning; while IIT Dhanbad's geodesy-integrated curriculum and projects on mining boundaries and slope instability assessment using InSAR technology are revolutionizing resource management locally. Further, RCG at IIST Trivandrum is building satellite geodesy capabilities, and IRS-Anna University is creating a skilled geospatial workforce through various innovative academic programs. MANIT Bhopal's reservoir sedimentation research involving DGPS and satellite data supports sustainable water management along with their initiation of various outreach programs with local academic institutions is strengthening the capabilities in the domain, and MNNIT Allahabad is developing disaster mitigation strategies through working on various geoid models, models based on SRTM and MERIT DEMs etc.

3.2.2 R&D in Geospatial Science

India's geospatial landscape is undergoing a transformative shift, redefining how we perceive and interact with the world around us. Keeping in view of the changing requirement and to strengthen the country's geospatial science domain, 14 R&D project proposals recommended last year were supported in the current year on various themes such as geo-kinematics, spatial data generalization, ubiquitous mapping, improved geodetic positioning, geospatial data collection standards, Data exchange platform, Geoid Modelling and large-scale geospatial data cubes etc. Among these, the details of the few projects are given below:

- **Development of an Integrated Geospatial Data-Sharing Interface (GDI)**- as Pilot (Foundation for Science Innovation and Development (FSID)-IISC Bengaluru): Initiated in November 2023 by the FSID at IISc Bengaluru, GDI is charting the course for a connected future. By seamlessly integrating over 400 datasets from 27 providers, GDI platform aims to provide seamless access to geospatial data for developers in startups, government, and academia using open standards. The details of the high level architecture of GDI are depicted in given Figure. It also serves as the technical backbone for Operation Dronagiri, a pilot project under the National Geospatial Policy 2022. Operation Dronagiri aims to facilitate the smooth exchange of geospatial data across key sectors such as agriculture, livelihoods, and transport, driving improvements in the quality of life for citizens and easing the process of doing business. Through various capacity-building workshops and strategic collaborations, GDI is ensuring the widespread adoption of geospatial tools for data sharing.

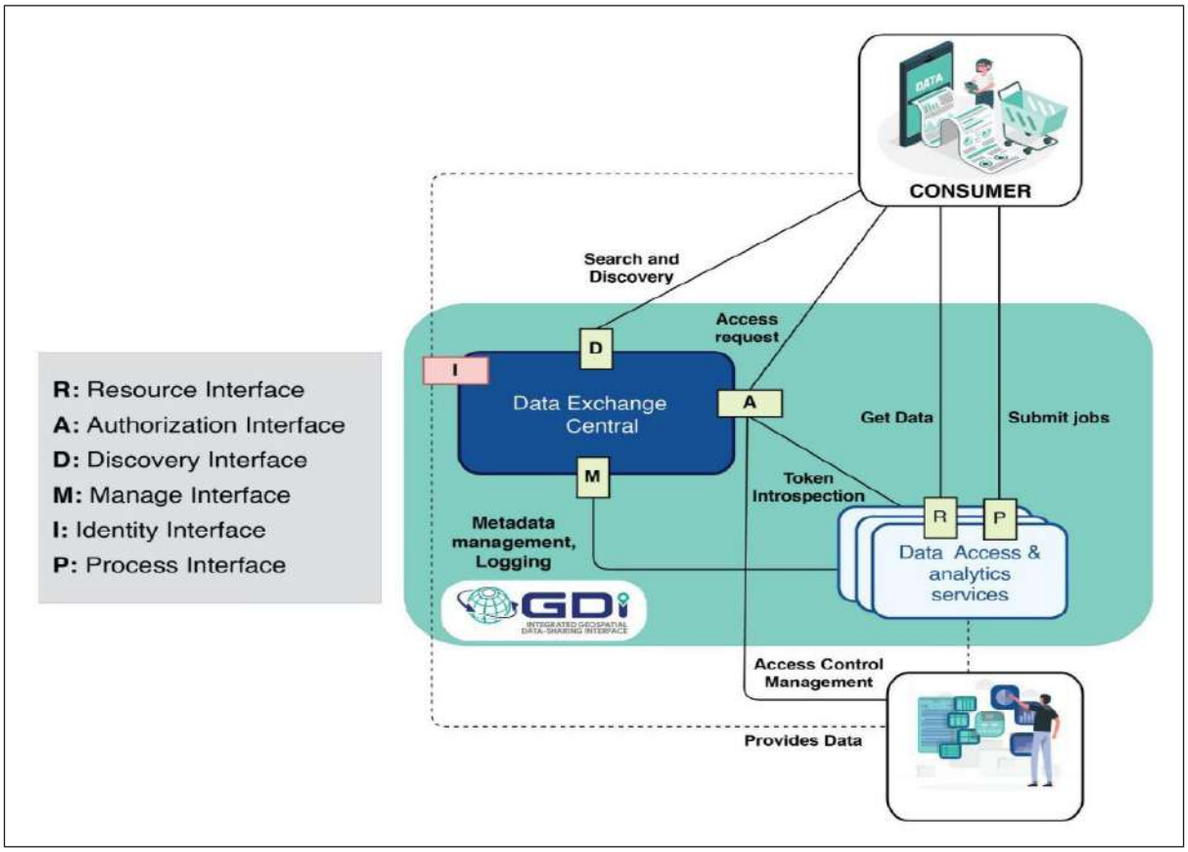


Figure: High Level architecture of Geospatial Data-Sharing Interface (GDI)

- **Development of the Upscaling Model for Carbon Stock Estimation (IIT Kanpur)** is an initiative that harnesses high-resolution Airborne Laser Scanning (ALS) for 250 sq km in Haryana and Terrestrial Laser Scanning (TLS) data for 12 plots, capturing 674 individual

tree point clouds to deliver precise carbon stock estimates, essential for addressing climate change. By developing a Random Forest model for leaf-wood classification and a hybrid QSM-meshing approach for tree volume estimation, the study sets new benchmarks in environmental monitoring and provides vital insights for sustainable land management and carbon offset strategies (Figure). Recognized at global platforms such as INCA 2023 and IEEE InGARSS 2024, it paves the way for more effective geospatial science guided climate actions.

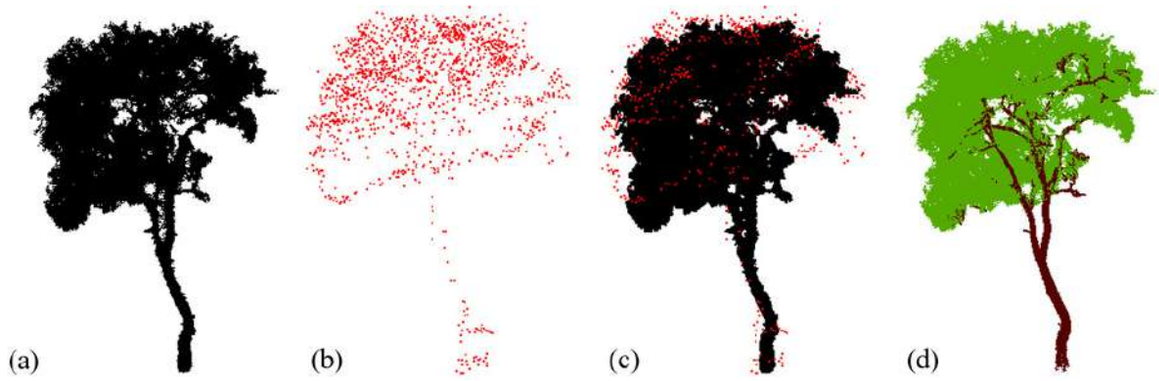


Figure: Visualization of a tree point cloud from a selected plot: (a) TLS point cloud, (b) ALS point cloud, (c) Integrated TLS-ALS point cloud, (d) Labelled wood-leaf point cloud

3.2.3 Geospatial Technology Programme

The sub-programme is designed to accelerate the development of indigenous geospatial and location-specific technologies in the Country, with a focus on enhancing the economic value of existing geospatial solutions and fostering demand-driven, forward-looking innovations. The brief of the key projects under this programme are given below;

Geospatial Information Science and Engineering (GISE) Hub at IIT Bombay: Established in 2022, the GISE Hub is driving pioneering research and fostering a vibrant entrepreneurial ecosystem. The hub is also dedicated to capacity-building through various initiatives such as; a Summer School focused on health, water, and transport geospatial applications, featuring participant presentations on practical implementations; Winter School in collaboration with leading institutions, incorporating an OGC tech sprint that attracted 53 participants from diverse sectors; 3-day GNSS Workshop in partnership with Trimble, engaging participants from the Survey of India, government, and academia etc. In addition, this year 09 multidisciplinary research proposals supported by GISE are focused on the themes such as Geospatially Enabled Learning for IoT applications, Movable Monostatic Radar Systems for Soil Moisture Retrieval, and Hyperspectral Imaging for precision remote sensing. Other notable projects include autonomous weeding tools based on plant geo-positions, low-cost GNSS RTK systems for accurate geolocation, UAV-based surface fire detection, and a Geospatial Framework for Precision Agriculture that integrates satellite and drone imagery with AI, big data, and cloud computing.

GEL-IoT: Geospatially Enabled Learning for IoT-based Water Quality Monitoring (Amrita Vishwa Vidyapeetham): This initiative combines IoT technology and community engagement to revolutionize water quality monitoring. By deploying Jeevamritam systems and conducting hands-on workshops, the study empowers local communities to take charge of their water resources. Using real-time water assessments it provides actionable data, fostering sustainable water management by enhancing local resilience to water quality challenges (Figure).

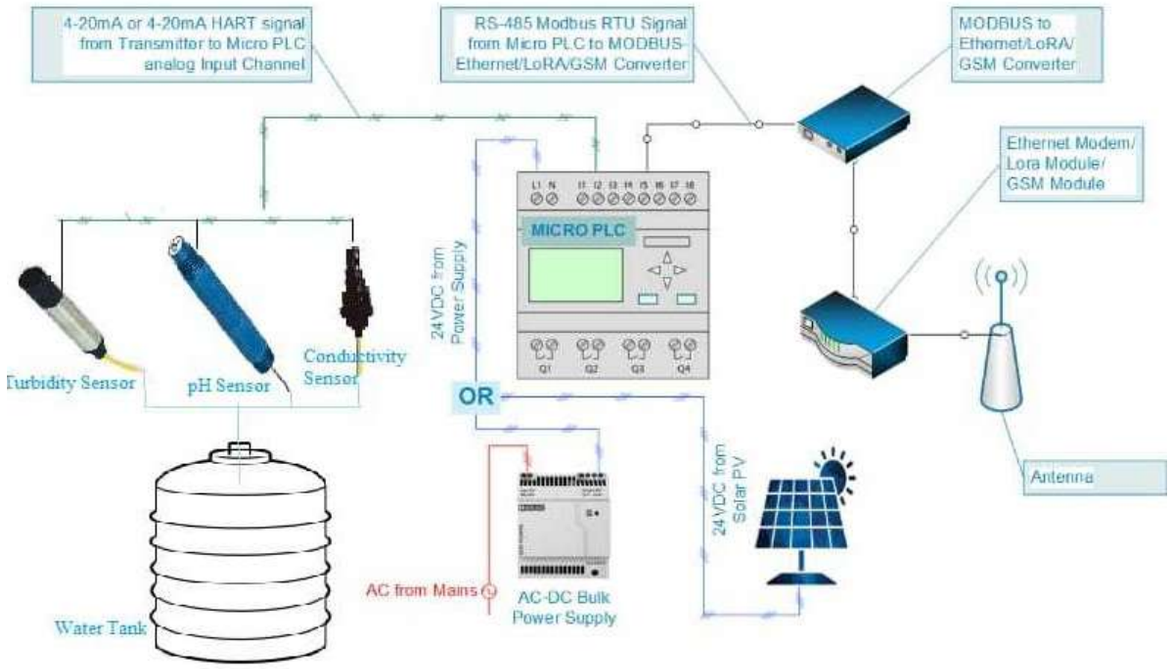


Figure: Design of IoT based water quality monitoring system

Figure: Water Sample collection and community workshop where Community Members Drawing Problem Tree

3.2.4 Geospatial Capacity Building Programme

The National Geospatial Capacity Building Program, aligned with the National Geospatial Policy 2022, plays a pivotal role in integrating geospatial thinking into education and professional development. Through various initiatives, it equips educators, students, and professionals to address real-world challenges and contribute to India's geospatial transformation. The brief of the key initiatives under this programme are given below

Spatial Thinking Summer/Winter Schools and Geo-innovation Challenge: Out of total 30 programs supported in the current cycle (2023-25), following were held at Pan India level including Level 1 (Standard), Level 1 (Spatial Thinking), Advance Level 2, and Geo Innovation Challenge Programs to deepen geospatial knowledge and foster interdisciplinary innovation, engaging over 880 participants including educators, students, and professionals to collaborate (**Table 1**)-

Table: Details of the various Geospatial Capacity building programs held

Program Type	Institutions	Participants
L1 Basic Training	11	250
Spatial Thinking Workshops	4	80
L2 Advanced Training	6	150
GeoInnovation Programs	6	400+

The Geo-Innovation Challenge saw over 400 youth propose geospatial solutions to critical environmental and social issues, driving forward the application of geospatial technologies in real-world contexts.

- Orientation workshops, conducted with SCERTs across several states, introduced educators to spatial thinking, training 180+ teachers and impacting 150 schools. The online Spatial Thinking initiative, imbibing a culture of creativity and problem-solving, reached over 6,000 students across 7 states, covering key topics like pollution mapping and flooding analysis. Collectively, these efforts empower educators, strengthen state collaborations, foster innovation, and enable youth to develop practical geospatial solutions.

3.2.5 International Collaboration

The Division has made steady progress in enhancing India's geospatial capabilities through international collaborations with organizations such as United Nations Global Geospatial Information Management (UNGGIM), Open Geospatial Consortium (OGC), Brazil Russia India China South Africa (BRICS) Cooperation, Indo-Africa collaborations etc. Notable activities include the participation in the Fourteenth UN-GGIM Session at the UN Headquarters in New York from August 7–9, 2024, where global geospatial stakeholders discussed strengthening

policies and frameworks for geospatial information management. UN-GGIM, led by Member States, addresses global concerns in geospatial information creation, availability, and application, notably in development agendas and policymaking. Divisional officers also participated in the UN-GGIM-AP Executive Board meeting and the Locate 24 conference held in Sydney, Australia, in May 2024, helping align national strategies with UN policies. At the Geospatial World Forum in Rotterdam, as a part of the Indian delegation, participated in the discussions on the role of geospatial technologies across various sectors like energy, defense, and infrastructure, which provided valuable opportunities for knowledge gaining and future collaboration. These engagements have helped strengthen India's position in the global geospatial community and opened doors for future collaboration in geospatial technology and sustainable development.

3.2.6 New Initiatives and Major Achievements

New Call for Proposals in consortium mode: an unique call for proposals (CFP) was issued for strengthening the Geospatial Innovation Ecosystem of the Country in alignment with National Geospatial Policy 2022. The main aim of the CFP was to form consortia connecting the academia, startups/MSME/industry & user-agency/practitioners to develop innovative solutions for critical challenges across eight sectors such as agriculture, water resources, urban planning, environment, healthcare, spatial data risk reduction, and logistics & transportation through application of geospatial technologies. The basis of this effort stands on the growing interest for using geospatial tools and techniques to address complex, real-world problems and highlights the potential for impactful advancements in various domains.

A Divisional user meet as a part of GeoSmart India 2024 was held on 'Strengthening Country's Geospatial Ecosystem with a focus on Data Infrastructure, Strategic R&D and leveraging State's Geospatial capabilities', in which, two panel discussions were organized with an aim of formulating the strategies for strengthening geospatial readiness of various States along with identifying potential areas for future R&D investments in the domain**.** The First panel, "Supporting Strategic R&D and Building Robust Geospatial Data Infrastructure," stressed the integration of AI, automation, and NLP into geospatial workflows, advocating for enhanced data resolution in flood modeling and air pollution. It called for greater investment in hyperlocal analysis and national collaboration to strengthen geospatial infrastructure. While the Second panel, "Empowering States for Geospatial Excellence under NGP 2022," discussed how states can leverage geospatial solutions for socio-economic growth. Successful applications in agriculture, disaster management, and urban planning were discussed, with an emphasis on geospatial education and data standardization. These discussions reinforced DST's efforts in fostering collaboration with the aim to position India as a global leader in geospatial domain.

3.4 National Initiative for Developing and Harnessing Innovations (NIDHI)

The programme focuses on nurturing start-ups and individual innovators in identified areas at various institutions across the country. The different components of the programme and the key activities undertaken during the year are as follows;

3.4.1 NIDHI – iTBI (Inclusive-Technology Business Incubator)

The initiative aims to inculcate the spirit of Innovation & Entrepreneurship (I&E) amongst the students, innovators and entrepreneurs, encourage and support innovative ideas, start- up creation through incubation. Inclusive TBI is a three years duration initiative supported by the DST for educational institutions. The i-TBI program focuses on promoting entrepreneurship and supporting i-TBIs primarily in Tier-2 and Tier-3 cities, with an emphasis on inclusivity in terms of geography, gender, and persons with special abilities etc. Currently, 48 Inclusive TBIs are running throughout the country and the total number of startups & innovators onboard are 800+, out of which 185+ were financially supported startups, more than 150 patents were filed and 74 patents were granted.

Hon'ble Minister of State (Independent Charge) of the Ministry of Science and Technology, on 6th Sept 2024 virtually inaugurated 8 new NIDHI iTBIs; 1. Central University of Rajasthan, Ajmer, Rajasthan; 2. Guru Angad Dev Veterinary and Animal Sciences University Ludhiana, Punjab; 3. BLDE Bijapur, Karnataka; 4. Aligarh Muslim University, Aligarh, UttarPradesh; 5. Pranveer Singh Institute of Technology Kanpur, Uttar Pradesh; 6. Guru Ghasidas Vishwavidyalaya (Central University) Bilaspur, Chhattisgarh; 7. GSSS Institute of Engineering and Technology for Women Mysore, Karnataka; and 8. University of Petroleum & Energy Studies (UPES) Dehradun, Uttarakhand.

Figure: Hon'ble Minister of Science & Technology, Dr. Jitenra Singh virtually addressing the gathering at DST

Startup Utsav, IIT Delhi on 6th Sep, 2024

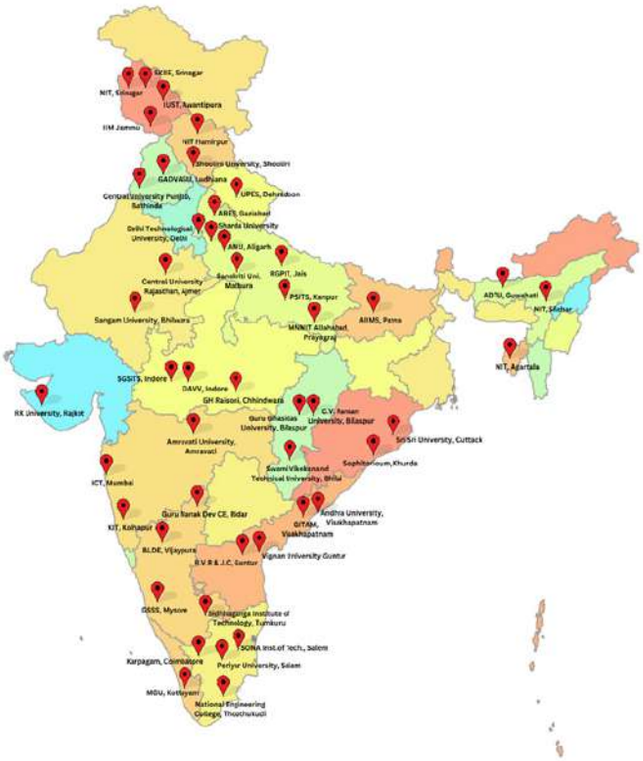


Figure: Launch of 8 new iTBIs & the map depicting iTBI Centres located across the country

3.4.2 NIDHI TBI (Technology Business Incubator)

The programme is supporting Technology Business Incubators primarily in and around academic, technical and management institutions to tap innovations and technologies for venture creation by utilizing expertise and infrastructure available with the host institution. DST supported TBIs typically provide Startups and Innovators with services such as Physical Workspace, Research Infrastructure, IP Development Support, Networking Opportunities etc. 39 NIDHI TBIs supported by DST are actively engaged in promoting and fostering Startups and Entrepreneurship in the country.

3.4.3 NIDHI - CoE (Center of Excellence)

NIDHI-CoE strengthens existing incubation capacities of Technology Business Incubators (TBIs) to make them world class, state-of-art startup incubation centres. NIDHI CoE supports potential start-ups for translating technological innovations into marketable products and high-growth ventures. DST has supported nine NIDHI-CoEs at different premier institutions. These NIDHI-CoEs (Centre of Excellence) are at CIIE-IIM Ahmedabad; SINE IIT Bombay; PSG-Science & Technology Entrepreneurial Park (PSG-STEP) Coimbatore; TBI- Veltech

University, Chennai; KIIT -TBI, Bhubaneshwar; EDC NCL-Pune; FITT IIT Delhi, T-Hub, Hyderabad, and FIRST-IIT Kanpur.Financial support was extended for the establishment of a new MedTech Centre-of-Excellence at IIT Kanpur.

Some of the promising products from startups incubated at NIDHI CoEs, NIDHI TBIs, and NIDHI i-TBIs are given below;

Vecmocon Technologies - Incubated at NIDHI CoE at IIT Delhi (FITT): Vecmocon Technologies provides advanced solutions like smart battery management systems and motor controllers. With a mission to drive sustainability, the startup raised $10 million in funding, led by Ecosystem Integrity Fund, to expand operations and innovation. Its products empower EV manufacturers with reliable, cost-effective, and scalable technologies, addressing challenges in safety, efficiency, and performance.

Figure: Smart Battery Management Systems and Motor Controllers developed by Vecmocon Technologies

- **Haystack Analytics Pvt. Ltd. - Incubated at NIDHI CoE at IIT Bombay (SINE):** Haystack is pioneering in delivering an end-to-end solution for at-scale genomics, with a focus on diagnostics and the mapping of infectious diseases. Leveraging a future-ready, data-driven approach, Haystack aims to revolutionize the healthcare sector by enhancing diagnostic precision and accelerating the response to global health challenges. The ΩTB® by Haystack Analytics helps in tuberculosis diagnostics, delivering comprehensive, clinically relevant reports within days using whole genome sequencing (WGS) of M. tuberculosis. Its precision and speed empower healthcare professionals with actionable insights, revolutionizing TB management and patient care.

Figure: Healthcare Diagnostics solutions by Haystack Analytics Pvt. Ltd.

- **AgroNxt Services Pvt. Ltd. – Incubated at NIDHI TBI at PUSA-IARI, Delhi:** AgroNxt offers climate-smart solutions that boost farmer productivity and profitability. The platform addresses critical challenges, including the lack of standardized crop and nutrition advisory and the need for quick, accurate, and affordable soil testing methods. AgroNxt's innovation has developed a rapid soil testing technology, delivering digital results in just 2 minutes at a highly affordable cost. This solution is scalable and accessible, serving farmers and stakeholders like input companies, agri-processing firms, FPOs, plantations, and sugar factories. AgroNxt has empowered over 86,000 farmers across 21 Indian states and 3 countries, supported by 250+ partners. AgroNxt has conducted more than 365,000 soil tests.

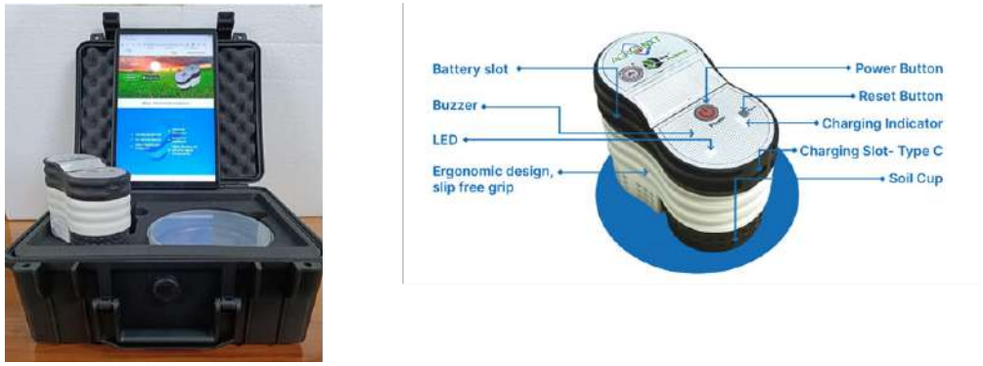


Figure: Soil testing solutions developed by AgroNxt Services Pvt. Ltd.

- **Defy Aerospace Incubated at TBI at JSSATE-STEP, Noida:** Defy is a R&D, manufacturing and operations company introducing state-of-the-art drone technology as its first suite of products rooted in protecting human lives. Defy has developed drone prototypes designed to deliver medical supplies and help farmers by monitoring crops and spreading nutrients. Defy Aerospace demonstrated the power of drones to speed up deliveries, reduce costs, and improve access in remote areas. Their ongoing work aims to bring faster, safer, and more efficient solutions to both healthcare providers and farmers, all while laying the groundwork for a future where drones seamlessly fit into everyday life

Figure: Product developed by Defy Aerospace

- **Iindepro Dyncamics Pvt. Ltd. – Incubated at TBI at IIT Mandi:** Iindepro Dynamics Private Limited is developing a dynamic motor that delivers efficient cooling, maintaining consistent speed and torque at higher RPMs. Utilizing an advanced thermal management system, the Startup aims to enhance performance and reliability, catering to the growing demands of various high-performance applications in the motor industry.

Figure: Dynamic motor developed by Iindepro Dynamics Private Limited

- **Rashvee-International Phytosanitary Research & Services Pvt Ltd (R-Iprs) - Incubated At Nidhi Itbi At Siddaganga Incubation Foundation:** Rashvee-International Phytosanitary Research & Services Pvt Ltd (R-IPRS) is an innovative agri-startup founded in 2022. The startup has developed a herbal fortified adjuvant wooden block/ stick for dispensing non-insecticidal repellent of Bruchid/ storage pests. The product has been tested and developed with the funding from DST NIDHI iTBI Scheme, incubated and supported by Siddaganga Incubation Foundation. The startup is operating in Karnataka and neighbouring districts of Chittoor, Vellore, and Madanapalle reaching 1000+ farmers in 2024 and generating revenue of close to Rs. 4 lakhs.

Figure: Herbal fortified adjuvant wooden stick developed by Rashvee-International Phytosanitary Research & Services Pvt. Ltd.

3.4.4 NIDHI- Promoting and Accelerating Young and Aspiring technology entrepreneurs (PRAYAS)

The NIDHI PRAYAS Program supports young innovators and entrepreneurs in turning their ideas into Proof of Concept (PoC) / Prototype. The PRAYAS funding helps innovators/startups reach a stage where they have a ready product and can progress towards commercialization. The program is implemented by PRAYAS Centres (PC) across the country. The program has generated a considerable impact, such as; total of 1900 innovators are supported across the country, around 1250 prototypes have been successfully developed, ~ 750+ patents filed by the innovators, cumulative funding raised ~ 654 crores, revenue generated ~312 crores, 7000+ employment generated. Five cycles of PRAYAS have already been implemented. Currently, PRAYAS program is being implemented by 46 PCs across the country. A 3rd party impact assessment exercise for the NIDHI PRAYAS program was conducted. The Impact Assessment concluded that "the NIDHI PRAYAS program has created and validated a template to harness young minds for creating significant value for the country as it can be replicated at the largest scale to deliver greater good for the society and economy". PRAYAS support is critical for encouraging entrepreneurship and fostering indigenously developed innovations and products in alignment with the nation's "AtmaNirbhar Bharat" Mission. Some of the success stories of NIDHI PRAYAS are as follows;

- **Galaxeye Space Solutions Private Limited:** The Synthetic Aperture Radar (SAR) system developed by Galaxeye Space Solutions Private Limited, utilizes a ground-based rail platform to enhance imaging capabilities. By moving the radar along this rail, it improves resolution and coverage, delivering accurate, high-quality data for various applications, regardless of weather or lighting conditions. The startup has raised funding of around Rs. 860 Crore and has generated a revenue of Rs. 30 Lakhs.
- **Toque Innovation Private Limited:** Product – A fully autonomous, temperature-controlled kiosk that prepares and serves fresh bowls of food. This cutting-edge machine guarantees fresh, hygienic, and customized dishes on demand, offering a unique and convenient culinary experience that redefines food vending. The startup has raised funding of around Rs. 150 Crore.

Figure: SAR System developed by Galaxeye Space Solutions and Temperature-controlled food kiosk developed Toque Innovation Private Limited

- **D-NOME Private Limited:** D-NOME is democratizing molecular diagnostics byutilizing its proprietary, deviceless ambient temperature platform technology based on synthetic biology. This enables rapid, scalable and point-of-care diagnostic testing, also tested for various diseases and cross-validated with over 200 clinical samples against gold-standard qPCR/RT-PCR, achieving an accuracy of over 95%. The startup has raised funding of around Rs. 120 Crore

Figure: Molecular Diagnostics Device developed by D-NOME Private Limited

3.4.5. NIDHI-EiR (Entrepreneur-in-Residence) Program

NIDHI-Entrepreneur-in- Residence (NIDHI–EIR) Program aims to encourage graduate students to take to entrepreneurship as a prospective career option by providing financial and non-financial support in the form of a fellowship. The programme provides a prestigious forum for deserving and budding entrepreneurs to pursue their entrepreneurial ventures while largely mitigating the risks associated with technology-based businesses. The program is currently implemented through a Program Implementation Partner (PIP) being the nodal agency, currently venture center at NCL Pune is PIP for NIDHI EIR program. 42 Program Execution Partners supported in total four rounds; List of all PEPs can be accessed at http://www.nidhi-eir.in/incubators.php. Status of NIDHI EIR program under all five rounds as on 31st Apr 2024 is given below;

- 42 PEPs funded across 25 states and 25 cities
- 1074+ EIRs supported under five rounds
- ~ 25 States representation- EIRS represented all corners of India
- 537 IPs created - 287 Patents, 205 trademark and 45 copyrights
- 3200+ New jobs created
- > 60% EIRs have private limited companies / Limited Liability Partnerships

After 5 cycles of the program, a 3rd Party impact assessment exercise for the NIDHI EIR program was conducted. The Impact Assessment concluded that "The program has thus significantly contributed towards encouraging and equipping budding and aspiring entrepreneurs, who in turn created large no of intellectual assets, spurred a sizeable mass of inventions and innovations, and developed, deployed and commercialized market relevant solutions through entrepreneurship". Some of the Success Stories of NIDHI EIR are as follows;

- **SMPS Electric Control Pvt Ltd.- Incubated at KIIT TBI, Bhubaneshwar, Odisha:** SMPS Electric Control has developed a Smart Cathodic protection Module which is capable of delivering uninterrupted DC power 4V and upto 200A rated capacity. It can draw power from any source like Grid, DG set, Solar, Wind and Battery bank. The Startup has raised Rs. 160 Lakh and has filed 3 Patents & 10 Trademarks
- **Adiabatic Technologies - Incubated at IIMK Live, IIM Kozhikode, Kerala:** Adiabatic Technologies builds intelligent lithium-ion batteries that can be fast charged in 20 minutes have 10X slower degradation i.e. long life, and have unparalleled safety. They are one-stop solution for all the energy needs for BESS starting off with the mobility sector. It's a next-gen Li-ion Battery packs for electronic vehicles. The startup has filed one IP and has sold more than 1300 Units.

Figure: Smart Cathodic protection Module developed by SMPS Electric Control and Li-ion battery developed by Adiabatic Technologies

3.4.6. NIDHI – Accelerator

DST-NIDHI Accelerator Programme, a 3 to 6-month fast-track initiative, is a post-incubation effort aimed at rapidly scaling potential startups through intensive mentoring and networking, targeting those with significant market validation and readiness for growth. In 2024, 8 institutions were recommended to run the NIDHI - Accelerator Program.

3.4.7 NIDHI- Seed Support Program (SSP)

NIDHI – Seed Support Program (NIDHI-SSP) provides early-stage financial assistance through incubators to potential startups with promising ideas, innovations and technologies.

During 2024-2025, seed support has been provided to 4 new incubators and 5 incubators with ongoing support as subsequent releases under NIDHI-SSP to further extend financial assistance to deserving startups. During this period, 100+ startups benefited under SSP. Few notable success stories of the NIDHI-Seed Support Program for this year are as under:

- **Bendable Technology Solutions Pvt. Ltd. – Incubated at DST supported TBI at iCREATE:** Karkhana.io (Bendable Technology Solutions Pvt. Ltd.), a woman-led start-up, is transforming contract manufacturing with scalable turnkey solutions, connecting over 500 vetted MSME partners to streamline production for start-ups and OEMs. Supported by iCreate under DST-NIDHI SSS, Karkhana.io has leveraged industry connections and networking platforms to accelerate growth, positioning itself as a leader in India's manufacturing ecosystem. Backed by Series A funding from Arkam Ventures, Vertex Ventures SEA & India, and Susquehanna Asia Venture Capital, Karkhana.io has served 100+ clients and delivered over 3 million custom components, earning multiple awards for excellence.

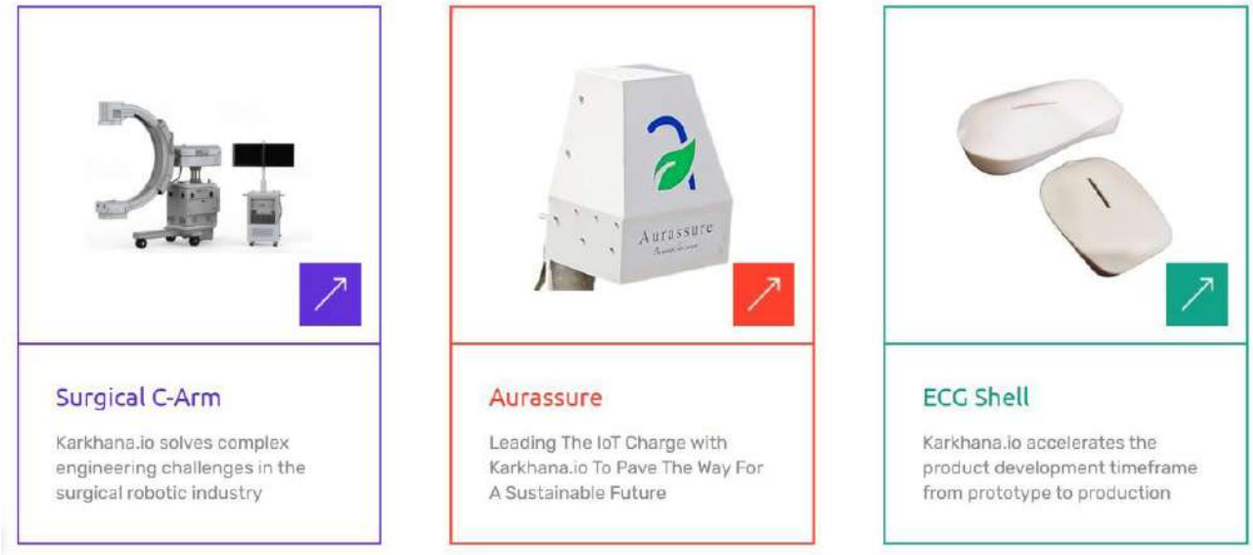


Figure: Products by Karkhana.io (Bendable Technology Solutions Pvt. Ltd.)

- **Galanto Innovations Pvt. Ltd. – Incubated at DST supported TBI at IIT Gandhinagar (IIT Gandhinagar Entrepreneurship and Innovation Center):** Galanto Innovations Pvt. Ltd. is a pioneering startup incubated at the IIT Gandhinagar Entrepreneurship and Innovation Center. Its flagship product, the RehabRelive Active Glove, has gained commercial success across India, offering innovative solutions for individuals in need of rehabilitation support. Galanto has developed prototypes for the RehabRelive Active Shoulder and Active Grip, demonstrating its commitment to enhancing the quality of rehabilitation devices.

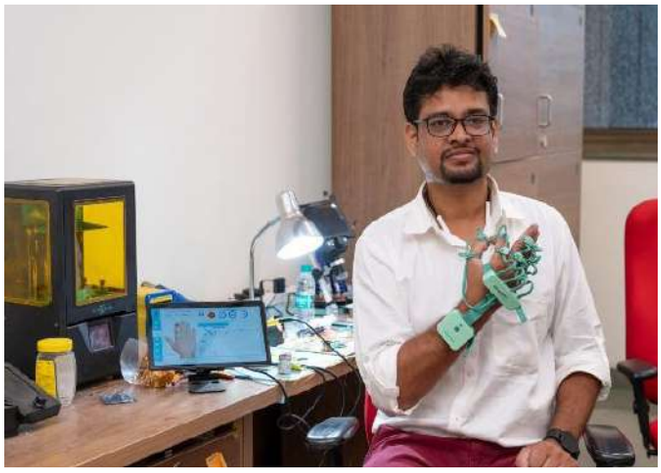


Figure: RehabRelive Active Glove by Galanto Innovations Pvt. Ltd.

3.4.7 Other Innovation & Entrepreneurship Initiatives

- The **DST-GDC IITM I-NCUBATE Program** was initiated to create a robust pipeline of deep tech startups in India. The program is designed to identify and nurture promising deep-tech startups based on STEM-research from Indian Universities and Laboratories. The DST-GDC I-NCUBATE Program is a joint initiative of the Department of Science & Technology (DST), Government of India, in partnership with the Gopalakrishnan-Deshpande Centre for Innovation and Entrepreneurship (GDC), IIT Madras, to identify and nurture the most promising deep-tech startups based on STEM research in Indian Universities and Labs. The DST-GDC I-NCUBATE program was launched by the Hon'ble Union Minister of State for Science & Technology (Independent Charge) in New Delhi on 6th September 2024. The program aims to catalyse STEM research and technologies from universities, research labs, and incubators across India by transforming innovations into deep-tech startups that create socio-economic impact at scale.

- DST on Sep 6, 2024 organised the DST Startup Utsav to celebrate the remarkable 8-year journey of National Initiative for Developing & Harnessing Innovations (NIDHI) program, DST's flagship initiative to nurture Startups and Innovators across India. The event saw the widespread participation of Startups and Incubators from across the country. The august gathering was addressed virtually by Hon'ble Minister of Science & Technology and Earth Sciences. The gathering at the event was also addressed by Secretary, DST and Director, IIT Delhi.

Figure: DST Startup Utsav 2024

- A special publication featuring **50 impactful women entrepreneurs** supported under the NIDHI program was launched. Additionally, key publications showcasing the impact and success stories of the **NIDHI EIR** and **NIDHI PRAYAS** programs were released.

Figure: Launch of DST NIDHI Compendiums

- The Department of Science & Technology (DST) of the Government of the Republic of India and the Deutscher Akademischer Austauschdienst (DAAD), German Academic Exchange Service of the Federal Republic of Germany, have signed a Joint Declaration of Intent to foster bilateral collaboration in innovation, technology transfer, and entrepreneurship. Leveraging the strong research partnership between the two nations, this agreement aims to catalyze science-based entrepreneurship and start-up ecosystems through cooperation between incubators, accelerators, higher education institutions, research bodies, and public-private partnerships in both countries. Key areas of focus include bilateral exchange visits for program managers, joint workshops to identify shared interests, pilot programs for ideation and market access, and dedicated support for women entrepreneurs.

Figure: Joint Declaration of Intent to foster bilateral collaboration in innovation, technology transfer, and entrepreneurship

3.5 National Council for Science and Technology Communication (NCSTC)

National Council for Science and Technology Communication (NCSTC) in DST, is fulfilling the national goal of scientific temper for all, as enshrined in the Constitution of India. The programmes & schemes of NCSTC aims at communicating and popularizing science and technology (S&T) to masses and stimulate scientific temper in interesting, informative and innovative formats at various platforms to enable delivery even up to the remote corners of India and to less endowed or stressed regions and communities. Some of the noteworthy achievements are as given below:

- **Low Cost Teaching Aids:** Fifty (50) Capacity building workshops were organized to build the capacity of 2000 teachers with low cost teaching aids in different states to motivate science teachers to perform hand on activities that would enable students for easily grasping the basic principles of science with fun. Approx. 6,00,000 students of the country were encouraged with these programmes. The participating teachers encourage students and promote the concept of learning science by fun. The program empowers teachers, trainers and students towards experiential learning through hands-on activities and scientific facts-based experiences beyond text books using limited resources in classroom teaching.

Figure: Resource Persons Demonstration of Low-Cost Hands-On Activities During Training Workshop

- **Science Communication through Folk Media:** Program envisages Science communication through popular language (local language) and it involves training & demonstrations using folk media. To promote S&T awareness field programmes training workshops, awareness campaigns were supported in different states to develop resource persons as science communicators through folk media. To promote S&T awareness field programmes 20 training workshops and 50 awareness programmes were supported in different states to develop resource persons as science communicators through folk media

Figure: Scientific Temperament by using folk media (Nukkad Natak & Awareness Camp)

- **STEMM Demonstration:** Science, Technology, Engineering, Mathematics and Medicine (STEMM) activities comprise of mobile science exhibitions, lecture-demonstrations, interactive media, visits to S&T establishments like labs and industry, hands-on-STEM activities, and so on. These events, whether stationary or mobile, including mobile science exhibitions, serve to utilize the expertise of resource persons trained/being trained by NCSTC in various aspects of activities.

- **Science Exhibition on Wheels:** The Mobile Science Lab (MSL) is a unique lab-on-wheels, which aims to take the laboratory experience to underprivileged children at their school premises. Students, especially having no or very little access to lab

facilities, get an opportunity for hands-on engagement in science activities which will help them in understanding difficult curriculum-based concepts with fun and ease. Several Mobile Science Exhibitions/Labs run in various states i.e. Assam, U.P, M.P, Karnataka, Chhattisgarh, Karnataka and Andhra Pradesh for Science Popularization, which benefited more than 10,00,000 students.

Figure: Glimpse of science on wheel activities

- **Visit to Industries:** Industrial visits, provides opportunity to students for interactive learning, and exposure to real working environments along with a practical perspective for career choice. A total of 20 industrial tours were organized to expose young minds to S&T, create their interest in new S&T subjects, and develop their curiosity, as well as creativity. Establishment like, research organizations, factories, telephone exchanges, steel plants, power stations, milk plant, railway control rooms, TV Kendra's, dams, hospitals, petroleum refineries, weather forecasting centre, automatic bakeries, newspaper, printing presses, automobile repair workshop, modern agriculture and poultry farms etc. Around 1000 students of 5 states were benefited with this initiative.

Figure: Visit to Industry

- **National Mathematics Day (NMD) Celebration 2024:** National Mathematics Day (NMD) is being celebrated on December 22, since 2012. The celebrations not only spreads awareness about the importance of mathematics but also highlights the contributions made by great Indian Mathematician, Srinivasa Ramanujan. The State S&T Councils of Madhya Pradesh, Punjab, Bihar, Mizoram, Tamil Nadu, Kerala, Goa, Himachal Pradesh, Karnataka, Arunachal Pradesh, Haryana, Meghalaya and other states were supported to conduct activities such as mathematics quiz, exhibition, Mathematics Model Exhibition-cum-Competition, mathematical models, Mathematics Lecture-cum-Demonstration, Origami, Hands on Activities, painting competition, debates, quizzes, exhibitions, lectures series, hands on workshops, awareness programmes, etc.

Figure: National Mathematics Day activities in various States

- **Development of an AR/VR platform for Science and Technology Literacy:** A web-based VR museum platform with placeholders for displaying content was developed by IIT-Tirupati. The platform supports multiple modes (i) Online mode (ii) Offline mode (without internet) (iii) Wiki mode (content can be queried from Wikipedia), and multiple types of content (image, video, mixed) for museum exhibits to create an immersive experience for users, and specifically students.

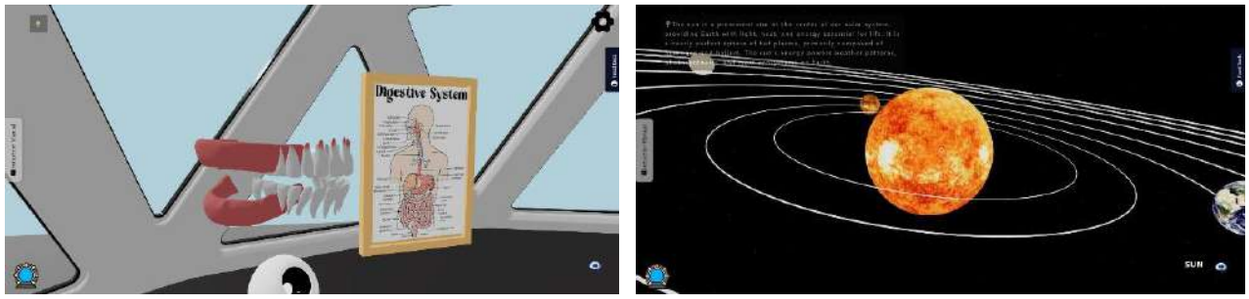


Figure: Demonstration of the platform for generation of prototype VR museum content variations for solar system and digestive system

- **Awareness related to Water Quality & Occupational Safety:** Shriram Institute for Industrial Research conducted four training workshops/awareness programs in Delhi and Uttar Pradesh on water and soil quality in Moradabad district and occupational health and safety of artisans in Saharanpur district. 100 science communicators to create awareness regarding water and soil quality and occupational health were created. Field test kits were used to demonstrate pollutants checking in water at local level in Moradabad and eco-friendly UV curable coating technology for wood handicrafts in Saharanpur.

3.6 Science for Equity Empowerment and Development (SEED)

Science for Equity Empowerment and Development (SEED) Division under DST provides support for action-oriented and location-specific projects aimed at the socio-economic development of disadvantaged sections of society through appropriate interventions of Science, Technology, and Innovation (STI). Through its various components; Scheme for Young Scientist and Technologist (SYST), Technology Interventions for Disabled and Elderly (TIDE), Strengthening, Upscaling & Nurturing Innovations for Livelihood (SUNIL), Science & Technology for Women (STW), respectively, projects have been supported to improve the quality of life and livelihood of marginalized sections of the society. Some of the representative achievements are summarized as follows;

3.6.1 Scheme for Young Scientists and Technologists (SYST)

The Scheme for Young Scientists and Technologists (SYST) programme is designed to foster a culture of innovation and research in the youth, encouraging them to find affordable and adaptable Science and Technological (S&T) solutions for identified socio-economic challenges for sustainable and inclusive development of society. Around 37 new projects have been supported and 8 projects were successfully financially closed with more than 50 research papers were published as knowledge output. Some of the noteworthy achievements under the supported projects under the programme are as follows:

- **Novel Dual-Layer PDMS-Paper Chip for Early Neonatal Sepsis Diagnosis:** YENEPOYA University, Mangalore has designed and fabricated a dual-layer microfluidic PDMS-paper chip for rapid detection of multiple biomarkers associated with neonatal sepsis. The chip was designed with multiple detection zones where monoclonal antibodies are immobilized to capture biomarkers like CRP, PCT, and SAA from blood samples. It could be deployed in field hospitals, remote areas, or rural clinics, improving overall healthcare outcomes for neonates.

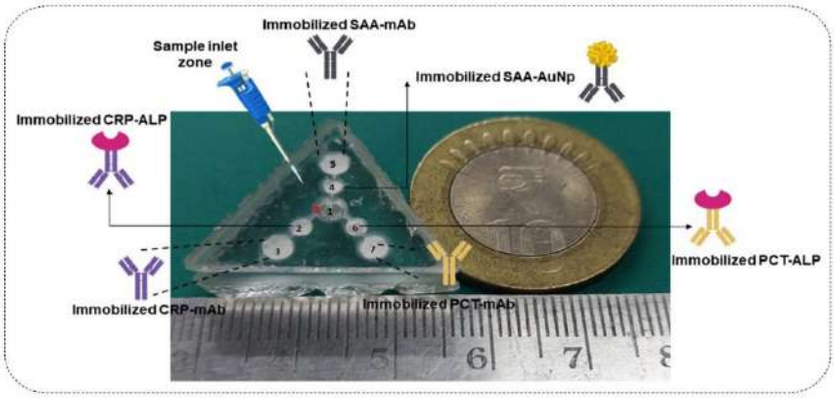


Figure: Developed triple biomarker based rapid testing kit for neonatal sepsis

- **Energy-Efficient Visible Light Insect Trap for Pests in Storage Environments:** ICAR-Central Institute of Post-Harvest Engineering & Technology, Ludhiana has developed a visible light insect trap and evaluated at various godowns, flour mills, storage sites of the institute. It is an effective trap for both beetle and moth pests' management, irrespective of the sex (male & female). It works with the LED PCB plate, which consumes much lesser energy than the conventional light bulb-based insect traps. The technology has been transferred to industry for mass manufacturing of the traps.

Figure: Visible Light Insect Trap

- **Pervaporation Technology for Lycopene Extraction from Tomato Waste:** Visvesvaraya National Institute of Technology, Nagpur has developed pervaporation process for Lycopene separation from Tomato Waste. The technology is at TRL 4, promotes waste valorisation, contributing to environmental sustainability. The beneficiaries include farmers, food processors, and consumers, with potential impacts on health and wellness due to the increased availability of lycopene-enriched products.

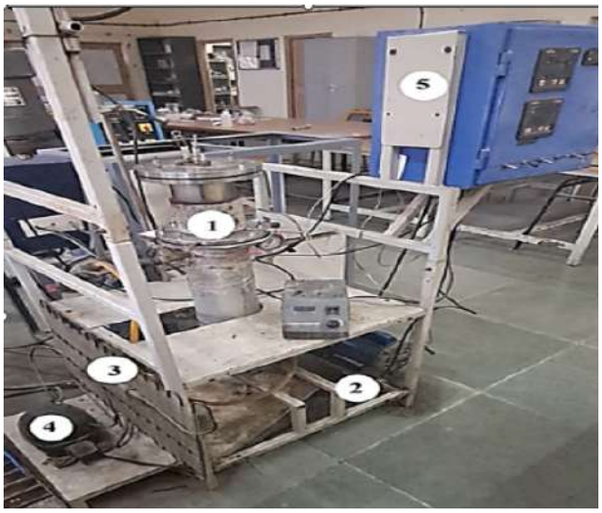


Figure: Setup of pervaporation; 1-5 (Feed Tank, Vacuum pump, Chilling coil, Compressor, Process variable controller)

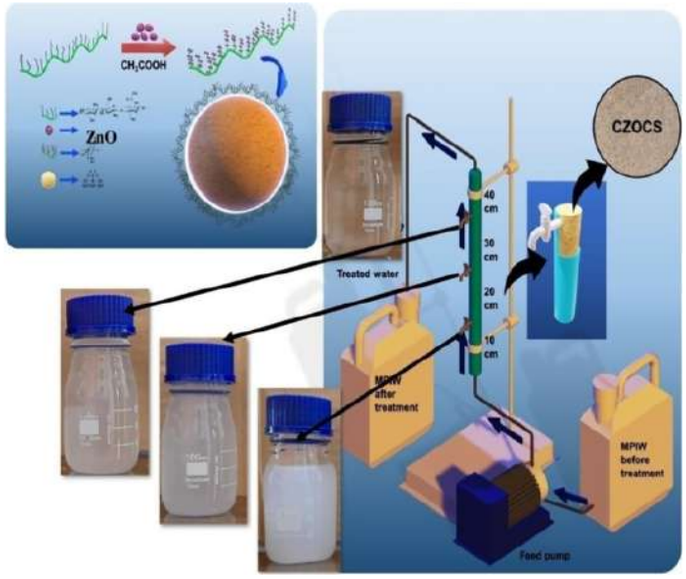


Figure: Optimization of fixed-bed column for dairy plant effluent treatment

Advanced Nano-Adsorbent Effluent Treatment System: From Waste to Resource: University of Agricultural Science, Raichur has developed, synthesized, characterized and coated with natural sand a nano-adsorbent filter system for dairy plant effluent treatment at low-cost. It has been fabricated for filtration capacity of 20000 L/day and demonstrated at Karnataka Milk Federation dairy plant, Raichur. The treated effluent was projected to be suitable for irrigation, safe discharge, and recycling.

3.6.2 Technology Interventions for Disabled and Elderly (TIDE)

The TIDE programme focusses on the development of affordable and adaptable Science and Technological (S&T) solutions aimed at enhancing the autonomy of Persons with Disabilities (PwDs) and the elderly. Around 10 new projects were supported during the year and 08 projects were successfully financially closed with more than 30 research papers and 7 patents were published as knowledge output. The few significant outcomes of the programme are as follows:

- **Empowering Lives: Compact EMG Sensor for Prosthetic Limb Control:** IIT BHU has developed a compact (2.2*3 cm), cost-effective EMG sensor for prosthetic limb solution that maintains market-standard EMG signal sampling frequency to benefit individuals requiring assistive technologies, particularly those with limb disabilities. The hybrid deep learning model and integration of EEG and EMG signals introduced as a novel approach to precise and efficient prosthetic control. The real-time control with minimal latency ensured smooth and intuitive operation, empowering users with more natural movements for daily activities.

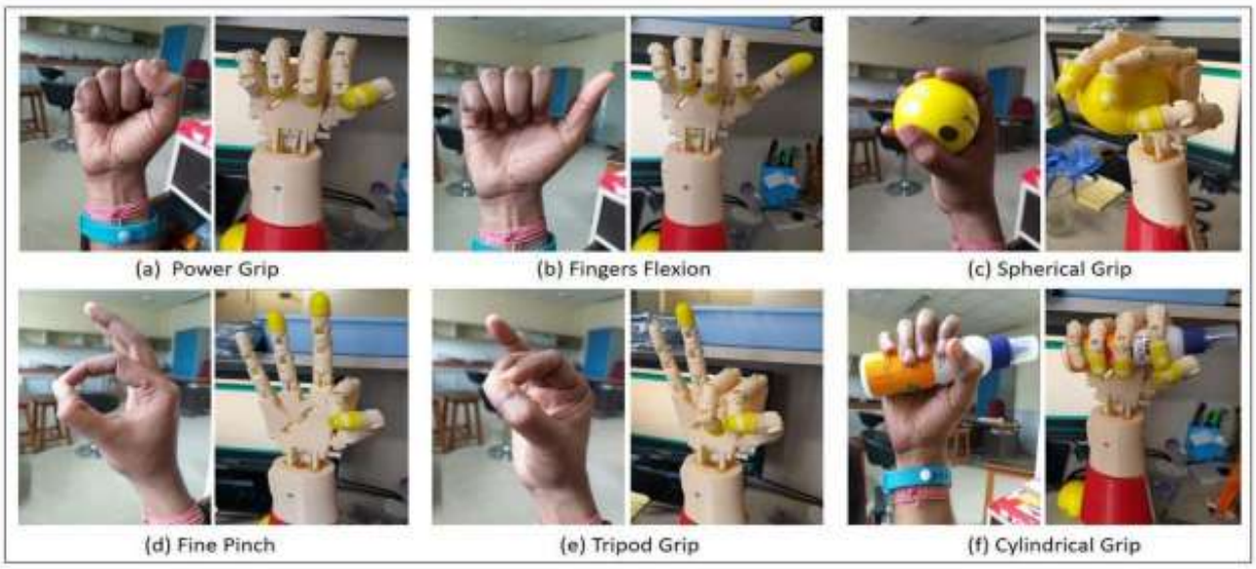


Figure: Different grasping tasks performed in Hand prosthesis trial

- **AI-Driven Retinal Imaging System for Early-Stage Glaucoma and ARMD Diagnosis:** G Narayanamma Institute of Technology, Hyderabad has developed a low-cost portable devices and retinal imaging system with deep learning models like Ensemble CNN for achieving high diagnostic accuracy for glaucoma/ risk of vision loss and ARMD at an early stage. Low-cost, portable retinal imaging devices (OCT Ophthalmoscope, D-Eye, ODOCS-NUN, G-Eye) were customized and pilot-tested for Indian healthcare

environments, facilitating the generation of a large-scale dataset in collaboration with local hospitals.

- **Assistive Device with Speech Enhancement for Elderly in Multiple Languages:** Karunya Institute of Technology and Sciences, Coimbatore has developed a handheld assistive device with Speech Enhancement System to help elderly individuals in enhancement of feeble voice to an audible clear voice by increasing the intelligibility of speech and also provides voice-controlled basic home automation system. Multiple languages, including Hindi, English, and Tamil, were incorporated into the predefined command mode based on user feedback. The same device functions have been developed into a mobile app, offering convenience and accessibility for elderly individuals on their smartphones.

Figure: Handheld assistive device with Speech Enhancement System

Figure: Demonstration of Assistive Device to Elderly

3.6.3 Strengthening, Upscaling & Nurturing Innovations for Livelihood (SUNIL) programme

The SUNIL programme aims to support network projects and location-based technology delivery models of social enterprise creation for Economically Weaker Section (EWS) of society. It also encourages improving their S&T knowledge, skill enhancement, capacity building and socio-economic conditions. During the year, total 25 projects have been supported out of which 8 were new projects. Some of the significant achievements during reported period are as follows:

- **Affordable Energy and Green Livelihood for Rural Communities of Tripura:** NB Institute for Rural Technology (NBIRT), Tripura introduced the renewable energy adoption and sustainable construction using bamboo-ferrocement technology and

improved resource efficiency & e-mobility. The project enhanced skills of approx. 250 artisans, farmers, and masons through utilization of food waste and create new livelihood opportunities to target substantial income growth (up to 80%), productivity gains (up to 70%), and expanded market access and linkages.

Figure: Low-cost solar solutions, NBIRT Tripura

- **Scientific Interventions for Profit of Salt Manufacturers in Kutch, Gujarat:** CSIR-Central Salt and Marine Chemicals Research Institute (CSMCRI), Bhavnagar, Gujarat converted two running solar salt works into model units and developed high purity solar salt technologies for agarias of Halwad Region, Gujarat. An overall purity of salt increased from 95 wt.% NaCl to BIS specifications i.e. 98.5 wt.% NaCl and net profit of approx. Rs. 220-250/- per ton of salt produced through innovative methods. Agarias have also trained to produce mixed salts from bitterns and recovery of magnesium and potassium salts to provide additional revenue.

Figure: Installation of solar still unit at Halvad site, CSMCRI Gujarat

- **A Flexible Cage Vehicle with Loading Adjustment for Transportation of Cattle:** Guru Gobind Singh College of Engineering and Research Centre, Nashik developed a "cattle cage" made up of non-alloy weldable fine grain steel and temporary adjustable fitments, which can be fitted with transport vehicle to provide ample space, minimize stress/ injury, and ensure access to essential needs like food, water and rest for safe transport of cattle. Several technical trainings to transporters and villagers were being given for operation and maintenance of the cage.

Figure: Flexible cattle cage, GGSCERC Nashik

- **Microclimate Moderation for Comfort of Tractor Operator:** ICAR-Indian Agricultural Research Institute, New Delhi developed a low-cost (~ Rs. 3500/- per module) retrofit evaporative cooling system to help tractor drivers working in harsh climatic condition, especially during the peak summer season. The model was demonstrated to farmers, local manufacturers in Kisan Melas and "Farm Operation Service Unit" of the institute. The process of commercialization of developed technology through the ZTMUBPD Unit, IARI, New Delhi has also been initiated.

Figure: Configuration of cooling pad on tractor, ICAR-IARI Delhi

- **Nutrient Management and Post-harvest Technology for Farmers, Kinnaur H.P.:** CSIR-IHBT Palampur and IIT Kharagpur through a network project developed nutrient management and post-harvest technology for Valeriana jatamansi & Tagetes minuta and evaluated metabolites status of Melissa officinalis and Artemisia brevifolia from different altitudes of Kinnaur. The farmers earned about 0.60-0.80 lakh/ac from the cultivation of Valeriana jatamansi and Tagetes minuta. MoU has been signed with District Administration of Chamba to promote the captive cultivation of targeted plants under different CSIR Mission mode projects and state-funded schemes.

Figure: Agroforestry system and crop diversification, IHBT Palampur

- **Controlling the bacterial development in snake bite wounds, Himachal Pradesh:** Himalayan Research Group (HRG), Shimla, Himachal Pradesh promoted cultivation and tested the Swertia cordata aqueous extract to control pathogenic bacteria isolates having high resistance to the existing antibiotics. Aqueous extract of chirayita was also tested for treatment of snake bite during 2023 rainy season on 5 patients and was successful in controlling the bacterial development in snake bite wounds. The herbal extract (234 ml) was sprayed 2 puffs (7-10 ml) on wounds of a series of 15 snakebite patients along with routine anti snake venom treatment saved lives, limbs and livelihood of snakebite victims in rural Maharashtra.

3.6.4 S&T for Women (STW) programme

STW program aims to improve the weakest link of the predominant livelihood system of women in an area and promote social entrepreneurship and women employment based on the strongest link of the livelihood system through interventions of STI. Women Technology Parks (WTP) as a resource centre provide necessary support to women from a single platform for their training and capacity building in various technologies by providing sustainable livelihood opportunities and improving the quality of life of the women through S&T interventions. During the year, total 27 projects have been supported, out of which 19 are new projects. Some of the notable achievements are as follows:

- **Modernization of Weaving Units for Tribal Women of Lakhipur, Assam:** National Institute of Technology, Silchar developed and established a "Semi-automatic loom" which includes automatic wrap stop, weft stop motions, and positive let-off motions and solar power solutions for continuous operation during power outages at Nangdailong village and Ramgaizang village in Assam. Under this project, 6 Wooden shuttle looms have been manufactured and delivered to the beneficiaries who earned about Rs 50,000/- per month and two self-help groups namely Chunthui & Rongmei Dolls were created and linked with Yarn Banking through Handloom & Textile Dept, Cachar.

Figure: Semi-automatic loom machine, NIT Silchar

- **Obstructive Sleep Apnea in North Indian Women with Polycystic Ovary Syndrome:** All India Institute of Medical Sciences, New Delhi conducted a study for the effect of Obstructive Sleep Apnea in North Indian Women with Polycystic Ovary Syndrome. A total of 3200 subjects were screened and revealed a notably higher occurrence of sleep apnea among individuals diagnosed with PCOS, particularly within the younger and obese population. A book "Obstructive Sleep Apnea & Polycystic Ovary Syndrome " has also been published to serves as a comprehensive guide, offering a wealth of knowledge about PCOS and sleep apnea for women's health.

Figure: Overnight Sleep Laboratory & booklet, AIIMS, Delhi

- **Flaxseed-rich Probiotic Dairy Foods to Address Menopause Symptoms:** ICAR-National Dairy Research Institute, Haryana developed FSSAI standard products namely flaxseed-rich probiotic dairy foods like Milk-Flaxseed-based fermented beverage & Flaxseed Lignan-Enriched Fermented Milk (TRL 4) to address postmenopausal Osteoporosis for women health and disseminated to approx. 500 women from villages Sangohi, Karnal in collaboration of Arpana Trust, Madhuban, Karnal. Besides this, established linkages with Institute Technology Management Committee (ITMC) and Agrinnovate India Ltd., New Delhi for transfer of technology and commercialization of the developed products.

Parameter	Raw flaxseed flour	Roasted flaxseed flour
Moisture (%)	7.95±0.17^a	1.93±0.07^b
TS (%)	91.95±0.48a	98.04±0.19^b
Ash content (%)	2.54±0.09^a	2.83±0.07^b
Fat (%)	43.07±0.50^a	48.92±1.52^b
Protein (%)	24.95±0.63^a	26.34±0.46^b
Crude fibre (%)	5.33±0.08^a	6.14±0.14^b
Oxalate content (mg/Kg)	5.14±0.71^a	4.13±0.21^b
Hydrocyanic acid (mg/100g)	285±5.50^a	195±4.58^b
Phytic acid (g/100g)	1.24±0.06^a	1.06±0.07^b
SDG (mg/g flaxseed)	10.44	10.32

Figure: Standardized dairy products for women health, NDRI Karnal

- **Preventive Women's Safety Device:** Aarupadai Veedu Institute of Technology, Paiyanaur developed an android based mobile application with 3 modes (Browse, tagging, Emergency) that can proactively enable women security when they visit unfamiliar places using location-based tagging (without internet facility) of safe to visit rankings. Institute filed a Patent No. 202241074797 entitled "GPS based Smart Women Safety Monitoring Wrist Band" and registered with a pre-incubation Start-up i.e. Ganesan Incubation and

Entrepreneurship centre. TITAN company, Hosur has expressed interest for fabrication of the casing design of the device.

Figure: Preventive Women's Safety APP using Location based Alerting, AVIT Paiyanoor

- **Machine Learning for Enhancing Women Safety at Public Women-only Spaces:** Dr Mahalingam College of Engineering and Technology, Tamil Nadu developed a Machine Learning (ML) algorithm and using deep-learned features for recognizing the patterns of women from men to provide access for only Women in Women-only spaces. The model outperforms all face-based gender recognition with the highest accuracy of 96.9% and trained around 561 women. An Indian patent No. 202241028482 entitled 'Automated Gender-based Access Control System for Public Women-Only Spaces' has been filed.

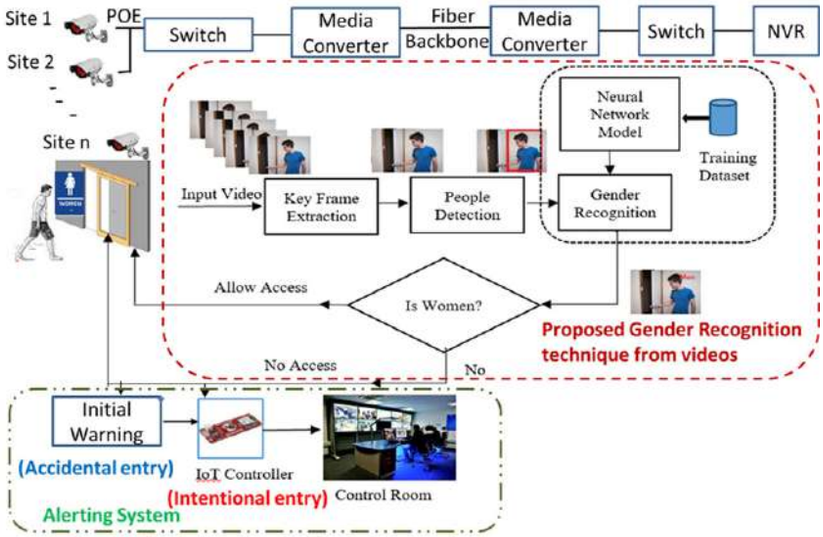


Figure: Safety device for women-only places, DMCET, Tamil Nadu

3.7 Scheduled Cast Sub Plan (SCSP) and Tribal Sub Plan (TSP)

The SCSP and TSP Schemes use Science and Technology (S&T) to empower SC and ST communities, promoting sustainable livelihoods and enhancing their quality of life. During 2024, around 50 new projects have been supported in sectors such as agriculture, health, energy, and sanitation. The ongoing People and Protected Areas (PPA) program benefits around 30,000 tribal individuals in forest fringe areas through the efforts of 16 NGOs. Additionally, 20 STI Hubs (13 for SC and 7 for ST) have been established across the country to address livelihood challenges, develop S&T solutions based on local strengths, improve agricultural productivity, skill development, and promotion of inclusive and sustainable growth for SC/ST communities. The key activities through the individual project under different components of the programme are as follows;

3.7.1 Projects under SCSP and TSP

- **Impact of Scientific Fish Farming Techniques on Sustainable Aquaculture in Odisha:** The project introduced scientific fish farming techniques to SC farmers and women in Odisha's Dhenkanal and Kandhamal districts, transforming traditional low-yield practices. Spanning 8.8 hectares and benefiting 220 participants, the initiative provided hands-on training in carp seed production, pond management, and composite carp culture, complemented by critical inputs like lime, fish feed, and fry. Remarkable outcomes included a 78% yield increase in Dhenkanal and a 95% rise in Kandhamal. Recognitions included honours for two exemplary farmers and a prize-winning presentation on SC women's successful aquaculture adoption.

Figure: Scientific fish forming-techniques

3.7.2 Projects under SC ST CELL

- **Leveraging GIS and Technology for Socio-Economic Empowerment of SC and ST Communities in Telangana:** The DST-supported initiative by TGCOST in Telangana's Warangal District utilizes GIS-based technology to collect real-time data on the five

capitals of SC and ST communities in Telangana. This data drives a Decision Support System (DSS) to identify targeted S&T interventions. In collaboration with CESS, TISS, and JNAFAU, the effort aims to enhance socio-economic conditions, health, and sustainability, while safeguarding traditional knowledge. Dissemination of solutions occurs through community demonstrations, local partnerships, and training, ensuring lasting and effective outcomes.

- **SC/ST Cell Empowering SC Communities in Punjab through Technology and Entrepreneurship Initiatives:** The SC ST Cell empowered the SC community in Punjab through a Hub-and-Spoke model. Surveys of 40 villages and 7,000 households identified key technological gaps. Interventions are underway in SC-dominated sectors such as Punjabi Jutti, Cobbler, and Handicraft clusters, focusing on raw material, processing, marketing, and skill development. Sustainable agriculture, pond management, waste management, and AI-based anaemia screening is also being piloted. Entrepreneurship programs for SC youth aim to enhance income and socio-economic progress.

Figure: Development Program in collaboration with FDDI and Tech Empowerment of Pottery Cluster, Moga

3.7.3 Projects under Science Technology and Innovation (STI) Hubs

- **Biomass driven Trigeneration System for Improving the Livelihood of SC:** This initiative addresses challenges in Tamil Nadu's Athanavur village, Yelagiri Hills by using biomass gasification technology to convert invasive biomass into energy. It powers cold storage, a milk chiller, a generator, and improved cookstoves, benefiting over 4,000 people. Technologies developed include a 50 kWe gasifier, a refrigeration system, and a community cooking facility. The effort has resulted in 5 publications, 3 patents, and participation in 4 international conferences. It has received several awards, such as the ISTE – Sayed Sajid Ali National Award (2024) and the Young Scientist Award (2023).

Figure: Pictorial view of the Biomass Gasifier based Trigeneration System

- **Solar Fish Dryer for Enhancement of Income and Sustainability for ST, Konaseema:** The solar fish dryer developed for the ST fishing community in Konaseema , Andhra Pradesh significantly reduced drying time from 7-10 days to 2-3 days, improving product quality and marketability. The innovation uses a 20° angled absorber to optimize solar energy, ensuring hygienic, nutrient-preserving drying. This technology has increased income by 30%, enhanced drying efficiency by 70%, and enabled year-round fish availability. The intervention has trained 100 beneficiaries, installed 10 dryers, and boosted product value by 20%. A patent is filed, and a research paper is in progress.

- **STI Hub for the development of SC/ST communities in Bangalore:** The STI Hub project in 10 villages of Bangalore Rural and Chikkaballapura districts of Karnataka introduced transformative innovations for SC/ST communities. This includes an IoT-enabled grape farming system that enhanced yields through real-time weather and pest control forecasting, a hybrid solar dryer that reduced crop drying time from days to hours, and a patented green water purification system (Patent No. 343851-001) that removed fluoride, improving health outcomes. Small-scale fruit processing units enabled local value addition for mangoes and grapes, creating new income streams, while fuel briquetting technology converted agricultural waste into eco-friendly biofuels.

Figure: Hybrid Solar Dryer and product development (raisins and jackfruit) at STI Hub nodal center

- **Digitizing and Validating Indigenous Medicinal Knowledge of The Nilgiris Tribes:** The validation and digitization of ethnomedicinal knowledge from tribal communities in Tamil Nadu's Nilgiris, Namakkal, Thiruvannamalai, and Tirunelveli districts has led to the creation of a digital database (https://audadham.in) that preserves traditional herbal knowledge. This resource is now accessible for scientific research and innovation, ensuring equitable revenue-sharing and empowering tribal healers to become entrepreneurs. By safeguarding valuable medicinal knowledge, it supports the socio-economic upliftment of these communities and offers opportunities for developing products based on traditional remedies.

Figure: Malayali tribe processing the Coffee seeds in the Kulivalavu village of Kolli hills, Tamil Nadu

- **Empowering Kerala's Fisheries Sector Microenterprise Development:** The STI Hub in Kerala's fisheries sector has launched 84 microenterprises, benefiting-490 individuals and increasing household incomes by 30%. Innovations include HDPE nets for cage culture, solar filtration systems, and a new fish fertilizer technology. Modern infrastructure, such as a digitalized STI-Hub, mobile training units, and smart classrooms, supports learning and collaboration. Notable achievements include 7 research articles, 30 accredited professionals, and recognition of two women stakeholders for their contributions.

Figure: Cage farming site, Thuruthippuram

- **Low-Cost Protein rich traditional food products of under-utilised linseed crop:** In Badser village, Himachal Pradesh, the decline in linseed cultivation due to limited processing knowledge led to the development of innovative linseed-based products, such as papad, cookies, and blended oils with enhanced shelf life and stability. A DST-Hub was set up, equipping SHG members to produce these products. The approach introduced cost-effective, protein-rich linseed products and blended oils, addressing nutritional needs and boosting market competitiveness. The hub, with advanced machinery, supports 100+ SHG members, promoting skill development and entrepreneurship. Byproducts like linseed oil cake provide omega-3-rich nutrition, improving public health.

- **STI Hub for Livelihood and Sustainability in SC Communities of Amalapuram:** The STI Hub for Development of SC Communities in Andhra Pradesh's Amalapuram Mandal has introduced several key innovations aimed at improving the livelihoods of the beneficiaries. Notably, mushroom production from banana pseudo-stems and leaves provides an additional income of around Rs. 15,000/month per person during lean seasons. The hydraulic-assisted palm bunch harvester reduces physical strain on farm workers, enhancing productivity and health. Additionally, bio-potash production from cocopeat leachate and activated charcoal from coconut shells have been developed, addressing market demand for sustainable products. Mango jelly production has also been automated, eliminating the use of synthetic preservatives. These innovations have resulted in the

Figure: Growing Mushrooms on Banana

3.8 National Good Laboratory Practice (GLP)

DST is implementing the National Good Laboratory Practice (GLP), a Compliance Monitoring Programme for certification of Indian Test Facilities (TFs)/ LaboratoDSries conducting non-clinical health and environment safety studies on various chemicals in accordance with the Organization for Economic Co-operation & Development (OECD) Principles of GLP and as

per the OECD Test Guidelines. India is full adherent to OECD Council Acts related to Mutual Acceptance of Data (MAD) since March 3, 2011. This facilitates sharing and acceptance of results/data generated in GLP certified TFs among 38 member-countries of the OECD and 7 non-member full adherent countries to MAD, thus removing the technical barriers to trade.

To implement the National GLP Programme in India, the National GLP Compliance Monitoring Authority (NGCMA) was set up under the administrative control of DST in August, 2002 and currently there are 60 GLP certified TFs in the country including four government laboratories.

Some of the major achievements of the GLP Programme during the year are given below;

- **India as Chair of the OECD'S Working Party on GLP:** Head- NGCMA, DST chaired the 38th meeting of WP on GLP in OECD Headquarters, Paris, France during April 16-18, 2024. This is a matter of great honour and pride, since India is first non-member, full adherent to MAD country in South-Asia to be designated on the Bureau as the Chair of the WP on GLP.
- **India as team leader during On-site Evaluation of GLP Compliance Monitoring Authority (Medical Products) of Spain:** Head-NGCMA participated in the On-Site Evaluation (OSE) of GLP Compliance Monitoring Authority (Medical Products) of Spain as team leader during November 18-22, 2024. Experience and expertise gained from the OSE would go a long way to harmonize the GLP quality system in the country.
- **GLP Certification:** During the financial year, 3 new TFs were certified as GLP compliant after thorough inspection and review of their facilities and GLP studies conducted therein. Further, 12 existing TFs were re-certified as GLP compliant as per the laid down procedures of NGCMA. Also, surveillance inspections for the certified TFs, under the National GLP programme were conducted by NGCMA, as per procedures.
- **Training Courses/ Capacity Building Programmes:** To augment capacity building in the area of GLP, NGCMA organized the following training programs/ workshops during the year:
  - A three-day training Course for Quality Assurance of GLP Test Facilities (December 4-6, 2024).
  - A one-day sensitization workshop on GLP for students and researchers at CSIR-IGIB, New Delhi (October 10, 2024)

Figure: GLP training course for Quality Assurance personnel

3.9 Technical Research Centres (TRCs)

The Technical Research Centres (TRCs) promote translational research and contribute towards strengthening country's excellence in science by striking right balance between fundamental research, directed development and deployment. 5 TRCs were established in 5 Autonomous Institutions of DST viz. Sree Chitra Tirunal Institute for Medical Sciences and Technology (SCTIMST), Thiruvananthapuram; International Advanced Research Centre for Powder Metallurgy and New Materials (ARCI), Hyderabad; Jawaharlal Nehru Centre for Advanced Scientific Research (JNCASR), Bengaluru; Indian Association for the Cultivation of Science (IACS), Kolkata and S. N. Bose National Centre for Basic Sciences (SNBNCBS), Kolkata during 2015-16. The TRC programme is translating scientific discoveries and technological inventions into products and services of societal and industrial relevance. The significant activities of these TRCs during 2024-2025 are given below.

3.9.1 International Advanced Research Centre for Powder Metallurgy and New Materials (ARCI), Hyderabad

The TRC project at ARCI aims to enhance translational research in the field of "Alternative Energy Materials & Systems." The TRC encompasses several sub-programs organized into four main areas: (i) Energy storage (including batteries and super capacitors), (ii) Energy conversion (fuel cells), (iii) Energy efficiency (such as magnets for motors and waste heat recovery) and (iv) Renewable energy generation (including Solar Concentrated Solar Power (CSP) and photovoltaic (PV) systems). This initiative seeks to advance the maturity levels necessary for the development and demonstration of prototypes, ultimately leading to the commercialization of technologies in the automotive sector and other energy-related industries. Some of the major achievements are given below

3.9.1.1 Energy Storage (Batteries and Super capacitors)

- Technology for the production of battery grade Lithium Iron phosphate (LFP) as a cathode material for Li-ion batteries was transferred to M/s. Altmin Pvt Ltd., Hyderabad on non-exclusive rights within India on 03/05/2024.
- A state-of-the-art 2MWh LIB Pilot facility at Nsure Reliable Power Solutions, Bengaluru is nearing completion as per ARCI-NSURE agreement for Indigenization of Lithium-Ion Battery Technology fabrication

Figure: LIB Pilot facility at Nsure Reliable Power Solutions, Bengaluru

3.9.1.2 Energy Conversion (fuel cells)

- A 20 litres/hour Hydrogen producing anion exchange membrane based alkaline electrolyzer with in-house Nickle electrodes has been developed.
- A 100W open cathode air-cooled PEMFC system for mobile charging applications has been developed and demonstrated at India-International Science Festival 2024 held at Indian Institute of Technology, Guwahati during November 30-December 03, 2024 for over 100 hours of intermittent operation.

3.9.1.3 Energy Efficiency (Magnets for motors and waste heat recovery)

- Using the industrially scalable method for the production of fine strontium hexaferrite powders, Ashvini Magnets, Pune has successfully produced coarse powder of strontium hexaferrite at Pilot scale (10 kg/ batch) under the Cooperative Research and Development Agreement (CRADA) between ARCI and Ashvini Magnets, Pune.

3.9.1.4 Renewable energy generation (CSP and PV systems)

- Optimized Silica nanoparticles-based aqueous anti-reflective coatings with a variation of surfactant agents in solution preparation. The optimized layered coatings on the Matt glass show enhancement above 2.6% in the 380-1100 nm wavelength.
- Prototype PSC modules fabricated on 50mm x 50mm size glass substrate exhibit good reproducibility, reached > 14 % efficiency and T80 life time of >700 hours (as per ISOS-D1 standard).

3.9.2 Sree Chitra Tirunal Institute for Medical Sciences and Technology (SCTIMST), Thiruvananthapuram

The TRC at SCTIMST, Thiruvananthapuram has a mandate of developing medical device technologies in five identified segments, viz. Cardiovascular, Neuroprosthetics, Hard Tissue Devices, Biological & Combinational Products and In Vitro Diagnostics. During the current year, 37 new projects were selected focusing on core areas such as Cardiovascular, Neuroprosthetics, and Hard Tissue Repair (Orthopedics and Dental). Additionally, certain Biological and Combinational Products, along with In-Vitro Diagnostic Devices, were also included.

Medical Device Regulatory Compliance Facility (MDRCF) for supporting the Indian Medical Device Industry in the areas of medical device regulatory compliance, an Industry Institute Partnership Cell (IIPC) for training manpower for the industry and a Technology Business Incubator for Medical Devices and Biomaterials (TIMed) are also components of the TRC. Significant outcomes of the TRC are given below

- Key Class D devices, including the Aortic Stent Graft, Atrial Septal Defect Occluder, Flow Diverter Stent, and Left Ventricular Assist Device, are nearing the final stages of validation.
- AG Chitra TB Diagnostic Kit developed at TRC and licensed to M/s Agappe Diagnostics, Kochi on 08.04.2024 was approved for manufacturing and marketing by The Central Drugs Standard Control Organization (CDSCO)

3.9.3 S. N. Bose National Centre for Basic Sciences (SNBNCBS), Kolkata

The TRC at SNBNCBS, Kolkata focusses primarily in the areas of Materials Science, Nanoscience, Nanotechnology, and Biomedical Science and the projects under TRC aim at translational research in the areas of health care and food security, environmental protection, spectroscopic techniques and optical instrumentation and value addition to metal and alloy industry. The following patents were granted in year 2024

- Milk Quality Estimation Optical Device – Patent No. 509256 (09.02.2024)

Methodology for Controlling Isotopic Fractionations in Carbon Gases – Patent No. 507919 (07.02.2024)

- Non-invasive Screening for Neonatal Hyperbilirubinemia – Patent No. 506019 (01.02.2024)
- Nanoceutical Fabric for Preventing COVID-19 Spread– Patent No. 529689 (21.03.2024)

Also, a new patent application has been filed for portable Point-of-Care LOPA-Device for Pathogen Detection – Application No. 202431039104 (18.05.2024). The key accomplishments in the current year under various projects are given below.

- A new organic material has been synthesized which can produce H2O2 from water splitting at ambient condition under sunlight. Scaling up and patent filing is under process.
- Artificial intelligence-based software using digital cytometric approach which is capable of quantifying and identifying CSCs with nearly 98.7% accuracy (with experimental results) from biopsy bulk RNAseq data has been developed. Patent filing and field trial are under process.
- A new inorganic material has been synthesized and characterized, which was then used to design a 3-electrode hydrogen evolution reaction (HER) protocol. The fabricated 3-electrode cell is capable to produce hydrogen from acidic electrolyte solutions. Scaling up of the process for commercial viability is under process.

3.9.4 Indian Association for the Cultivation of Science (IACS), Kolkata

The TRC in Molecules and Materials in IACS, Kolkata covers a wide range of areas such as nanomaterials, quantum materials, functional polymers and other organic molecules and systems, materials with spintronics applications, strongly correlated electron systems, bio-materials and biology-inspired material**.** Several innovative projects were undertaken. Significant outcomes of few projects are given below.

- Advanced nanomaterials for gene and drug delivery, including lipid nanoparticles for EpCAM-targeted CRISPR/Cas9 plasmid delivery and antisense oligonucleotide-based

nanoparticles for breast cancer therapy, both demonstrating significant in vivo efficacy, were developed.

- Drug-conjugated polymeric materials were tested for combating uropathogenic bacteria. Additionally, a novel molecular gel for controlling fungal pathogens in agriculture is under patent, offering a sustainable solution to enhance crop yield and food security.

3.9.5 Jawaharlal Nehru Centre for Advanced Scientific Research (JNCASR), Bengaluru

During the year several projects were implemented by the TRC at JNCASR, Bengaluru. Some key projects are as follows;

- Multielectrode patterns on soft substrates as brain interface for recording and stimulation.
- Noncanonical nucleic acid targeted diagnostic platform for tuberculosis
- Development of High-Performance Electrocatalysts for Green Hydrogen Production.
- Antimicrobial and hemostatic sponge: Point of care Technology to tackle infection and hemorrage for traumatic injuries.
- Novel analogues of 6-BIO as modulators of autophagy for treatment of neurodevelopment disorder and neurodegenerative diseases.

Protection of Intellectual Property Rights (IPR): TRC has partially supported the protection of the Intellectual Property Rights generated by JNCASR faculty members in the areas of health, energy, solar, supply of raw materials, climate action, etc. 9 patents (India – 6, PCT – 1, Europe – 1, USA – 1) were and 4 patents are granted (India - 4).

3.10 National Spatial Data Infrastructure (NSDI)

The National Spatial Data Infrastructure (NSDI) established with a mandate to “acquire, process, store, distribute and improve utilization of geospatial data” has played a significant role in creation of technologies, policies, standards, spatial data infrastructure and human resources necessary for strengthening the geospatial data ecosystem in the country. The new geo-spatial network of applications based on the standards is the requirement of the time and NSDI has a significant role to play in strengthening the Geospatial Infrastructure building on existing data and ICT Infrastructure with best practices in collection, management and availability of data. A brief outline on the activities of NSDI and their significance are given below.

3.10.1 Strengthening the Spatial Data Infrastructure (SDI) in States: Spatial Data Infrastructure was established in 14 States for coordinated development of National and State Level Geospatial Fundamental Sectoral Data Sets and Applications. During the current

year Arunachal Pradesh State Spatial Data Infrastructure (APSSDI) has been established along with development and operationalization of the APSSDI Data Centre and Geo-Portal.

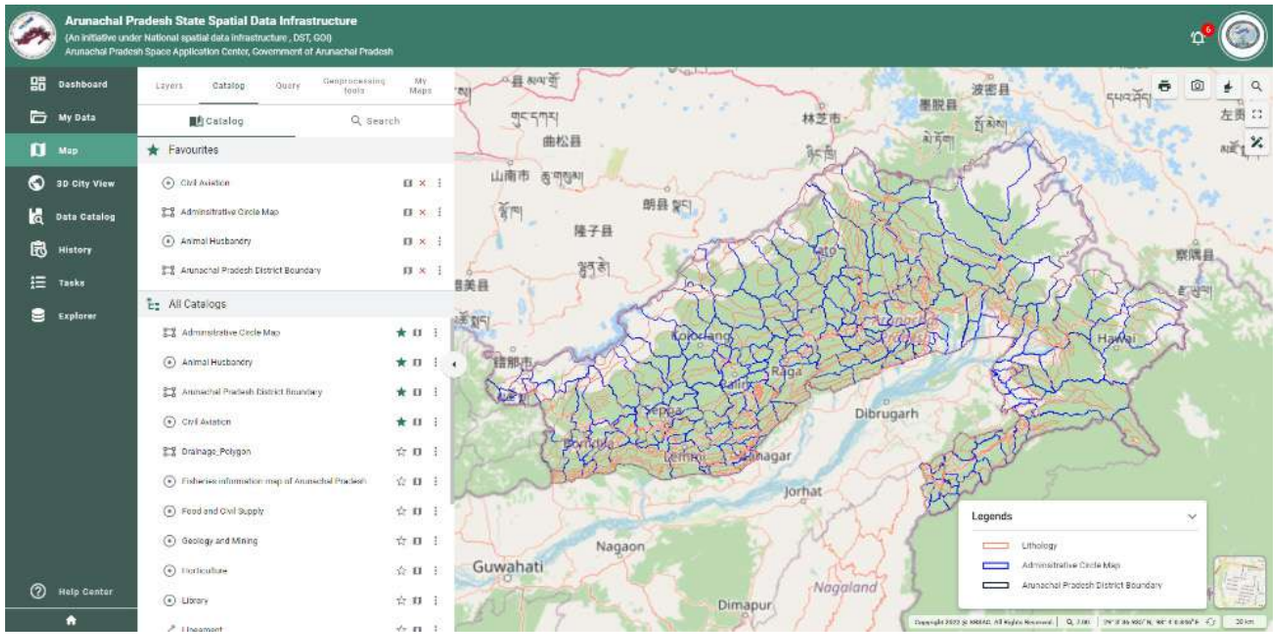


Figure: Overview of Arunachal Pradesh State Spatial Data Infrastructure Geoportal

The data collected from the surveys have been processed into highly accurate LiDAR layers. These layers enable precise mapping of terrain, infrastructure, and natural resources, supporting a wide range of applications from urban planning to disaster management. Foundational dataset in 1:500 scale for 230 sq.km. of Itanagar Capital Region (ICR) has been developed with 0.5m contour interval. A Digital Elevation Model (DEM) in 0.5 m grid has been generated with Building Vector Model of Itanagar Capital Region in LOD2 (Level of Details). 5 cm GSD of the Ortho Rectified Image (ORI) has also been generated for ICR. Comprehensive Mobile and Aerial LiDAR surveys were conducted to capture high-resolution geospatial data for the Itanagar Capital Region. Till date, 32 GIS layers have been successfully uploaded to the National Data Registry (NDR) and 28 Datasets from Line Departments have been collated. These surveys have provided an unprecedented level of detail, forming the basis for advanced spatial analysis and planning.

One of the potential applications of State geoportals is development of Unique Land Parcel Identification Number (ULPIN 2D) where the vertices of the land parcel were used to create the Unique ID/ULPIN for the plots based on ECCMA standard. The Draft International Standard on Unique Identification of Geospatial Features (e.g. Land Parcels or Property Units) have been tested and demonstrated to Department of Land Resources (DoLR) for adoption by 26 State Governments in Land Administration.

Figure: Screenshot showing Registration of Land Records and Use of ULPIN

3.10.2 Establishment of National Data Registry (NDR): The NDR built over a set of open standards from OGC, ISO and BIS in under operationalization with an accessible set of registers/ catalogue of data sets and services. The NDR has a provision for consumer-oriented products, applications, services and solutions using the metadata contained in the NDR and utilizing the data supply chains from the Central and State level partnering agency data nodes. All stakeholders producing geospatial data are being encouraged to collaborate in mutually beneficial manner and work towards open-linked Geospatial Data. NDR currently hosts 600 data sets approximately.

3.10.3 Cloud-based Geospatial Platform: A proof-of-concept (PoC) Geo-platform has been made operational at Survey of India, Hyderabad for high resolution (1:2,000 scale) data life cycle management of Varanasi City, Uttar Pradesh under National Urban Information System (NUIS). Some of the potential applications demonstrated are assessment of sun shadows for planning and optimal deployment of photo-voltaic panels for effective generation of solar energy, measurement of bill board dimensions for estimation of advertisement cost, optimal location of mobile towers etc. A proof of concept of the ULPIN 3D was created and demonstrated using high resolution Varanasi 3D data sets. The ULPIN 3D/PNIU (Property Natural Identifier Unit) is based on the coordinates of the centre of main door of the building unit. The ULPIN 3D/PNIU Web Service has potential to be used in various applications like taxation, routing, property registration, Land use planning, Infrastructure development etc.

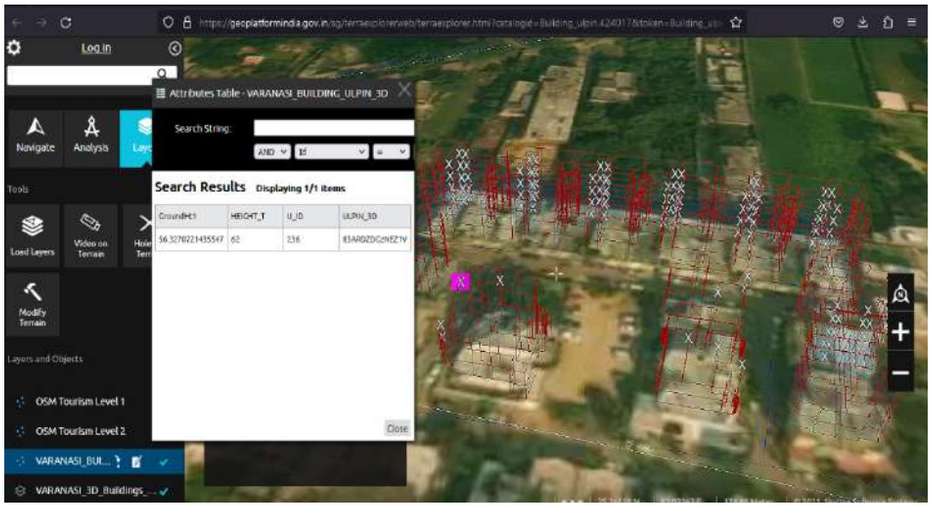


Figure: Creation of 3D ULPIN in Geoplatform using Varanasi Data Sets ULPIN 3D using ECCMA standards of OGC/ISO has been developed and is being implemented by NIC in states

3.10.4 Development of Geospatial Standards and Support: NSDI since inception has been actively involved in implementation as well as development of several geospatial standards. 14 geospatial standards are being implemented in NDR. NSDI had extensively contributed to Panel 3 of LITD 22 of BIS for development of Standards on LiDAR and Panel 5 of LITD 22 of BIS on Land Admin-Cadastral Data Content Standards (DCS) which were submitted to BIS. NSDI has been directly involved with its nodal agencies like ICAR NBSS&LUP and GSI for development of DCS for Soils and Geology which were at final stage of publication by BIS. NSDI is also actively associated with 8 panels of LITD 28 of BIS meant for developing Smart City standards. Most of the draft standards have been framed and are in processing phase of BIS.

3.10.5 Interim Data Sharing Framework (IDSF): NSDI is the Nodal Agency for implementing the Interim Data Sharing Framework (IDSF) which aims at ensuring effective data sharing. In IDSF, each partnering agency is expected to compile and maintain the metadata, pricing and terms & conditions in order to share those with NSDI and in turn with the end users in support of the data sharing. As of now, every month, the data sharing reports of 24 organizations are being compiled and shared. Development of an online system for data sharing is under progress along with constituting a Sub- Committee comprising of members/ Nodal Officers from SOI, NRSC, NIC, GSI, FSI, NBSS&LUP, MoSPI, and KSCST for meeting virtually and reporting the progress to the NSDI-Executive Committee on a monthly basis.

3.10.6 Training, Capacity Building and Outreach: Stakeholders/User groups from different domains and experts were sensitized on utility of NDR, State SDI services, application of cloud based geospatial platform through various events. NSDI had displayed exhibits in various forums like Geo-smart India, 2023, INCA International Congress. GISE-Hub and

NSDI have conducted OGC Stack Winter School on OGC API's, Data Models and City GML etc. Workshops and trainings programmes were conducted for Andhra Pradesh SDI, Odisha SDI, Arunachal Pradesh SDI along with initiating up-gradation of National Spatial Data Infrastructure (NSDI) Data Nodes using state-of-the-art Geo-spatial Cloud.

3.11 Science and Heritage Research Initiative (SHRI) Cell

The Science and Heritage Research Initiative (SHRI) aims to protect, preserve, and propagate tangible and intangible heritage for sustainable evolution through technological interventions and scientific validation. Some of the significant achievements under SHRI Cell are as follows:

3.11.1 Tales of Ajanta – VR Experience

The project Digital Ajanta supported to IITM Pravartak Technologies created an ecosystem for scientific preservation and non-invasive investigation of the Ajanta caves by leveraging technologies like 3D digital scanning, freeze animation, 3D modelling, and virtual reality.

"Tales of Ajanta – VR Experience," is therefore a transformative initiative to bring the timeless beauty of the Ajanta Caves to global audience through immersive virtual reality as mentioned by Hon'ble Prime Minister Shri Narendra Modi Ji in the 115th episode of *Mann ki Baat*. This unique VR experience illustration, a significant milestone in preserving India's cultural heritage using advanced technology illustration was launched on 16th December 2024 by Dr. Jitendra Singh, Honourable Union Minister, Ministry of Science and Technology, Government of India, in the presence of Prof. Abhay Karandikar, Secretary, DST.

Figure: Ajanta caves restored through technological interventions and the launch of experiential VR show by Hon'ble Minister of S&T

3.11.2 Development of processing technologies for traditional complementary foods of Western Himalayas and establishment of training and processing centre for local artisans

The centre of Excellence on "Traditional Complementary Foods of Western Himalayas" established at CSIR-IHBT, Palampur is extensively working on documentation and characterization of traditional complementary foods from Western Himalayan region.

Seventy-five (75) traditional recipes unique to Western Himalayas were identified and documented in the book for preparation of complementary foods for diversified stakeholders. The recipes predominantly utilizing wheat (*Seera*) and barley (*Sattu*), were scientifically standardized to prepare ready-to-eat products for the benefit of society. These technologies were further transferred to Pvt. Companies.

Figure: Images of few traditional foods of Western Himalayas

Further, the evaluation of nutritional and phytochemical quality of various wild edible plants consisting of edible flowers, green leafy vegetables, and fruits from the Western Himalayas and their ability to combat malnutrition and food preparation was documented. Many of these flowers (i.e. Rhododendron arboreum, Bauhinia variegeta etc.), fruits (Cordia obliqua and Ficus auriculata, etc.) green leafy vegetables (i.e. Amaranthus, Zanthoxylum, Urtica etc.) were used traditionally for the preparation of squash, chutney, roti, curry and pickles etc. An antioxidant-rich rhododendron and lavender-based tisane was commercially released on 16th December 2024 by the Hon'ble Minister of S&T.

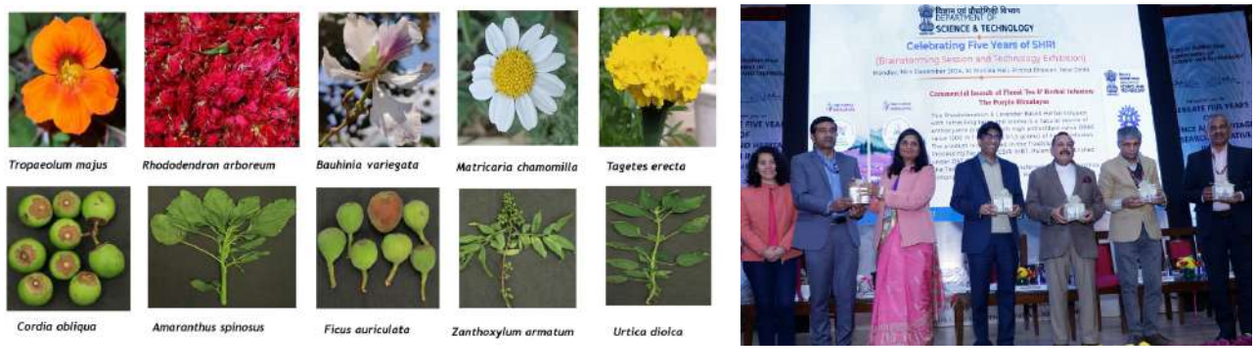


Figure: The wild-edible fruits and plants characterized for their nutritional and phytochemical quality and the product launch by the Hon'ble Minister

3.11.3 Traditional Weaving Art of Tamil Nadu through Smart Production Technology

- An innovative electronic jacquard was designed for traditional handloom weaving, amalgamating cutting-edge smart production technology to create beautiful ethnic textiles. Some of the salient features of the indigenous loom are:
- DC solenoid mechanism for harnessing, reliable and easy to maintain system.
- The system is not only strong but also durable as the hooks can handle heavy loads (up to 2kg), allowing weavers to use a wide range of yarns and create intricate designs.
- The "What You See Is What You Get" (WYSIWYG) software makes it incredibly easy to design and visualize the woven fabric.
- This technology empowers handloom weavers with modern tools while preserving the rich tradition of handloom weaving.

Figure: The mechanized loom developed with smart production technology

3.11.4 Scientific Assessment on Ethno-Dermatological Plants Used by the Malayali Tribal Community of Tamil Nadu

The traditional healing practices of Malayali Tribal Community of Tamil Nadu were documented for its potential in contemporary medicine, and promote affordable scientifically validated healthcare solutions. HerbaHeal a gel and cream for burn wound healing was developed from deep-rooted traditional knowledge of these tribes and was unveiled by Hon'ble Minister of Science and Technology, during the 5th Anniversary Celebration of SHRI on 16th December 2024.

Figure: Showcasing of products developed from ethno-dermatological plants used by the Malayali tribal community

3.11.5 Technology Interventions for Indigenous Handcrafted Products of Tamil Nadu

The Thanjavur Art Plate, a heritage craft of Thanjavur, Tamil Nadu, made of metals - Silver, Copper, and Brass was revived by introducing technology & design interventions for a sharper image by perfecting the mould edges and detail precision. Artisans were trained in tools such as Rhino, Zeebrush, 3D printing tools etc., to empower them to use this technology self-sufficiently. 72 artisans were trained to make the products with accuracy based on scientific and mathematical calculations.

Figure: Dasavatharam reimagined in a contemporary style on Thanjavur Art Plate

3.11.6 Dairy Waste-Scum Derived Fatty Acid Methyl Ester as a Potential Biofuel for Industrial Applications

Under Scientific Utilization through Research Augmentation-Prime Products from Indigenous Cows (SUTRA-PIC) program of SHRI Cell, a lab-scale non-catalytic reactor prototype was developed. The biodiesel was produced using dairy waste scum obtained from state government dairy industries and several heterogeneous catalysts were synthesized and tested for the transesterification process. The biodiesel was characterized as per industry standards and its performance was evaluated in real-time diesel engines. A scale-up process using a 10 L per day reactor with developed heterogeneous catalyst was developed and further scaling efforts are ongoing.

Figure: (a) Biodiesel reactor (10 L per day capacity) and (b) Computerized diesel engine with gas analyser

3.12 Exhibition & Fairs

The Exhibition Cell is assigned with the task of organizing exhibitions, participating in science exhibitions at National and International level. In addition to this, Exhibition Cell has also been assigned with the responsibility to coordinate the work of participation of DST along with its organizations {Autonomous Institutes/Subordinate Offices/Professional Bodies} in science exhibitions organized in the different part of the country. The aim of Exhibition Cell is to organize exhibitions to create awareness among students, scholars and general public on various Government policies, schemes, scientific innovations & milestones in the field of Science & Technology.

- During the year the following activities under the Exhibition Cell have been carried out;
- Participated in the India International Trade Fair – 2024
- Participated in the 27th National Science Exhibition

Instrumental in organising the 10th edition of India International Science Festival (IISF)-2024 at IIT Guwahati, Assam during 30th November - 03rd December, 2024

CHAPTER 4

NATIONAL MISSION ON INTERDISCIPLINARY CYBER PHYSICAL SYSTEMS (NM-ICPS)

The Department of Science & Technology (DST), Government of India is implementing the National Mission on Interdisciplinary Cyber-Physical Systems (NM-ICPS) approved by the Union Cabinet at a total cost of Rs 3660 crores. As part of the Mission implementation, 25 Technology Innovation Hubs (TIHs) had been established in reputed institutes across the country in advanced technologies like AI/ ML, AR/ VR, Robotics, Cyber security etc, out of 23 TIHs are active at present. NM-ICPS is in line with high aspirations that offer a strategy to make India a leading player in CPS technologies. NM-ICPS is a comprehensive Mission aimed at complete convergence with all stakeholders by establishing strong linkages between academia, industry, Government and International Organizations. The Mission has four major activities i.e. 1. Technology Development, 2. Human Resource & Skill Development, 3. Innovation, Entrepreneurship & Start-Up Ecosystem and 4. International Collaborations.

The TIHs are aimed at boosting new and emerging technologies to power national initiatives in key areas and for bringing out several technological solutions for people-centric problems. Each hub follows a technology life cycle approach, addressing all stages of the same namely, Knowledge- Development-Translation-Commercialization. These hubs emphasize on the development of infrastructure tools for direct application of basic and applied research leading to technology development. TIHs are also responsible for delivering commercial technology, and taking ideas/concepts or prototypes and turning them into marketable products by way of proactive coordination, communication and interfacing for technology transfer to the industry. this work closely with the start-ups, industries, government and regulatory bodies. The TIHs are aimed to be equipped sufficiently to function independently as a stand-alone entity. Further details may be found at https://nmicps.in

Some of the major achievements and technologies developed by the TIHs under the mission are given below;

4.1 IHUB NTIHAC Foundation (C3iHub) at IIT Kanpur, working in the Technology Vertical "Cyber Security and Cyber Security for Physical Infrastructure":

(i). C3iHub IIT Kanpur has developed blockchain-based crypto forensics tool to help Law Enforcement Agencies (LEAs) in investigating crypto crimes. This indigenous tool is economical and empowers LEAs not to share sensitive investigation information with foreign firms. West Bengal Poilce and Telangana State Police have procured this tool and over ten LEAs have been trained in different states.

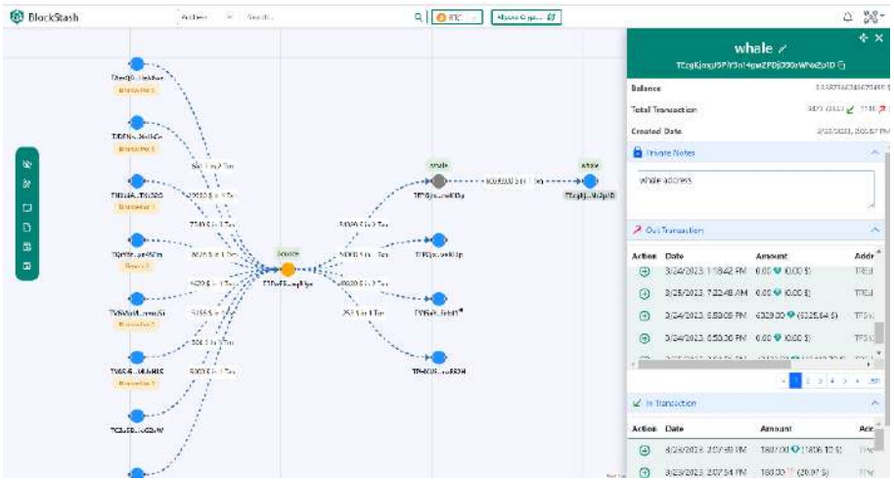


Figure: Crypto Transaction Network Visualization on Dashboard

(ii). C3IWallet, public bockchain-powered self-sovereign identity App developed by C3iHub, is an advanced verifiable credentials wallet (Android or iOS) that securely stores and manages wide range of digital credentials. Credentials are designed with selective disclosure property, allowing holder to control the information they share. The verification process is made simple by QR code generation from user credentials. The wallet is available on Google Play and was used to award degrees in 57th IIT Kanpur and 10th IIT Jodhpur convocations.

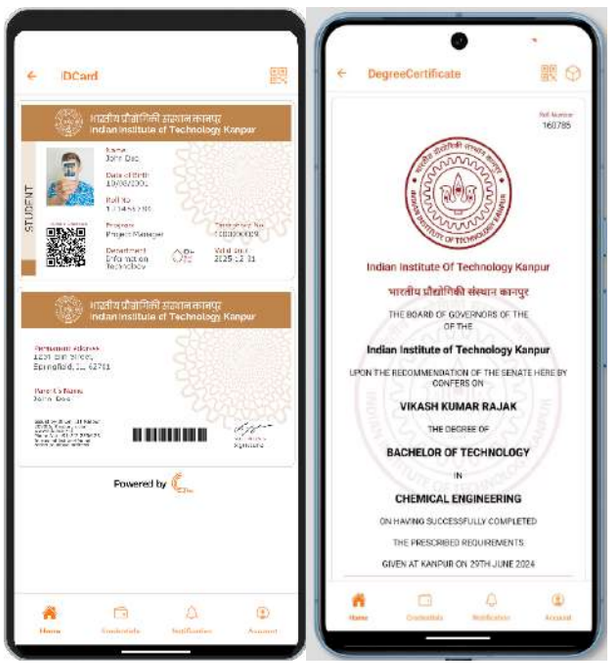


Figure: Credentials on C3iWallet

4.2 TIH Foundation for IoT And IoE at IIT, Bombay working in the Technology Vertical "Technologies for Internet of Things & Internet of Everything".

(i) The TIH Foundation for IoT and IoE has launched BharatGen- world's first government-funded multimodal, multilingual Large Language Model (LLM) initiative, developing advanced *generative AI models* tailored to India's linguistic, cultural, and socio-economic diversity. It is being implemented by TIH-IoT with premier academic Institutes as partners namely IIT Bombay, IIIT Hyderabad, IIT Mandi, IIT Kanpur, IIT Hyderabad, IIM Indore and IIT Madras. At its core is Bharat Data Sagar, a vast repository of India-centric data that ensures the AI models are deeply rooted in the country's unique context. By integrating text, speech and images, BharatGen builds accessible Generative AI technologies that foster innovation across key sectors like agriculture, education and healthcare, ensuring inclusivity for India's diverse population. A critical component of BharatGen is the development of a highly skilled talent pool, empowering the next generation of AI researchers and practitioners to drive India's AI revolution. Through strategic industry partnerships, startup collaborations, and educational initiatives, BharatGen aims to cultivate expertise, creating a sustainable ecosystem for AI-driven solutions.

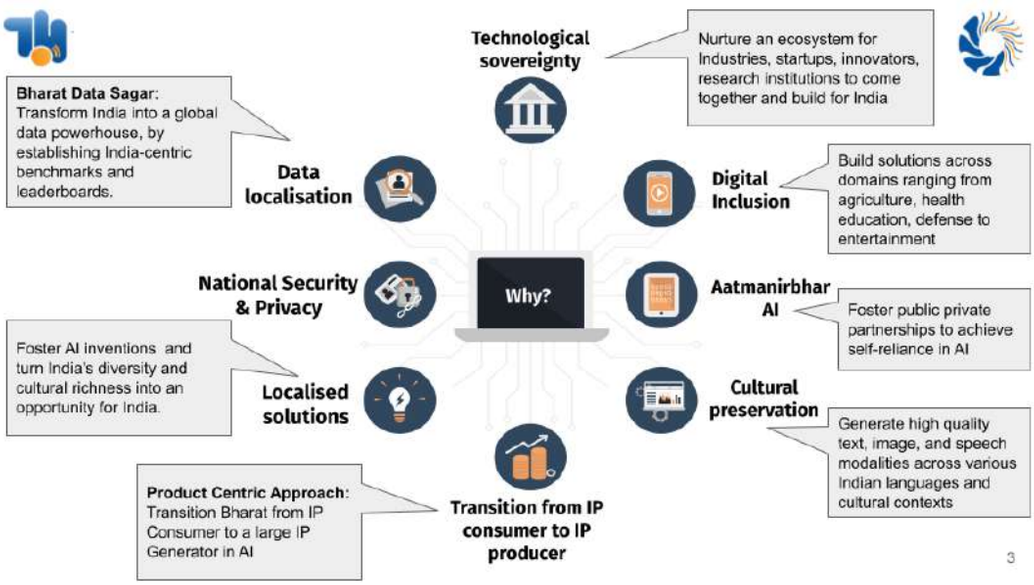


Figure: BharatGen

(ii). The TIH in collaboration with the Telecom Engineering Centre (TEC) of DoT has developed ASHA (**A**nyTime **S**mart **H**elp **A**nywhere), an IoT-based safeguard device that uses multimodal communication (LoRA, GSM, WiFi) to send distress signals, including time and location, to a centralized monitoring system. The distress signal can be activated either through a button press or a loud voice. The device communicates via all communication protocols to ensure that the distress message is delivered reliably.

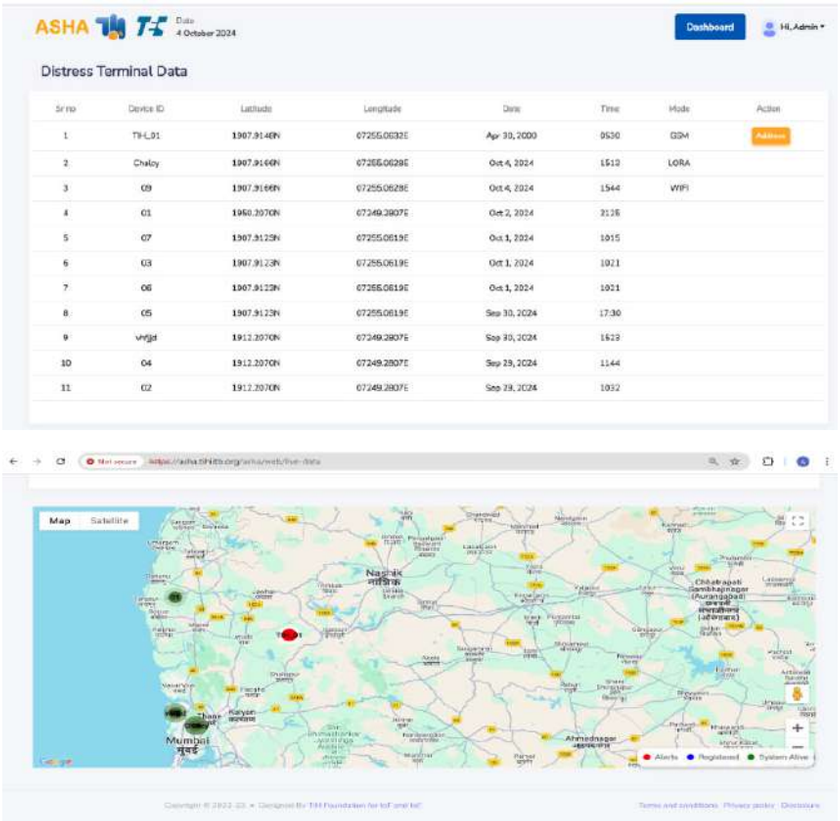


Figure: AnyTime Smart Help Anywhere (ASHA)

(iii). Through Drone Phenotyping the TIH is facilitating interventions such as irrigation/ fertilization/pesticide spraying, etc. Drones are flown over agricultural land to capture multispectral images of onion crops at The Directorate of Onion and Garlic Research, Rajgurunagar, which is one of the ICAR labs. Image processing technology is then applied to stitch the images together and come up with Normalized Difference Vegetation Index (NDVI), which is a measure of the health and amount of vegetation in the area.

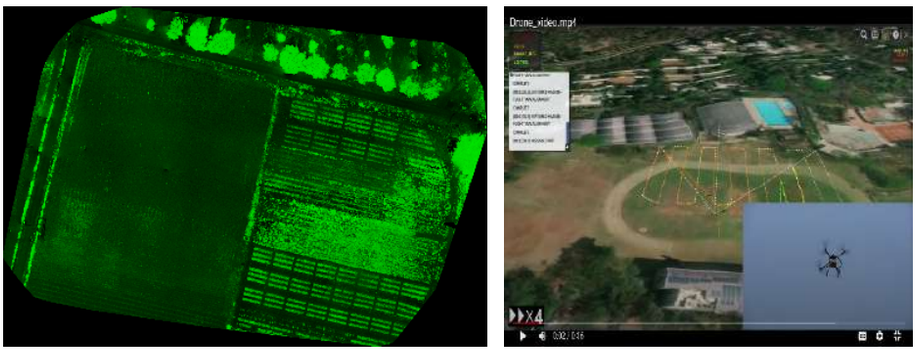


Figure: Drone phenotyping

4.3 IITM Pravartak Technologies Foundation at IIT Madras working in the Technology Vertical "Sensors, Networking, Actuators & Controls"

(i). TuTr Hyperloop Private Limited, a startup incubated under the TIH is working on the hyperloop technology, a proposed high-speed transportation system for both, passengers and freight using capsules supported by an air-bearing surface within a low-pressure tube. The startup is building a pod prototype with a maximum speed capability of 150 kmph.

Figure: Pod prototype

(ii). Folium Sensing Private Limited, the startup incubated at IITM Pravartak, leverages optical fibre-based distributed sensing to enable real-time monitoring of acoustics, temperature, and strain over vast areas. By converting standard fibre optic cables into high-precision sensors, their systems deliver unparalleled insights for applications such as leak detection, structural health monitoring, and border security. This scalable, non-invasive technology ensures cost-effective, accurate, and long-range performance, making it ideal for industries requiring robust and reliable sensing solutions.

4.4 I HUB for Robotics and Autonomous Systems Innovation Foundation at IISC, Bengaluru working in the Technology Vertical "Robotics & Autonomous Systems"

(i). The TIH has launched an initiative to develop 5G-enabled drone corridor, a virtual 3-dimensional flyway, mathematically represented as a set of keep-in geo-fences.

5G replaces the conventional communication channel between Unmanned Traffic Malmanagement (UTM) and UAV for both control and telemetry data. 5G-based positioning provides reliability and improved system redundancy in GPS-denied environments.

Drone Corridor Use cases:

- Media, Entertainment, Advertisement, Logistics, Transportation
- Surveillance, Remote Sensing, Precision Agriculture
- Disaster Response, Emergency Management

Potential Impact/Benefits of Drone Cooridor:

- Declutter airspace with optimal usage
- Safe mobility at a mass scale
- Reliable communications with low overhead

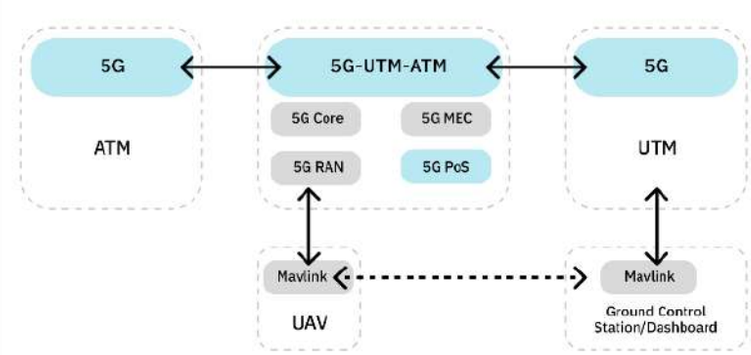


Figure: Schematic representation of drone corridor

(ii) VayDyn Technologies, an incubated startup under the TIH has developed indigenous AI based controllers for autonomous systems including drones, air, underwater and ground.

Figure: AI based controller

4.5 Technology Innovation in Exploration & Mining Foundation at IIT, Dhanbad working in the Technology Vertical "Technologies for Mining"

TIH is committed to develop cutting edge technologies for the mining sector. To realize this, the TIH has established following Centres of Excellence:

(i). Center of Excellence (CoE) established in collaboration with Hexagon India and Guideline Geo. This initiative aims to advance technological solutions and innovation in the mining sector, furthering India's progress in sustainable and efficient mining practices.

(ii). "Innovation in Mining (IMiN) - Centre of Excellence (COE) in collaboration with Coal India Limited.

4.6 I-Hub Foundation for Cobotics (IHFC) at IIT Delhi working in the Technology Vertical "Cobotics"

(i). Cocoslabs Innovative Solutions Private Limited, a startup supported under the TIH has developed Pixuate, an advanced AI-driven video analytics platform that operates on edge devices to deliver real-time insights, enhancing safety, security, and compliance monitoring across sectors including road safety and industrial safety etc.

Figure: Pixutae use case

(ii). xTerra Robotics supported by IHFC is an Indian deep tech robotics & AI startup, specializing in autonomous legged robots. The startup has developed Svan, a versatile quadruped platform which is India's first industrial quadruped robot with cutting-edge AI-powered mobility, high-torque in-house actuators, and all-terrain adaptability, providing a full-stack robotics solution for academia, industrial inspection, defence, and security.

Figure: Quadruped robot

4.7 NMICPS Technology Innovation Hub on Autonomous Navigation Foundation (TiHAN) at IIT Hyderabad working in the Technology Vertical "Autonomous Navigation and Data Acquisition systems"

(i). With first of its kind state-of-the-art testbed for Autonomous Navigation (Aerial/Terrestrial), TiHAN advances safe, smart, and sustainable mobility by integrating United Nations Economic Commission for Europe (UNECE) standards and Euro New Car Assessment Program (NCAP) scenarios to test Advanced Driver Assistance System (ADAS) features like Autonomous Emergency Braking System (AEBS), Forward Collison Warning (FCW), and Adaptive Cruise Control (ACC). The testbed enables Vehicle-in-Loop testing, ensuring safety and reliability, aiming to address India-specific driving challenges and enhance innovation in mobility solutions.

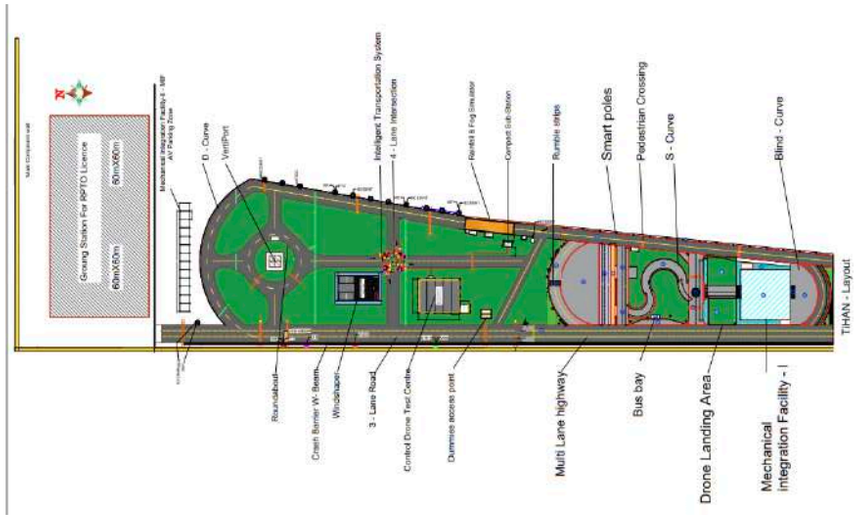


Figure: Autonomous Navigation Testbed (Aerial/Terrestrial)

(ii). TiHAN's High-Altitude Cargo Drone is engineered to lift payloads ranging from 100 to 150 kg, making it ideal for challenging operations in elevated terrains. It features a robust single-propeller failure management system, ensuring safe and reliable performance during emergencies. With a tested endurance of 40 minutes, the drone utilizes Global

Navigation Satellite System (GNSS) and Map-based navigation for precise route planning and autonomous flight. Advanced obstacle avoidance systems, with Camera and LIDAR, further enhance its operational safety and efficiency, making it suitable for logistics, disaster relief, and high-altitude transport missions.

Figure: Heavy Payload High Altitude Cargo Drone

4.8 IIIT-H Data I-Hub Foundation at IIIT Hyderabad working in the Technology Vertical "Data Banks & Data Services, Data Analysis".

The TIH has developed AnaVu, a 3D visualization tool for understanding anatomy of human body. Designed with feedback from educators, it addresses the pedagogy challenges such as limited cadavers, limitations of 2D images, visualization of hard to see structures and limited availability of teaching staff. It ensures accuracy of the image and mimics as close an experience as possible, as working with real cadavers. AnaVu does not require specialized GPUs to render the 3D models and can operate on standard laptops.

The components of the AnaVu solution currently include a content authoring tool for educators and a content publishing platform. The former is a software package that the educator can download to create the 3D models as described above.

Figure: AnaVu 3D visualization tool

4.9 Divyasampark IHUB Roorkee for Devices Materials and Technology Foundation at IIT Roorkee working in the Technology Vertical "Device Technology and Materials".

(i). Nexactly AI Solutions Pvt. Ltd, a startup supported under the TIH has developed Behave Neu EEG Headband, a single-channel EEG device designed for cognitive enhancement through neurofeedback and gamification. It supports children with Adult Attention-Deficit/Hyperactivity Disorder (ADHD) and attention challenges, reduces screen-time distractions & social media overuse impacts and empowers educators & parents with real-time cognitive insights. The technology is currently marketed for focus and productivity enhancement, with a B2C subscription model for gamified learning apps.

Figure: Behave Neu EEG Headband

(ii). Mythyaverse Pvt. Ltd., another startup supported under the TIH has developed "VR Placed", a comprehensive platform that combines hyper-realistic VR environments with advanced Generative AI, revolutionizing interview preparation and recruitment by providing immersive, data-driven solutions that bridge the gap between education and employment. The technology is deployed for recruitment with IIT Roorkee, MyFurries, Toyow, and Four clips, resulting in successful hires for various roles.

4.10 IIT Ropar Technology and Innovation Foundation at IIT Ropar working in the Technology Vertical "Technologies for Agriculture & Water":

Building on its mission to revolutionize agriculture and water sectors, iHub-AWaDH has introduced cutting-edge technologies designed for real-world applications including:

(i). Weather Monitoring Station: A cutting-edge IoT-based system for real-time monitoring of temperature, humidity, wind speed/direction, light intensity, rainfall, pressure, and solar radiation. Integrated with cloud platforms, it enables visualization, analysis, and forecasting.

Figure: Automatic Weather Station

(ii) Chloritron: An innovative solution for real-time monitoring of residual chlorine levels in water. Using a BH5530D sensor interfaced with an nRF microcontroller (Nordic Semiconductor Radio Transreceiver), it ensures water safety through precise data collection and cloud-based remote monitoring via a 4G gateway module and mobile-app.

Figure: Chloritron

4.11 IHUB Anubhuti-IIITD Foundation at IIIT Delhi working in the Technology Vertical "Cognitive Computing & Social Censing"

Monitra Healthcare Pvt. Ltd., a startup supported under the TIH has developed UpBeat, a smart device to monitor cardiac health. The product detects heart rhythm disorders in real-time for pre-emptive treatments. The mobile application also identifies heart disease, monitors cardiac activity before and after surgery, and other cardiac procedures. It also helps in assessing the effects of therapeutic drugs on cardiac activity.

Figure: UpBeat

4.12 IIT Mandi IHub and HCI Foundation at IIT Mandi, is working in the Technology Vertical "Human Computer Interaction"

(i) The TIH has created domain based Legal LLM for the enterprise with New-Age Digital Infrastructure using the opensource Indian legal database. This could facilitate establishment of e-courts which aims to provide online access (accessibility), automate case management (efficiency) through new age technology intervention like LLM to digitize court processes (transparency) thereby reducing pendency.

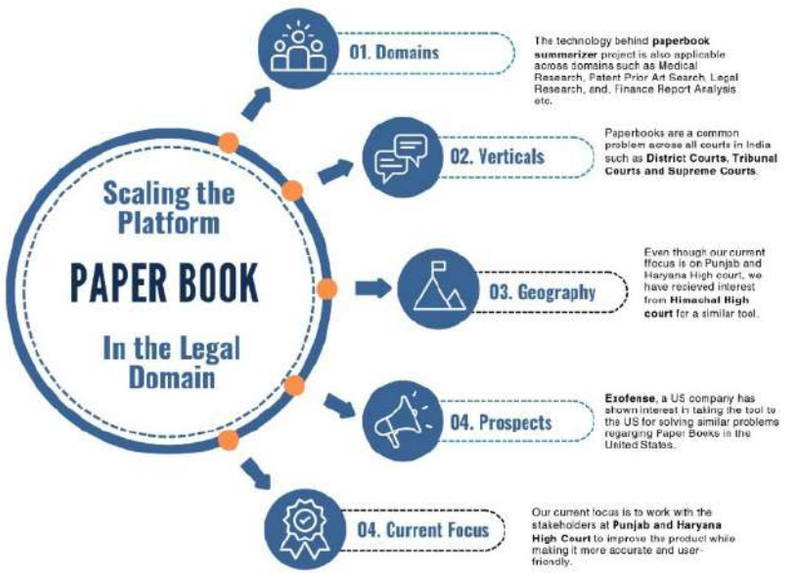


Figure: Paper book in the legal domain

(ii) The TIH has developed a non-invasive and portable, sensor and biomarkers-based system to detect Alzheimer's disease at an early stage. The novel feature of the technology is microwave imaging of different stages of brain which is obtained through electric field distribution in the brain using sensor.

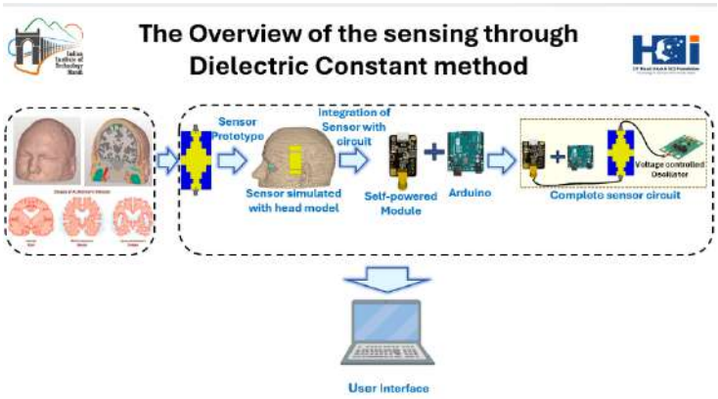


Figure: Overview of sensing through dielectric constant method

4.13 I-Hub Quantum Technology Foundation at IISER Pune working in the Technology Vertical "Quantum Technologies"

(i) The TIH has developed a low-cost voltage pre-amplifier which has a very low internal noise level. The noise level for this device is lower than that of widely available commercial voltage pre-amplifiers. This system finds its application where very tiny signals are to be amplified and measured, in semiconductor industries as well as in future quantum technologies.

Figure: voltage pre-amplifier

(ii) The TIH organized a 'Hands-on workshop to be Quantum Ready' in collaboration with NVIDIA. This workshop was aimed at preparing individuals for the era of Quantum Computing, wherein 40+ faculties/scientists from various institutions and organizations

participated. Distinguished speakers discussed and demonstrated the need and usefulness of large-scale quantum computing simulations in Quantum Materials, Quantum Communications, Quantum Computing, Defence, Theoretical Physics etc.

(iii) The TIH promotes start-ups, translational research, and commercialization activities in the quantum technology space. The TIH is supporting 8 start-ups spanning across different domains of Quantum Technologies, including Quantum Computing, Quantum Communications, Quantum Sensing, & Quantum Materials. These start-ups are being supported through comprehensive guidelines, developed under the National Quantum Mission (NQM) and officially adopted by I-Hub QTF.

4.14. IIT Patna Vishlesan I-hub Foundation at IIT Patna working in the Technology Vertical "Speech, Video & Text Analytics"

Eyecan, a startup incubated at the TIH uses advanced artificial intelligence to interpret and describe what's around. It identifies objects, recognizes faces, and reads text in real-time, helping the visually impaired to understand their surroundings at a glance. The key features of the technology are :

- Smart, AI-Driven Assistance
- Adaptive Machine Learning
- Customizable Sound and Voice
- Instant Object and Text Recognition
- Simple Integration with Your Digital World
- Regular Updates for Continuous Improvement

Eyecan empowers visually impaired to move through the world more confidently. It reduces guesswork, offers immediate assistance, and tailors itself to their individual style and preferences.

4.15. IIT Palakkad Technology I-Hub Foundation (IPTIF) at IIT Palakkad working in the Technology Vertical "Intelligent Collaborative Systems"

(i). IPTIF has developed an Inverter for Solar & Other High-Power Applications that convert the sun's energy into usable electricity, optimizes the power output from solar panels and monitors the performance efficiency. It uses two modular half-bridges (800V, 40A at 10KHz switching frequency) to build a single-phase sine wave inverter. A DC voltage of 420-450V is converted to 300-320V peak sine (220-240V rms). The modular design of half-bridges helps in scaling up for multiple power phase applications.

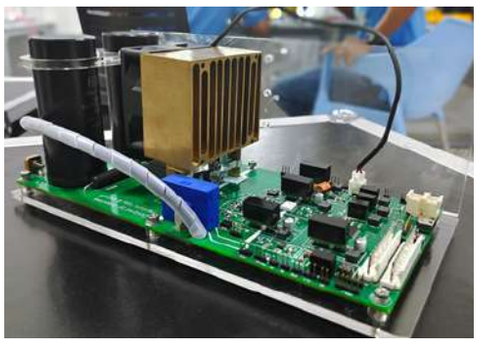


Figure: Inverter for Solar & Other High-Power Applications

(ii). InfinityX Innovation Pvt. Ltd., IPTIF supported startup has developed a Proprietary cell swapping technology. The discharged cells from the vehicle's battery pack are replaced by fully charged cells from the charging station via the swapping cable in 30 sec.

Figure: Cell swapping

4.16. IIITB Comet Foundation at IIIT Bengaluru, Karnataka working in the Technology Vertical "Advanced Communication Systems"

(i) The circuitry for a Reconfigurable Intelligent Surface (RIS) prototype has been designed and fabricated under the TIH. Tejas Networks Pvt. Ltd. is working with IIITB COMET Foundation and its academic partners on further development and testing of the RIS technology.

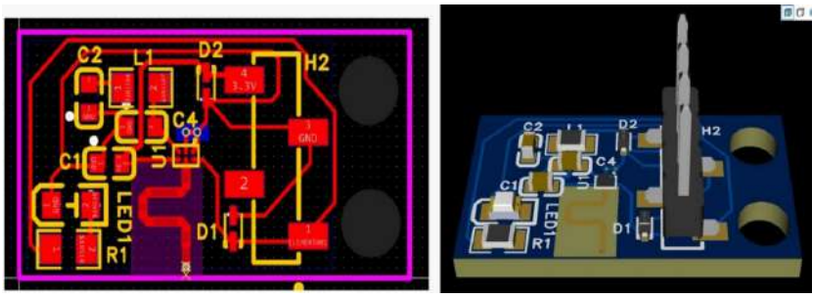


Figure: Circuitry designed for individual RIS elements

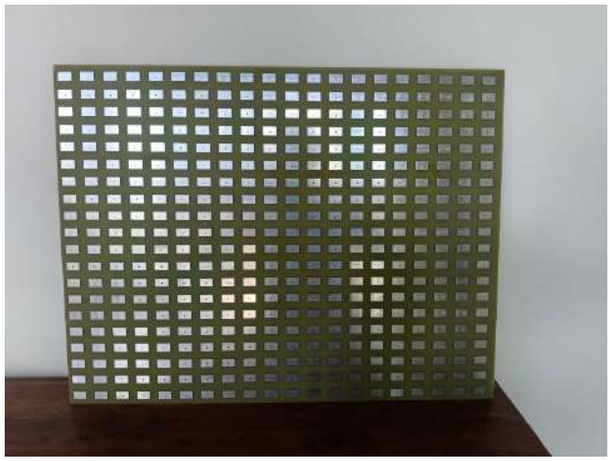


Figure: RIS tile fabricated

(ii). Through the support of IIITB COMET Foundation, one of the first standards worldwide on interfaces for Reconfigurable Intelligent Surfaces (RIS)-assisted communication has been standardized at the Telecommunications Standards Development Society, India (TSDSI). The title of the standard is "Methods and Interface Design for RIS-assisted Communication Systems" (TSDSI STD 5003 V1.0.0).

4.17. BITS BioCYTiH Foundation at BITS Pilani, Rajasthan working in the Technology Vertical "Bio-CPS"

A prototype biosensor chip for specific detection of *E. coli* and *Salmonella* in drinking water is developed with analysis time less than 30 min and detection as low as 10 copies. It uses proprietary probes and the patented method. One of the startups has developed a rapid, easy, and cost-effective electrochemical sensor-based solution to detect infection and Antimicrobial Resistance (AMR). This technology includes AI / ML tools to analyse gene specific bacterial infection and AMR.

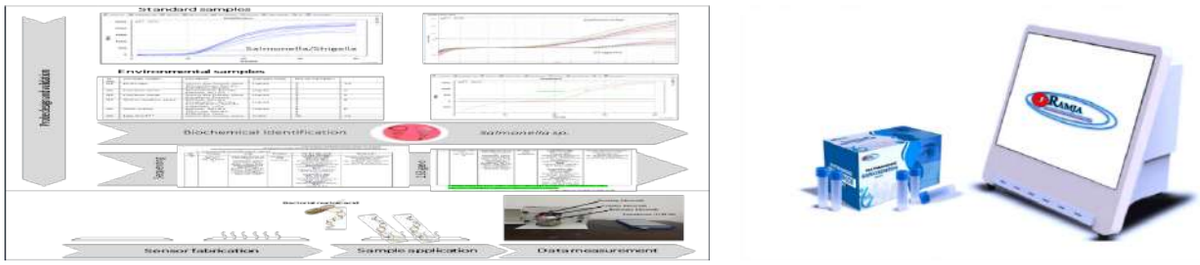


Figure: prototype biosensor chip for specific detection of E. coli and Salmonella

4.18. IHUB Drishti Foundation, IIT Jodhpur working in the Technology Vertical "Computer Vision, Augmented and virtual reality"

The TIH has developed chARitram - Ancient Story Telling AR Platform**,** a cutting-edge Augmented Reality (AR) application. It is focused on reviving ancient stories and legends through ancient painting scanning. By blending historical narratives with interactive digital experiences, the project aims to create an engaging platform for users interested in exploring and learning about ancient and educational stories.

Figure: chARitram

4.19. I-DAPT-HUB Foundation at IIT BHU working in the Technology Vertical "Data Analytics & Predictive Technologies"

(i). I-DAPT Hub Foundation has developed a demonstrable prototype of a real-time onboard vehicular exhaust gas monitoring system. This system uses the signature pattern analysis of the volatile organic compounds (VOCs) using artificial intelligence (AI) based algorithms. It is used to monitor the real-time vehicular exhaust, whenever it crosses the threshold value. This system transmits real-time inferences along with the raw sensor responses onto the cloud which in turn, sends these results to the user's app for necessary observation and compliance.

(ii). Further, its core, the "पवन संतरी (The Air Guard)" has also been tested over variety of real-time volatile organic compounds (VOC) based application such as "real-time monitoring of perishable fruits in transit," "Classification of organically and chemically ripened fruits," "Fish freshness estimation," "Monitoring of food processing stages during real-time cooking processes" and recently the same has also been tested for the development of "Digital Twin of a Chemical Plant and a Smart City," in a consortium project with CDAC, NCL-Pune and IIT(BHU) funded by Ministry of Electronics, and Information Technology (MeitY) under National Supercomputing Mission (NSM).

4.20 IIT Guwahati Technology Innovation and Development Foundation at IIT Guwahati working in the Technology Vertical "Technologies for Under water exploration"

The TIH has made significant strides in developing an Intelligent Underwater Robot aimed at target detection and aquatic health monitoring. Validation is underway for an automatic path-planning algorithm verified in ROS to enable efficient underwater maneuvering. Also, real-time testing of underwater image processing algorithms for crack detection is in progress for final validation.

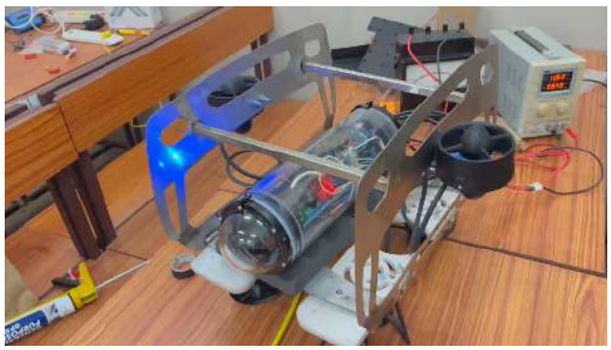


Figure: Testing of robotic vehicle in Lab

4.21. IIT Tirupati Navavishkar I-Hub Foundation at IIT Tirupati working in the Technology Vertical "Positioning and Precision Technologies"

The TIH has developed Hyperspectral Camera, in collaboration with Karunya Institute of Technology & Sciences, Coimbatore, Tamil Nadu, which represents a significant advancement in hyperspectral imaging. Central to the camera is a multilayer thin-film deposition on lens capable of absorbing full wavelength and laser-deposited film-coated Complementary Metal-Oxide-Semiconductor (CMOS) sensor, specially designed to enhance light collection and sensitivity, enabling high-resolution spectral data capture even under low-light conditions.

This cutting-edge system leverages advanced fore-optics, light enhancement mechanisms to further optimize performance, while Technology Computer-Aided Design (TCAD) simulations for spectral conversions augment sensor design, reducing both development time and costs. The 3D-printed console ensures a lightweight, compact, and customizable housing, enhancing portability and affordability.

Figure: Laser plume deposited Optic based Hyperspectral Camera for Remote Sensing

4.22 IIT Bhilai Innovation and Technology Foundation at IIT Bhilai, is working in the Technology Vertical "Positioning and Precision Technologies"

(i). The TIH has developed an iECS platform which addresses the critical pain point of the "lack of immediate expert support and real-time decision-making tools for emergency care providers in remote healthcare settings. By providing 24/7 access to expert consultations, AI-powered decision support, and India-specific emergency protocols, iECS empowers healthcare providers in resource-limited settings to deliver faster, more accurate, and effective care in emergency situations.

Figure: Digitizing vital parameters related to a patient with ST Elevation Myocardial Infarction (STEMI) through the iECS platform

(ii). The TIH has developed Solar based E-rickshaw smart charging infrastructure and route optimization, a platform that provides Solar power EV charging access, reducing carbon emissions, UPI-enabled payment integration, automated power control, and real-time monitoring. The solution with multilingual mobile APP provides seamless experience for EV-Rikshaw owners, offering flexible payment options and the ability to locate nearby charging stations.

Figure: Solar Panel based charging station for EV-rickshaws with integrated e-payment system

4.23. IITI Drishti CPS Foundation at IIT Indore, is working in the Technology Vertical "System Simulation, Modelling & Visualization"

(i). In the area of Digital Healthcare, the TIH has supported Startup Easiofy Solutions which has developed a secure cloud-based PACS (Picture Archiving and Communication System) called ImagiXAI, enabling medical professionals to generate 3D models from CT/MRI/PET scans for improved diagnosis and treatment planning. The solution ensures secure sharing of high-quality medical images across devices without requiring a Virtual Private Network (VPN), mitigating risks of data breaches. Key features include AI-assisted report generation, role-based access, and a mobile-compatible medical image viewer. The platform is being integrated with the CharakDT platform being developed by the hub.

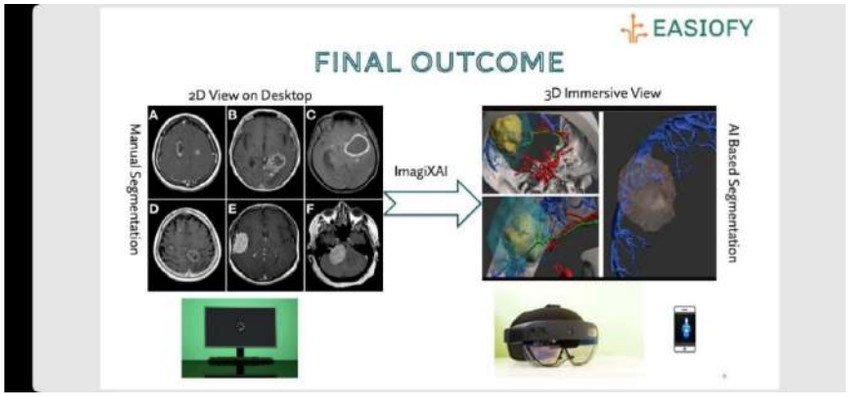


Figure: ImagiXAI from Easiofy Solutions

(ii). On the Intelligent Manufacturing domain, the TIH has supported a Lab to Market initiative by the name of Zwilling Labs, which has developed cutting-edge digital twin platform leveraging IoT technology to enable real-time machine monitoring and remote factory control. This innovation optimizes production schedules, minimizes idle time, and reduces material overproduction, helping manufacturers decrease their environmental footprint.

Figure: Digital twin platform

CHAPTER 5

NATIONAL QUANTUM MISSION (NQM)

The Union Cabinet, approved the National Quantum Mission (NQM) at a total cost of Rs.6003.65 crore for a period of eight years. The Mission objectives include developing intermediate-scale quantum computers with 50-1000 physical qubits in 8 years in various platforms like superconducting and photonic technology. Satellite-based secure quantum communications between ground stations over a range of 2000 kilometers within India, long-distance secure quantum communications with other countries, inter-city quantum key distribution over 2000 km as well as multi-node Quantum networks with quantum memories are also some of the deliverables of the Mission. The National Quantum Mission will focus on developing magnetometers with high sensitivity in atomic systems and Atomic Clocks for precision timing, communications, and navigation. It will also support the design and synthesis of quantum materials such as superconductors, novel semiconductor structures, and topological materials for the fabrication of quantum devices. Single photon sources/ detectors, and entangled photon sources will also be developed for quantum communications, sensing, and metrological applications.

Recently, the Department launched the establishment of four Thematic Hubs, each dedicated to a specific technology vertical:

(i) Quantum Computing at IISc, Bengaluru;

(ii) Quantum Communication at IIT Madras, in association with C-DOT, New Delhi;

(iii) Quantum Sensing & Metrology at IIT Bombay; and

(iv) Quantum Materials & Devices at IIT Delhi

These T-Hubs comprises of 14 Technical Groups having 17 Project Teams across 17 states and 2 Union Territories. These hubs bring together a total of 152 researchers from 43 institutions, including 31 Institutes of National Importance, 8 research laboratories, one university and 3 private institutes. This initiative reflects the nation's collective ambition to lead in the rapidly evolving field of quantum technologies.

The four T-Hubs will focus on Technology Development, Human Resource Development, Entrepreneurship Development and International Collaborations in their respective technology verticals. National Quantum Mission (NQM) has taken a significant step in fostering innovation and entrepreneurship by developing comprehensive guidelines for supporting startups in the areas of quantum technologies. These guidelines serve as a structured framework to identify, support, and empower startups engaged in cutting-edge research and development across

various quantum domains. In line with these guidelines, a Call for Proposals was launched by the Department of Science & Technology to onboard start-ups focused on developing quantum technologies. The initiative garnered significant interest, demonstrating the growing potential of India's quantum ecosystem. After rigorous evaluation process, 8 startups were selected which represent diverse domains of quantum technology, including quantum communication, computing, sensing, and materials.

NQM has the potential to elevate the country's Technology Development ecosystem to a level of global competitiveness. The Mission would greatly benefit various sectors including communication, health, finance, energy with applications in drug design, space, banking, security etc. The Mission will also provide a huge boost to National priorities like Digital India, Make in India, Skill India and Stand-up India, Start-up India, Self-reliant India and Sustainable Development Goals (SDG).

The four T-Hubs will focus on Technology Development, Human Resource Development, Entrepreneurship Development & Industrial Collaborations and International Collaborations in their respective technology verticals.

Institutes involved in the T-Hubs:

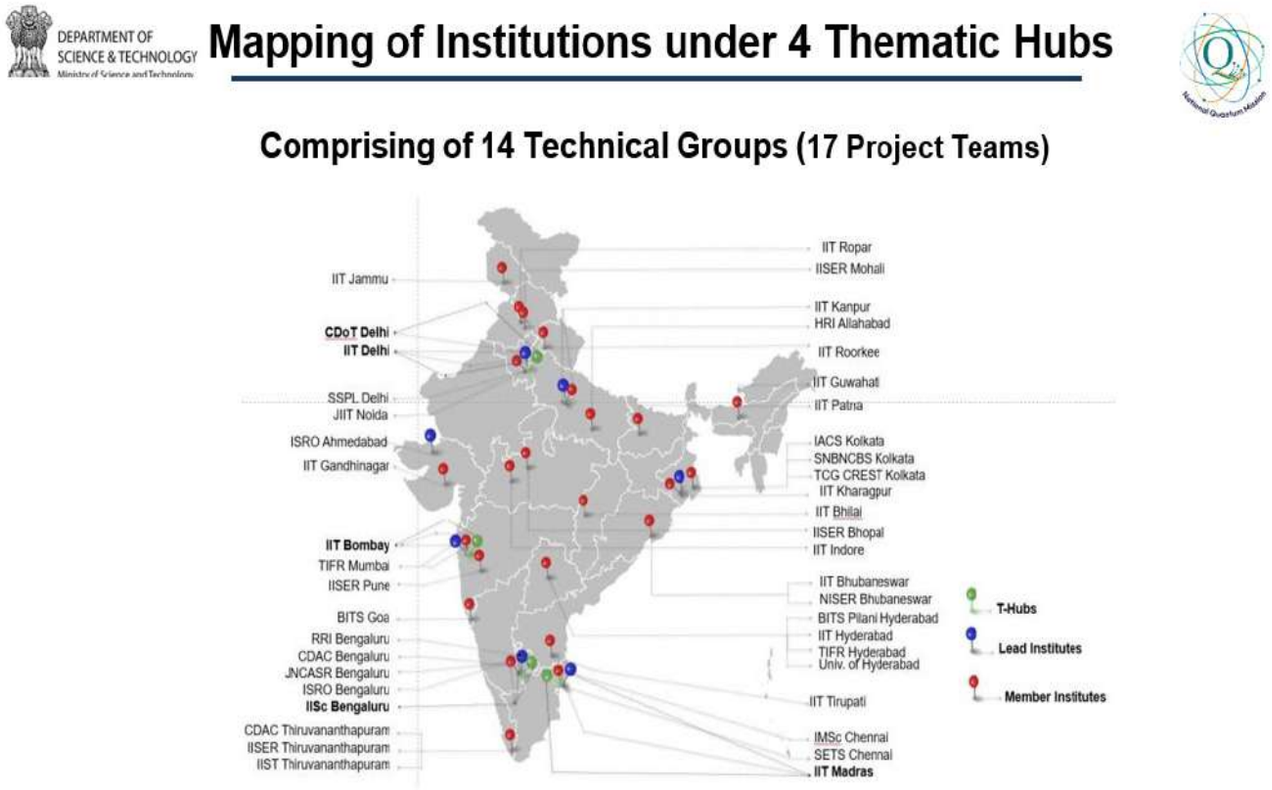


Figure: 152 researchers from 43 Institutions (Lead & Member) across India involved in the 14 TGs

Guidelines to support startups in the areas of Quantum Technologies:

The National Quantum Mission has formulated an inclusive set of guidelines designed to support and nurture start-ups operating in the transformative domain of quantum technologies. These comprehensive guidelines provide a well-defined roadmap that seeks to empower startups by addressing their unique needs and challenges. A key focus of the guidelines is to facilitate access to resources, funding, mentorship and infrastructure support through T-Hubs. Additionally, the guidelines encourage collaboration between start-ups, academia, and industry stakeholders, fostering an environment of shared knowledge and innovation. By addressing these multidimensional aspects, the National Quantum Mission aims to establish a robust start-up ecosystem, propelling India to the forefront of quantum research, development, and commercialization on the global stage.

CHAPTER 6

AUTONOMOUS INSTITUTES

The Department of Science and Technology nurtures 25 Autonomous Bodies (ABs). These include 16 research institutions, 05 professional bodies, and 04 specialized knowledge and S&T service organizations. These institutions, with long and cherished history and their variety of activities, occupy a very important place in the S&T eco-system of the country. Activities and achievements of autonomous institutes during the year under report are briefly described below:

6.1 Agharkar Research Institute (ARI), Pune

The Agharkar Research Institute (ARI) has research focus on Biodiversity & Palaeobiology, Bioenergy, Bioprospecting, Developmental Biology, Genetics & Plant Breeding, Nanobioscience. ARI has made significant strides in various research and societal outreach domains during 2024-25. Below is a summary of the major accomplishments during 2024-25:

- The diversity of *Smilax* species in India was documented. 40 fungal and lichen samples were authenticated, discovering four novel fungi. Entire genome sequencing of a novel fungus was completed. Efficient enzymatic saccharification of rice straw using a blend of commercial and in-house enzymes is achieved in the field of Bioenergy. Significant progress is made in microbial research with the revival and passage of strains in the MCM database. Polyphasic characterization of *Marinospirillum* sp. Was done. Studies on sulphate-reducing and acid-producing bacteria indicated potential risks in subsea pipelines. A TGFbeta ligand was identified as a regulator of autophagy, and Celsr1 was implicated in motor neuron navigation. 262.3 quintals of soybean breeder seed were supplied for the benefit of seed agencies and farmers. Advanced varietal trials and marker-assisted selection strengthened wheat and soybean breeding programs. Key mutations in grape genes linked to sterility traits were identified. Cutting-edge technologies, including aptamer-conjugated nanoconjugates for oncogene repair, biodegradable nanoparticles for cardiac regeneration, and graphene-based scaffolds for co-culture studies were developed. Methanotroph research achieved milestones with field applications for methane mitigation and plant growth promotion.

Figure: *Smilax turbans* Wang & Tang was rediscovered from Arunachal Pradesh after a gap of 98 years

- ARI conducted several workshops, training programme, and field demonstrations engaging farmers, students, and researchers. Popular articles, radio talks, and academic contributions (e.g., NCERT's Science Book) were made to enhance public awareness of science. Repositories and analytical services supported academic institutions and industries across India. The book "Smilacaceae of the Indian Subcontinent" was published. Several MoU were signed to strengthen partnerships with the leading research and academic institutions.

Figure: Farm study tour of Mahila Self Help Group to the frontline demonstration plot of MACS 1460 soybean variety

6.2 Aryabhatta Research Institute of Observational Sciences (ARIES), Nainital

Aryabhatta Reseach Institute of Observational Sciences (ARIES) is a specialised research institute in Astronomy & Astrophysics and Atmospheric Sciences. There are three divisions in ARIES. The Astronomy division specialises primarily in observational and theoretical research of the Sun and solar system objects, galactic and extragalactic celestial sources. The Atmospheric Sciences division specialises in studying and understanding the physical, chemical, and dynamical processes governing the Earth's atmosphere, with specific attention on air pollution and climate change studies. The engineering division caters to the design, development, maintenance and upgradation of the instruments and support facilities. It supports maintenance of the ARIES infrastructure with primary focus on astronomical telescopes and back-end instruments. Below is a summary of the major accomplishments during 2024-25:

- A team led by ARIES scientists have successfully detected and measured the properties of an Intermediate-mass Black Hole or IMBH in a galaxy 4.3 million light-years away. This breakthrough, achieved through innovative techniques and world-class telescopes at ARIES, brings us closer to understanding how black holes grow and galaxies evolve. Another team led by ARIES scientists utilised a vast repository of open star clusters

revealing varied chemical trajectories across the Milky Way Galaxy. ARIES scientists have studied time-dependent transonic viscous accretion flow around black holes to explain Quasi Periodic Oscillations (QPOs). Another new study revealed the formation of stars in a filamentary molecular cloud.

- ARIES scientists were part of an international team that used NASA's planet hunter satellite TESS to detect the smaller supermassive black hole from the supermassive black hole pair at the centre of the distant galaxy OJ 287 directly for the first time. A study by ARIES scientists has unveiled powerful flares erupting from the scorching and thin outer atmosphere called corona of a very young star AB Dor using a treasure trove of X-ray data spanning over four decades. 85 research papers were published in various journals of national and international repute and 06 PhD was awarded. Several MoU were signed for research and academic excellence and several training programmes were also organized for faculty and students.

6.3 Birbal Sahni Institute of Palaeosciences (BSIP), Lucknow

Research activities at BSIP involve a multidisciplinary approach which includes a variety of biotic and abiotic proxies, for a holistic understanding of the evolution of floras, faunas, climate and ecosystems at different temporal and spatial scales through time. Some highlights of research work during 2024-25 at BSIP is given below:

- Palaeo-vegetational studies by BSIP scientists reveal that during the Eocene Thermal Maximum 2 when atmospheric carbon dioxide concentration was greater than 1000 ppmv near the palaeo-equator, the rainfall decreased significantly leading to the expansion of deciduous forests. This study raises important questions about the future survival of equatorial rainforests and biodiversity hotspots under increased carbon emissions. An assessment of the distribution of key Non-Timber Forest Product species in India was made which is mainly centred in the Western Ghats regions, Central Highlands, North-eastern India and Siwalik hills. The projections of habitat suitability areas can be used as a valuable foundation for developing conservation and restoration strategies aimed at alleviating the climate change impacts on NTFP species.

- The BSIP has constituted an 'Earth and Planetary Exploration Group' (EPEG-BSIP) to carry out dedicated Astrobiological research in the Institute. As part of the Geoconservation efforts by BSIP, an MoU was signed between the BSIP and the Uttar Pradesh Ecotourism Development Board (UPEDB) to promote and develop 'Salkhan Fossil Park' (Sonbhadra District, Uttar Pradesh) to develop it for gaining a UNESCO World Heritage Site status.

- A number of new facilities (long lake core repository, Unmanned Surface Vehicle (USV), Micro-Computed Tomography (Micro-CT) National facility and Coal Quality Assessment laboratory etc.) established/underway which will enhance our understanding on monsoon behaviour, help to estimate lake volume and glacial lake outburst flood (GLOF) risks in

the Himalayan region, 3D reconstruction of fossil and geological materials and to cater the Hydrocarbon Industry, respectively.

During 2024-25, a total of 8 In-house projects and up to 27 extra-mural projects were implemented/handled by BSIP Scientists sponsored by various national and international agencies. The BSIP Scientists have published 75 research articles/book chapters in journals/ books of international repute.

6.4 Bose Institute (BI), Kolkata

Bose Institute (BI) carries out cutting edge research in basic sciences. In addition, it pursues research for augmentation of fundamental knowledge-base and developing solutions to selected problems of national importance in the areas of healthcare, food security, environmental pollution and climate change. Research is mainly pursued in the area of High Energy and Nuclear Astrophysics – Quantum Chromodynamics and Quark-Gluon-Plasma; Quantum gravity; Quantum Information and Computation; Plant response under Biotic and Abiotic Stress; System and Synthetic Biology; Environmental Microbiology and Climate Change; Structure and Functions of Macromolecules; Bioinformatics; Bioorganic Chemistry for Drug Development. Some highlights of research work during 2024-25 at BI is given below.

- BI scientists have identified a novel microRNA-oncogene interaction that is important in the pathogenesis of pancreatic cancer. It was confirmed that the hitherto unknown interaction of miR-615-5p onto the 3'-UTR of the ID1 gene through luciferase as well as pull down assays. Moreover, they have Identified p300, the classic HAT to play a major role in GM2-synthase transcription in cancer. BI scientists have shown that RFA-1 inhibits rifampicin-resistant RNA polymerase by binding to a site different than rifampin. BI scientists have identified a new microbe reverting sesame flower to the vegetative state.

- BI scientists have shown that a novel low pH-dependent metacaspase governs defense-response against pathogens in tomato. It was shown that SlMC8 activation due to concurrent drop in cellular pH during infection contributes to the basal resistance of the plant by promoting cell death at the site of infection, and the pH dependence acts as a guard against unwarranted cell death.

- BI scientists have demonstrated the role of a unique type II toxin-antitoxin system in helping heat-loving archaea adapt to stressful conditions. Geomicrobiology laboratory of BI explores the biochemical and biophysical windows of opportunity that sustain life at the entropic and bioenergetic extremities of the Earth's biosphere. The geological manifestations of the microbial processes discovered hold implications for early metabolism, ancient ecosystems, and planetary health and habitability, including those of potential extraterrestrial locations. Scientists of BI have discovered strictly aerobic microbes and O_2-consuming metabolisms, alongside microbes and genes having

potentials for O_2 production without light, within an anoxic (sulfidic) marine sediment system. It was also shown that geothermal waters are not habitats reserved exclusively for thermophilic microbes, instead phylogenetic relatives of diverse mesophilic bacteria thrive consistently in the boiling fluid discharged by Trans-Himalayan sulfur-borax spring systems. Environment-guided rudimentary thermophilicity develops within natural populations of mesophilic bacteria that get stochastically introduced to hydrothermal systems by the action of local geodynamic forces . BI scientists have also developed a novel method and small molecules for targeted degradation of DNA-binding protein. Such small molecules can be applied for genomic loci-specific interactome targeting and mapping.

- Valleytronics is an emerging energy-efficient approach for encoding, processing, and storing information using the “valley degree of freedom” in the momentum space of materials. For the first time, BI scientists have shown the valleytronics property in bilayer TMDCs at room temperature without relying on any external parameters. They observed a significantly high valley polarization at room temperature, which is a major advance for valley-based electronics applications.

6.5 Centre for Nano and Soft Matter Sciences (CeNS), Bengaluru

Centre for Nano and Soft Matter Sciences (CeNS) carries out research in the area of Nanomaterials and Composites, 2D materials, Soft-materials, Soft-nano composites, Supramolecular polymers, Surfaces and interfaces, Halide perovskites, Sensors, Photovoltaic materials, Electrocatalysts, Energy storage devices, Memristors, Electro-optical devices, Electrochromic devices, Smart windows and displays. The major research activities of CeNS during 2024-25 are given below.

- Redox potential-based self-powered electrochromic (RP-SPEC) technology was developed
- for unconventional electrochromic windows that operates autonomously, without external
- power that is suitable for energy efficient sustainable smart window applications. High-performance room temperature NOx sensor based on ZnFe2O4 nanoparticles was developed in mixed spinel structure with ultrasensitive and selective detection of ppb level concentrations.
- Vanadium disulfide incorporated polymer nanocomposite for flexible piezoelectric energy generators and road safety sensors were developed as a prototype with outstanding power density. Topo chemically synthesized Nb_3VS_6 is demonstrated as a stable anode for sodium-ion batteries with a specific capacity of 101.15 mA h g^{-1} at 0.5 A g^{-1}, along with excellent cycling stability with 100% capacity retention after 2500 cycles.

- A chemical modification involving partial oxidation of the spent catalyst consisting of Ni@CNT, generated from industrial methane decomposition plants, is found to augment sustained urea oxidation activity in extensive alkaline conditions for hydrogen generation applications.
- The existing facilities were strengthened by installation of a High-pressure homogenizer for large scale exfoliation of 2D materials, Double beam UV-visible spectrophotometer with variable temperature mount for monitoring phase transitions in supramolecular assemblies and other soft matter.

67 papers in various referred national and international journals were published and 06 patents were granted successfully. 08 PhDs were also produced during the mentioned period.

6.6 Indian Association for the Cultivation of Science (IACS), Kolkata

Indian Association for the Cultivation of Science (IACS) carries out cutting-edge research in various field of Theoretical Sciences, Molecular Sciences, Materials Sciences, Biological Sciences, and Mathematical and Computational Sciences.

- In the field of Anticancer Drug Discovery, molecular mechanism of DNA topoisomerase 1-targeted clinical anticancer drugs and the role of DNA repair enzymes in the nucleus and mitochondria in cancer chemotherapy was investigated, Targeting DNA Topoisomerase with small molecules inhibitors in human cancer.
- New strategies for novel organic transformations and synthesis of bio-active natural products were designed and developed. Unified understanding of phenomena at various lengths and time scales using techniques based on ab-initio and extended quantum mechanical methods were developed. It was uncovered that the pre-organization environment of the ATP hydrolysis reaction of kinesin-1 is critically dependent on having the broken state of the Arg203-Glu236 salt bridge sufficiently populated and this disruption is responsible for the HSP disease in humans.
- Piezoelectric nanoparticle-based silica composite has been developed for ultrasound-based water purification applications. 3 new Na-ion cathode materials were synthesized, performance was monitored in coin cell battery, and in-situ and ex-situ characterization was carried out to understand the mechanism behind the improved performance. Design the synthesis of novel functionalized covalent organic frameworks were done for the separation of oil from oil-in-water microemulsion, adsorptive removal of pollutants from water, and metal-organic-frameworks for photocatalytic organic transformations. A facile, scalable and affordable synthesis process of 2D and Quantum materials was developed. Design and development of efficient and stable energy harvesting and storage devices were done.

- Study of active and passive systems is carried out using theoretical and computational models. Reaction pathways related to hydrogenation of fullerene systems, C60, C70, and C36 via dehydrogenation of Ammonia–borane are analyzed. Natural language processing methods and super-resolution of bio-medical images for easier detection of lung edema have been studied. Designed and developed an open-source model-checking software (SAT-Reach) for verification of cyber-physical systems, and AI-generated plans for solving tasks on cyber-physical systems are made. Dynamics of non-autonomous families of automorphisms of complex affine spaces have been carried out. Extraction of topics from a text corpus, optimization of topic models, document summarization, and construction of personal knowledge graphs using machine learning methods have been accomplished. A few results on numerical ranges and Halmos conjecture and related topics were proved.

- An ongoing DST-sponsored mega-project of the institute in the form of a Technical Research Centre (TRC), established with the aim of capacity building in carrying out translational research and developing a symbiotic relationship with the industries. Several sophisticated research facilities have been put in place in the past few years under this scheme. The new facilities set up during the year are, Low-Temperature Superconducting Magnet based Measurement System, HR-Transmission Electron Microscope (TEM), Sea Horse Analyzer, EPR Spectrometer, and Maskless Lithograph system as Central facilities.

IACS published 382 papers in refereed journals and 02 Indian patent were granted. 44 PhDs were also awarded by the institute.

6.7 Institute of Nano Science and Technology (INST), Mohali

Research activities at Institute of Nano Science and Technology (INST) encompass physics, chemistry, biology, and interdisciplinary sciences addressing problems in the field of energy, environment, quantum materials, nano-devices, and chemical biology. Institute has set a unique mission to work at the forefront of fundamental science together with the development of technologies to address problems of national and global priorities.

- Targeted nano therapy controlling epigenetic regulation of pediatric solid tumors has been reported. GD2 conjugated Ring1b inhibitor/siRNA nano therapy has shown successful EMT prevention in Neuroblastoma in vitro and in vivo models.

- Co-encapsulation of mycorrhizal with the bacteria for enhanced biofertilizer efficiency has been developed. Chitosan-based coating methodology has been developed for the shelf-life expansion of the apricot.

- Scientists at INST have developed an indigenous intra-operative combination treatment consisting of metal-based nanomedicine reinforced with patient derived blood

components (autologous) as a hybrid implant of blood clotting protein fibrin which can help post-surgical management of locally recurrent tumours.

- A new way to confine nano-catalyst molecules without impeding their movement was explored. INST researchers have found a droplet microfluidics technology to produce microspheres with a high electroactive (EA) phase that can lead to piezoelectric devices for wearable applications, serving as self-powered sensors for monitoring diverse physiological signals.
- INST's faculty have recently reported two novel Keggin-based hybrid solids, (C5H7N2)5[CoW12O40] (PS-96) and (C5H7N2)5[CuW12O40] (PS-97), the latter was found to be active for efficient and photocatalytic N-formylation of various substituted anilines and morpholine with CO2 using phenyl silane as a reducing agent, which operates under ambient conditions. This work opens up extensive research investigating POM-based hybrid solids in photocatalytic N-formylation of amines using CO2.
- Researchers of INST have developed a bunch of electrochemical and optical biosensors based on nano polymers multifunctional Metal-organic framework (MOF) and 2-dimensional (2D) materials. Scientists at INST have produced for the first time a transparent conducting interface between two insulating materials with room temperature spin polarized electron gas, which allows for see-through devices with efficient spin currents.
- Scientists at INST have developed a novel and cost-effective technique for fabricating paper-based devices using an Advanced PAP (A-PAP) pen, which offers a practical alternative to conventional sensing methods that necessitate specialized equipment.

INST published 286 papers in refereed journals, 03 books were published and 03 patents were granted. 23 PhDs were produced.

6.8 Institute of Advanced Study in Science and Technology (IASST), Guwahati

The area of focus of Institute of Advanced Study in Science & Technology (IASST) is Basic and Applied Plasma Physics, Advanced Material Sciences, Mathematical and Computational Sciences, Traditional and Modern Drug Discovery and Disease Diagnosis, Biodiversity and Ecosystem Research, and Interdisciplinary Research.

- A novel and rapid detection kit was developed for the detection of Indian Red Scorpion venom using polyclonal antibodies (PAb). This invention relates to antibodies against modified toxin-epitope of Indian red scorpion venom, a novel composition for efficient detection in vitro and in vivo of scorpion sting patients, and a fast, reliable, and effective system for detecting scorpion envenomation in humans and other organisms.

- A study revealed anti-obesity property of the traditional fermented bamboo shoot of Tripura, called '*Melye-amiley*'. An environment friendly, non-toxic and sustainable biopolymer based antimicrobial composite film was developed using Guar Gum−Sodium Alginate−I-Carrageenan Tribiopolymer which are tough and can be used as a food packaging material. A Sodium alginate-nanocellulose-based active composite film for edible oils packaging applications was developed. Amino Acid Functionalized Phosphorene has been developed as an Optical sensing platform for the Detection of Antibiotic Residues in Milk and a Clay Based Electrical CO_2 Sensor.
- Using a quantum modelling approach a potential half-metallic Heusler compound for spintronics applications have been developed. A series of photocatalyst were developed and the mechanism of photocatalytic efficiency of the photocatalyst were understood. Study by IASST indicated that the photocatalytic efficiency of the photocatalyst can be improved by tuning the band gap through doping, controlling the size, tuning the surface area etc.
- IASST has developed several potential probiotics with healthy ageing property from the traditional fermented foods and beverages of the north east India and has signed agreement with Bharat Biotech International Ltd (BBIL), Hyderabad for joint GLP validation and GMP production for clinical trial and subsequent commercialization.
- The sting of the Indian Red Scorpion (*Mesobuthus tamulus*) is a neglected public health issue in tropical and subtropical nations. Due to the shortcomings of traditional treatments involving anti-scorpion antivenom (ASA) and α1-adrenoreceptor antagonists (AAA), a suitable formulation to enhance therapy for *M. tamulus* stings was invented. A novel therapeutic drug formulation (TDF) of low doses of commercial ASA, AAA, and ascorbic acid has remarkably improved in neutralizing the *in vivo* toxic effects of *M. tamulus* venom (MTV) tested in *Caenorhabditis elegans* and Wistar strain albino rats *in vivo* models.

IASST published 81 papers in refereed journal, 01 book and 29 conference papers. 15 PhD were produced.

6.9 Indian Institute of Astrophysics (IIA), Bengaluru

Indian Institute of Astrophysics (IIA) is a specialized R&D institute in the field of Astronomy, Astrophysics, and Astronomy Instrumentation. Major achievements of the institute during 2024-25 are given below.

- The first 1.44-m mirror segment for the international Thirty Meter Telescope was successfully fabricated and verified at the India-TMT Optics Fabrication Facility at IIA's CREST campus. Fabrication and testing of the first set of 5 Segment Support Assemblies and first 12 Actuators and shipment of the latter were done with industry partners.

- Evidence of interaction between a radio jet emitted from Active Galactic Nuclei (AGN) and the surrounding interstellar medium at small spatial scale of about 10 parsecs has been detected for the first time ever in a dwarf galaxy. Using Ultraviolet Imaging Telescope (UVIT/AstroSat) data of the Andromeda Galaxy from public archives, UV emission from 42 novae was discovered, including 4 of them in the act of outburst, allowing a study of novae at different phases of their life. Using UVIT data, a vampire star in the star cluster M67 was discovered, that has been rejuvenating its youth by accreting material from a companion star, providing insights into the binary star evolution process and an important missing link in the rejuvenation in these stars.

More than 390 schools and colleges visited various field stations and campus of IIA. A total of 48 popular talks, 13 sky watch sessions, and many special public events were organized or facilitated, reaching many people in person. IIA put up stalls at 07 different national exhibitions. A total of 157 papers were published in refereed journals and 10 students were awarded PhD degrees.

6.10 Indian Institute of Geomagnetism (IIG), Mumbai

Indian Institute of Geomagnetism (IIG) is a specialized research institute under DST which work in Geomagnetism and allied fields. Major achievements of IIG during 2024-25 are given below.

- Using MAVEN spacecraft data, the first observations of harmonics of magnetosonic waves in the Martian magnetosheath region are reported by IIG researchers. These low-frequency waves, crucial for particle heating on Earth, may similarly influence Mars' plasma environment. The LAMI-1 map of India's lithospheric magnetic anomalies, based on seven years of Swarm satellite data (2014–2020), was refined by removing non-lithospheric fields using geomagnetic data and CHAOS model corrections. It reveals distinct tectonic features: low magnetic anomalies in the Himalayas and Deccan Plateau, positive signals in the Central Indian Zone, and clear divisions in the Dharwar Craton. **T**he link between solar activity, represented by sunspot numbers (SSN), and tropical cyclone (TC) activity worldwide across six regions: Eastern Pacific, North Atlantic, North Indian, South Indian, South Pacific, and Western Pacific, is examined. In the North Atlantic, an anti-correlation between SSN and TC activity is observed over 11-year averages. Globally, more TCs occur during low solar activity, while extreme category-5 storms are likelier during the solar cycle's declining phase. Groundwater in the drought-prone Mann River basin, eastern Maharashtra, was studied to assess its suitability for drinking, agriculture, and industry. About 52% of samples were excellent for drinking. Most samples were suitable for irrigation based on SAR and percentage of Na, though industrial use showed high corrosion potential.

- The equatorial electrojet (EEJ) is a strong current in the upper atmosphere around 100 km altitude, confined to ~105–110 km height and ~600 km width along the geomagnetic

equator. This geophysical phenomenon provides insights into equatorial ionospheric processes, influencing satellite dynamics, GPS, communication links, and power grids. A study led by IIG presents a new empirical model predicting diurnal, seasonal, and solar activity variations in EEJ intensity over the Indian longitude sector.

IIG published 57 papers in refereed journals and also 03 PhDs were produced.

6.11 International Advanced Research Centre for Powder Metallurgy and New Materials (ARCI), Hyderabad

International Advanced Research Centre for Powder Metallurgy and New Materials (ARCI) is focused in research related to Materials and Devices for Energy Storage, Solar Energy Materials, Nanomaterials, Engineered Coatings, Ceramic Processing, Laser Processing of Materials, Fuel Cells, Carbon Materials, Additive Manufacturing and Advanced Powder Metallurgy.

- Technology for the production of battery grade Lithium Iron phosphate (LFP) as a cathode material for Li-ion batteries was transferred to M/s. Altmin Pvt Ltd., Hyderabad on non-exclusive rights within India**.** Know-how demonstration for the Process to apply barrier coating for biodegradable containers made from coconut shell and bamboo powders was completed and know-how document was handed over by ARCI to Agropak Pvt Ltd., a Bengaluru based start-up company.

ARCI developed a process for the production of Low Expansion Glass Ceramics (LEGC) block of appx. 380 x 380 x 150 mm in dimension having a weight of 62 Kg. From this, various blocks of different sizes as per requirement were supplied to DRDO and ISRO for field trials. HD graphite based components, flap seals, carbon bushes and piston ring were developed for shut off valve assembly, as a part of CARS-DRDO project.

Thermal barrier coatings (TBC) successfully deposited on 60 nos. HP rotor turbine blades using EBPVD system for HAL. 3 mm thick Ag-50WC coatings have been successfully deposited on ETP Cu breaker arms for high power electronics application. Deposited Ni based alloy coating for internal diameter (10mm) of gun barrel using pulsed electrodeposition and supplied to ARDE, Pune and field tests were successfully completed. Open-pore aluminium foam filled with organic Phase Change Material (PCM) developed at ARCI exhibited thermal conductivity improvement by four times as compared to the bulk PCM.

- ARCI has made significant progress in energy storage and renewable energy technologies. The highlights of the recent progress include Development of a cost-effective solid-state process to synthesize cobalt- and nickel-free high-voltage LFMP cathode material with promising electrochemical performance; Successful synthesis of hard carbon from industrial waste for Na-ion batteries, achieving a capacity of 252 mAh/g; Validation of large-scale synthesized sodium vanadium phosphate in cylindrical

and pouch cell formats; Demonstration of Fe-Co embedded and MnO2 modified Carbon-sulfur composite cathodes with a specific capacity exceeding 1200 mAh/g at 0.1 C and good cycle stability in Li-S cells. Further, a novel top lid assembly for all battery types has been designed, developed, and validated. Fabrication and evaluation of large-scale aqueous binder-based LFP cathodes was also carried out. Furthermore, ARCI developed a new formulation for aqueous AR coating for PV glass applications, uniform & stoichiometric wide band gap (MAPbBr) perovskite absorber layer on 100mm x 100mm FTO glass substrate by industrial bar coating process and a 100W open cathode air-cooled PEMFC system for mobile and charging applications, demonstrating over 100 hours of intermittent operation.

- Key highlights of ARCI's Fuel Cell technology facility include, Dual chambers automatic humidifier for minimized operation down time; Modular PEMFC systems of 1-10 kW for stationary applications; Open cathode PEMFC system for mobile and charging infrastructure-100 W; PEM based hydrogen generation technology upto 5 kg/day production of H2.
- STAs are implants used widely for sports injuries and repairing tendon, ligament, and cartilage damage. BD implants are under development worldwide to address long-term issues with permanent implants and Fe-Mn, Mg, and Zn-based alloys are potential candidates for the same. Process optimization for production of powders as well as implants by additive manufacturing by laser powder bed fusion was carried out for Fe-Mn alloys by ARCI and supplied about 35 kg of Fe-Mn alloy powders to Wipro 3D for printing STAs. The design of STAs were finalized with German partners and Wipro 3D. ARCI has successfully synthesized AM grade Mg-Zn alloy powders (4.5kg) by inert gas atomization for the first time in the country.

ARCI published 104 research papers in refereed journals and 05 PhDs were produced. 10 Indian patents were granted to ARCI and 18 Technologies/IP were commercialized.

6.12 Jawaharlal Nehru Centre for Advanced Scientific Research (JNCASR), Bengaluru

JNCASR is focused on research in the areas of Chemistry and Physics of Materials, Engineering Mechanics, Evolutionary and Organismal Biology, Geodynamics, Molecular Biology and Genetics, Neuroscience, Theoretical Sciences, New Chemistry, and Chemical Biology.Some research breakthrough during 2024-25 is given below.

- A quantum-based model system was identified for a better understanding of new materials. A unique mechanism of electric polarization was identified via magnetic ordering in a novel mineral named "MnBi2S4", which can be useful for energy-efficient data storage. A unique methodology was developed to harness and convert carbon dioxide to ethylene to help India's march towards clean fuel and can be used as fuel gases and also for

the polymer industry. This recent breakthrough has facilitated the development of the country's 1st plant that can convert CO_2 into methanol. This involves connecting directly to flue streams from a power generation plant in the state of Telangana. A novel material was synthesised that exhibits the properties of both glass and metal and can efficiently convert waste heat to electricity. The research can help advance processes in thermoelectric energy conversion, where waste heat from sources like industrial processes in power plants, households and vehicle exhausts can be converted into electricity.

- Scientists developed a Pancreas-Mimicking System for Responsive Insulin Delivery in Diabetes Treatment. In this system, the insulin was encapsulated in the silk protein "fibroin" and injected under the skin, resulting in the slow diffusion of insulin over a period of five days; Scientists reported rare observation in hidden structure in crystals brings new paradigms in materials design for advanced energy solutions. The study underlines the significance of chemical design in triggering unconventional phenomena in crystalline materials useful for phononics, thermoelectrics and solar thermal conversion; A method of identification and detection of conserved G-quadruplex was developed in monkeypox virus using conformation specific fluorogenic probe. A process of unambiguous detection of LTR-III G-Quadruplex was developed by JNCASR scientists in the HIV genome using a tailored fluorogenic probe-based assay, thereby significantly reducing false positives in HIV detection.

Several of our faculty members have received national and international honours and accolades in recognition of their remarkable scientific research this year. Several students have also received best poster awards and many other prestigious recognitions for their research work. The current student strength at JNCASR is 439. 72 degrees were conferred to students across various degree and diploma programmes.

Several faculty members were granted patents for their respective technologies. Several agreements were also signed during the period in our efforts to promote translational research. This includes signing of 9 MoUs, 11 agreements for collaborative research, IP assignment & other purposes. 10 Non-disclosure agreements were also signed during this period. One tripartite Know-how License Agreement was signed between JNCASR, ICAR-NBAIR and Krishi Vikas Sahakari Samiti Ltd, Haryana for the transfer of the technology co-developed by JNCASR and ICAR-NBAIR, viz., "*Controlled Release Dispensers for Delivery of Semiochemicals*".

JNCASR has organized 40 Science Outreach Programmes, reaching out to both urban and rural areas in Karnataka and various other states. These programmes include conducting of workshops focused on learning science through experiments, workshop for teachers and interactive lecture programmes focused on areas such as astronomy, physics, chemistry, geoscience, and biology for students at high school, class 11 and 12. Over 5700 students and 919 teachers participated in these programmes.

Figure: School outreach program organized by JNCASR, Bangalore

6.13 Raman Research Institute (RRI), Bengaluru

The Raman Research Institute (RRI) was founded by Indian Science Nobel Laureate Sir C V Raman in 1948, marking 2023 as its Platinum Jubilee Year (PJY). The research at the Institute spans mind-boggling spatial and temporal scales from the very large- galaxies, galaxy clusters and beyond, to the very small – on the scale of atoms; from processes that happen over millions and billions of years to ultrafast processes that occur in attoseconds. Major highlights during the period are given below.

- POLIX, launched onboard XPoSat mission by ISRO on January 01, 2024, is the world's first instrument designed to operate in the medium X-ray band of 8 to 30 kilo electron Volt (keV) energy. It was conceived, designed and built at RRI. POLIX is designed to detect the scattered X-rays, enabling X-ray polarisation measurements. After initial calibrations and tests, the first light was obtained in early February and since then, the instrument has been making scientific observations.

- RRI is presently involved in National Quantum Mission (NQM) and working on quantum communication & quantum computing. The cluster of quantum labs at RRI have demonstrated frontline achievements such as secure quantum communication between two stationary sources, and between a stationary and a moving source, developed quantum sensing of magnetic fields at unprecedented sensitivities using neutral atoms at room temperatures, and uncovered novel quantum physics of laser cooled atoms at ultracold temperatures using in-house built apparatus.

- Shaped Antenna measurement of the background RAdio Spectrum (SARAS) is an indigenous, correlation spectrometer designed for precision measurements of the cosmic radio background and faint features in the sky spectrum at long wavelengths arising from redshifted 21-cm from gas in the reionization epoch. SARAS 3 model, the

third generation antenna, was deployed at remote and radio quiet regions of Ladakh and Andaman and Nicobar islands. RRI team led India's first winter expedition to the Arctic, an endeavour to scout radio quiet areas for future astronomy observations.

A low-cost, high-throughput amplifier was designed in-house to detect cell volume, mechanical and physiological changes in Red Blood Corpuscles of patients suffering from Sickle Cell Disease (SCD), a disease that is unfortunately common in rural areas of our country.

The Institute celebrated its PJY with five international and a national conference, women centric workshops, launched prestigious named lectures and talks that cover the breadth of research at the Institute. RRI published 74 research papers in refereed journals and produced 10 PhDs.

6.14 Sree Chitra Tirunal Institute for Medical Sciences and Technology (SCTIMST), Trivandrum

Sree Chitra Tirunal Institute of Medical Sciences and Technology (SCTIMST) has been actively contributing to biomedical technology development and its translation, creation of intellectual property, collaboration with industries and other institutions, academic activities, and patient care. As the outcome of its research and development activities, the following products could be launched to the market:

- **National Launch of AG Chitra Tuberculosis Diagnostic Kit:** SCTIMST launched a new innovative open isothermal amplification kit for the early diagnosis of pulmonary tuberculosis. The AG Chitra TB diagnostic kit was developed with funding received through the Technical Research Centre Scheme of DST. This kit was developed as an open platform for affordable, fast, and accurate diagnosis of pulmonary Tuberculosis. The technology was licensed to M/s. Agappe Diagnostics Ltd., Kochi, Kerala. Following the successful validation, the Central Standard Drug Control Organization (CDSCO) approved the kit for manufacturing and commercialization.

- **Scire Chitra GelMA UVS Bioink for 3D Bioprinting:** This innovative product enables the biofabrication of tissues of organs such as the liver, kidney, pancreas, skin, brain, and heart using advanced 3D bioprinting technology. It is India's first patented indigenous bioink formulation. The bioink's primary component is Gelatin Methacrylamide (GelMA), a chemically modified gelatin. The 3D bioprinting technology can create custom organs or tissue patches using a patient's own cells for transplantation. This reduces the risk of immune rejection, addresses organ shortages, and improves the success of transplants in regenerative therapies. SCTIMST transferred the technology of the gelatin-based, Chitra-GelMA- UV Safe bioink, to the company, M/s. Scire Science Pvt. Ltd., KINFRA at Kochi. The company officially launched the product under the brand name, Scire Chitra GelMA-UVS Bioink, on November 20, 2024, at SCTIMST, Trivandrum.

- **Titanium nitride (TiN) coated coronary stent**: This implant device is intended for the treatment of coronary artery disease and consists of the following components: (a) L605-based metal stent platform and (b) TiN ceramic coating. The technology transfer agreement was signed with M/s. Invasive Technologies Pvt. Ltd., Kerala on 23rd September 2024.
- **Automatic contrast injector**: This device is meant for the automatic delivery of contrast agents for facilitating coronary angiography and angioplasty. The device consists of a handheld power drive and a disposable manifold. The disposable manifold directs the contrast to the catheter during delivery and sucks the contrast agent from the reservoir. The technology was transferred to M/s. Cyrix Healthcare Pvt. Ltd., Kerala.
- **Automated trolley e-drive**: This device is a universal electric trolley puller/pusher designed to be attached to any type of patient trolley so as to convert it to an electrically powered trolley. The technology was transferred to M/s. Quasys Software and Consultancy Pvt. Ltd., Kerala.
- SCTIMST signed a MoU with the World Health Organization to participate in their Health Technology Access Pool initiative. The formal announcement of the MoU took place in New Delhi on August 9, 2024, in the presence of Hon'ble Minister of Science and Technology and WHO India representative. Several other MoUs were signed with different industry partner as given below**:**
- **MoU With M/s Citizen Industries**: The MoU was signed on 01st March 2024 for the development and commercialization of a box-tunnel system with secured gates for mice transfer and enrichment.
- **MoU With South Indian Surgical Co. Ltd., Chennai**: MoU signed on 02nd April 2024 for collaboration in testing and commercialization of the Chitra retractor.
- **MoU With M/s. Skillveri Training Solutions Pvt Ltd**: For the collaborative development of a Virtual reality-based solution for the upper limb rehabilitation of patients who have mild to moderate disability post-stroke.

Approvals for creating two advanced centres for specialized areas were received as given below:

- **Centre of Excellence (CoE) in Minimally invasive devices**: Funding support from the Department of Biotechnology (DBT) for developing minimally invasive devices such as Transcatheter Aortic Heart Valve, Endovascular Aortic Repair Graft (Abdominal Aortic Stent Graft), Clot Retriever Stent, PDA Closure Device, Flow Modulator Device, Peripheral arterial stent (SFA), Venous Stent (iliofemoral vein stent), Vascular Plug, IVC filter, and VSD Occluder.
- **Centre of Advanced Research (CAR) in preclinical evaluation:** The National Centre for Preclinical Evaluation of Cardiovascular Devices was approved under the Centre for Advanced Research scheme of the Indian Council for Medical Research (ICMR). It is expected to provide preclinical evaluation support to 03 devices from ICMR-sponsored centre and 07 medical devices developed at SCTIMST. It is a first-of-its-kind centre in the country, facilitating the upgradation of Medical Device Technologies from TRL 3 to TRL 6 in the cardiovascular domain.
- **Academic Programs:** Currently, the institute is conducting 69 academic programs, which include, post-doctoral, doctoral, masters, and postgraduate diplomas and certificate programs in various medical, biomedical, and public health domains. Many new academic programs were initiated during the year. They are: Post Doctoral Fellowships in (a) Adult Cardiothoracic Vascular Anaesthesia, (b) Perioperative Neuro Monitoring, (c) Neurosurgical Intensive Care, (d) Functional Neurosurgery, and (e) Spine Surgery. Post Doctoral Certificate Courses in (a) Neuropathology, (b) Hospital Infection Control, (c) Transfusion Transmitted Disease Testing, and (d) Biochemistry. Other programs initiated are MTech Biomedical Engineering, Post Basic Diploma in Cardio-Thoracic Nursing, and Post Basic Diploma in Neuro Science Nursing. SCTIMST awarded 09 PhDs during the year.

6.15 S. N. Bose National Centre for Basic Sciences (SNBNCBS), Kolkata

S.N. Bose National Centre for Basic Sciences (SNBNCBS) is focused on the following research areas: Quantum Materials and Devices; Quantum information and communication; Computational Study of Materials, Machine learning; Observational Astrophysics; Quantum field theory, Statistical Physics and Non-Linear Dynamics. Some highlights of research during 2024-25 are presented below.

- An emergent electronic phase has been observed in quasi-2D ferromagnet Fe4GeTe2 via magnetization, electronic transport measurements, and first-principle calculations. Further, electron spin resonance measurements reveal the contribution of intrinsic magnetic anisotropy. A highly responsive broadband photodetector has been realized in large-area single-layer graphene decorated with WS2-Ag nanoparticles hybrid on large-

area single-layer graphene. A high-efficiency spin injection has been demonstrated at the interface of BiSbTe1.5Se1.5/Co20Fe60B20 at room temperature by using the time-resolved magneto-optical Kerr effect. Large anomalous and topological Hall effect has been observed in layered monoclinic ferromagnet Cr2.76Te4 due to skew scattering and noncoplanar spin structure, respectively.

- Researchers at SNBNCBS have made significant strides in classifying quantum nonlocal correlation. Subsequently, applications of nonlocal correlations have been reported in establishing shared randomness, enabling zero-error communication, obtaining advanced means of communication task, and in combinatorial optimization and operational research problems. Furthermore, an intriguing and experimentally testable criterion has been validated within the NMR architecture, certifying the presence of quantum entanglement in multipartite quantum systems.

- A combination of supervised and unsupervised machine learning (ML) techniques was used towards significant advancement in understanding the formation of atomic gold wires through mechanically controlled break junctions (MCBJ). Researchers trained deep learning models on vast datasets of conductance-displacement traces to identify optimal conditions for creating long, stable atomic chains.

- Scientists under the Technical Research Centre (TRC) have synthesised a crystalline Covalent organic framework (COF) based on dithiophenedione moieties in its backbone (TTT-DHTD), which has further been employed as an electrode material for supercapacitors. Such materials offer a profound enhancement in the capacitance. Due to the synergistic impact of its high porosity, well-defined crystalline structure, and the presence of redox-active components, these materials exhibit both high energy storage density and long-term durability, which is likely to have huge potential in industrial applications. Another research in TRC demonstrated that COFs with high-density hydrazone linkages, which provide optimal docking sites for water and oxygen, enhance the photocatalytic H_2O_2 generation performance, leading to highly efficient solar-to-chemical energy conversion. Scientists under TRC have also developed a spectroscopy-based detection method for lead (Pb). The key findings from this study could pave the path towards the development of low-cost lead sensors for monitoring lead pollution in the ecosystem.

- On Thursday, September 26, 2024, Hon'ble Prime Minister launched three new supercomputers named Param Rudra, developed in India and funded by the National super-computing Mission (NSM) under the Ministry of Electronics & Information Technology and the Department of Science and Technology, Government of India. This includes an 838 TFLOPS system at the S. N. Bose National Centre for Basic Sciences (SNBNCBS) in Kolkata.Developed indigenously, this high-performance computing (HPC) facility will significantly enhance India's computational research capabilities

Figure: Supercomputer Facility at SN Bose Centre

Satyendra Nath Bose was one of the founding fathers of quantum mechanics. In 1924, he authored the last of the four revolutionary publications which led to the new quantum mechanics. The S. N. Bose Centre has been celebrating the Centenary of Bose Statistics in the year 2024 through organizing conferences, seminars, Outreach Activities, etc. A total 192 papers were published in refereed journals and 26 PhDs were produced by the institute.

6.16 Wadia Institute of Himalayan Geology (WIHG), Dehradun

Wadia Institute of Himalayan Geology (WIHG) is dedicated to carrying out fundamental and applied research to understand the surface and subsurface processes of the Himalayan Orogeny. This is achieved through various Geoscience disciplines such as structural geology, geophysics, seismology, petrology, sedimentology, biostratigraphy, earthquake geology, engineering geology, hydrology, river science, glaciology, and AI/ML. The research aims to characterize the geodynamics of Himalayan orogeny, geo-hazards (earthquakes, landslides, glacial hazards, avalanches, and flash floods), geo-resources (hydrocarbons, minerals, geothermal resources, and cold springs), glacial dynamics, biotic evolution, and the interplay between climate and tectonics.

- A machine learning (ML) approach with advanced seismic attributes was applied to explore subsurface depositional environments and geologic structures compartmentalizing reservoirs in the Upper Assam foreland basin. ML technique was developed to solve industrial challenges like Missing logs, Lithology, and Petrophysical property estimation. A shallow mantle discontinuity (Hales Discontinuity) at ~54-78 km depth in northeast India that has implications for understanding the geodynamic evolution of the region was delineated. New rodent fossils of 5 million years old are discovered from the Siwalik sediments of Uttar Pradesh, suggesting that the dominance of C3 plants implies cool, wet, and cloudy climates prevailed. An enhanced YOLOv5-based landslide detection model was developed for identifying events across diverse geological settings using multi-source remote sensing data. Potential groundwater recharge zones are identified in Udham Singh Nagar, Uttarakhand which will help local communities for the sustainable use of groundwater resources.

- The first record of nanno-fossils from the Surma group of Naga Hills, Indo-Myanmar range was revealed. New Ichno-fossils (trace fossils) from the Siwalik of Punjab Himalaya was revealed and from these ichno-fossils indicate well-oxygenated, low-energy fluvial depositional environment were identified. A pre-vegetation sandy stable barrier-inlet system has been reported for the first time from the Rautgara Formation, Lesser Himalayan basin. Paleoclimatic reconstructions in the Himalayan and Ganga Plain reveal decadal to millennial-scale summer monsoon changes during the Holocene and this study suggests that pre-Meghalayan human migration from Tibet to northeast India is driven by climate variability.

WIHG organized several conferences/workshops, published 125 research papers in refereed journals and total 11 PhDs were produced.

6.17 Indian National Science Academy (INSA), New Delhi

Indian National Science Academy (INSA) is one of the renowned science academies in India which is mainly engaged in recognition of scientific talent, promotion of science and outreach programmes.

- The Academy elected 61 Fellows and 06 Foreign Fellows to the Fellowship during 2024-25. 20 young researchers were selected by the Academy for each of the INSA Young Associates and INSA Associate Fellows for the year 2024. 07 INSA Distinguished Lecture-1 Fellows and 09 INSA Distinguished Lecture-2 Fellows were selected for the year 2024. 01 Presidential Lecture, 16 INSA Distinguished Lectures, 51 New Fellows Lectures, 01 Previous Fellow Lecture, 02 New Foreign Fellow Lecture, 17 New INSA Young Associate Lecture, 18 New INSA Associate Fellow Lecture, 05 Previous INSA Associate Fellow Lecture and 02 INSA History of Science Young Associate Lecture were delivered during Anniversary General Meeting (2024) held at Chennai.

- The U.S. National Academies of Sciences, Engineering, and Medicine (NASEM), in collaboration with the Indian National Science Academy (INSA) and other partners, organized two virtual workshops in August 2024, focused on opportunities for biotechnology cooperation, critical and emerging biotechnologies in India and the U.S. The INSA-NASEM Workshop, brought together scientists and policymakers to discuss collaborative research and policy development in critical areas like biotechnology, health, and environmental sustainability. The workshop focused on strengthening Indo-U.S. ties, sharing best practices, and fostering innovation through joint initiatives.

- The INSA Symposium on ‘Science Policy Futures for Asia,’ was successfully organized by INSA, which gathered experts from AASSA member academies, International Science Council (ISC), Inter Academy Partnership (IAP) etc., to discuss emerging science policies shaping Asia’s future. The symposium fostered collaboration across diverse fields, emphasizing innovation, sustainability, and the role of science in addressing regional challenges.

- Three quarterly Journals, Proceedings of the Indian National Science Academy (PINSA), Indian Journal of Pure and Applied Mathematics (IJPAM), and Indian Journal of History of Science (IJHS) were published.

6.18 National Academy of Sciences (NASI), Allahabad

National Academy of Sciences (NASI) is one of the oldest Science Academy in India focused in promotion & popularization of Science & Technology and science communication. The main activities of the academy include Children Science Meet, Teacher's Training Workshops, Vigyan & Health Chaupals, Seminars etc.

- The NASI-HQ and its 21 Local Chapters spread across the country, organized a few science communication programmes/ activities related to Science Awareness, communication, training and skill development in pursuit of its Science & Society mandate, NASI has carved a niche in every stratum of the society.
- Every year, the Academy awards its prestigious Fellowship/Membership to some of the distinguished scientists all across the country and abroad to recognize their outstanding scientific contributions. A Total 140 scientists (80 Fellows and 60 Members) working in different areas of Science & Technology were selected from all across the country in the year 2024. Three Foreign Fellowships were also awarded to the scientists who are working in different countries and have collaborated with the scientists from India.
- NASI published the internationally recognized Research Journals in collaboration with Springer Nature: *National Academy Science Letters*; *Proceedings of NASI, Sec. A*; *Proceedings of NASI Sec. B*. during 2024-25. Special Issues/Books are also published by the NASI on Socio-scientific problems.

6.19 Indian National Academy of Engineering (INAE), New Delhi

Indian National Academy of Engineering (INAE) aims to provide inputs on engineering education, engineering interventions to solve problems and for framing policies on topics of current engineering interest. In this direction, the important activities undertaken during the 2024-25 are highlighted below:

- Engineers Conclave 2024 (EC-2024), an annual mega event organized by INAE jointly with major engineering institutions of the country was organized together with Defence Research and Development Organization (DRDO) on September 26-27, 2024 at the prestigious Defence Research and Development Laboratory in Hyderabad. This year's Engineers Conclave was a grand celebration of engineering excellence, knowledge sharing, and collaboration showcasing the R&D success stories of DRDO and Industry for Defence Applications. The two themes were "Additive Manufacturing for Defence Applications" and "Defence Manufacturing Technologies.

- The 18th National Frontiers of Engineering Symposium was organized by INAE jointly with Anusandhan National Research Foundation (ANRF) and National Institute of Technology Warangal during November 16-17, 2024 and was attended by young researchers across various academic institutions, R&D laboratories and industries as speakers and participants. In addition, National Competition on Innovation in Manufacturing Practices (IMP 2024) was also organized NIT Warangal on November 17, 2024 to provide a platform for engineering students and start-ups to showcase innovations in manufacturing sector. There were technical sessions on four thematic areas in the symposium namely, Additive manufacturing and Automation, Smart Grid: Power Electronic Converters, Control and Protection, Green Hydrogen and Storage Technologies and Quantum Computing, Artificial Intelligence and Machine Learning. Around 75 faculty and researchers from various engineering institutions had participated in the two-day program.
- The Youth Conclave 2024 was organized at the Indian Institute of Technology Bhilai from December 12-13, 2024 under the aegis of "ANRF (SERB)-INAE Innovation Hackathon". The themes were AgriTech, HealthTech, FinTech, and Sustainable Technologies. The objective was to provide a platform to Bachelor/Master's and Doctoral Level youth to express their technological creativity in these thematic areas. There was a total participation of almost 220 engineering students who made presentations on the themes.
- The Conference on "Green Hydrogen," was organized as the INAE and Royal Academy of Engineering (RAEng), UK Exchange Program 2024 on January 31, 2024 at CSIR-National Chemical Laboratory (NCL), Pune, India. The conference aimed to foster collaboration and knowledge exchange between Indian and UK experts in the field of green hydrogen, with a focus on sustainable energy solutions.

6.20 Indian Science Congress Association (ISCA), Kolkata

Indian Science Congress Association is one of the oldest organizations established in 1914 to advance and promote the Science in India. During 2024-25, important alterations have been made to improve the governance and scientific integrity of ISCA, driven by the need to maintain top-tier standards of excellence and integrity. A key aspect of these adjustments has been the establishment of new byelaws, carefully designed to align with the Memorandum of Understanding (MoU) between ISCA and DST, in accordance with the General Financial Rules (GFR)-2017. ISCA participated in different programmes like Raj Bhasha programmes, Mission Karmyogi, Vigilance Awareness Week etc.

6.21 Indian Academy of Sciences (IASc), Bangalore

- The Indian Academy of Sciences (IASc) strives to meet its objectives through promotion of original research and dissemination of scientific knowledge to the community via a variety of activities that include scientific meetings, discussions, seminars, symposia and science education courses and workshops. The major focus areas of IASC are

Publication of scientific journals, election of Fellows and selection of Associates, organization of mid-year and annual scientific meetings, curation of Fellows' repository, Chair Professorships, Science education programmes and other activities in promotion and dissemination of Science.

- During 2024-25, over 1880 peer-reviewed articles have been published in 11 thematic journals. The entire contents of journals of IASc made available on a free online access platform of the Academy. 13 Special Issues of the journals and 02 books are published in 2024.
- Under the Summer Research Fellowship programme, 1134 students and teachers underwent 2 months' Fellowship and worked with Fellows and other mentors located in 210 research institutions of the country.
- Fifteen lecture workshops and 2 refresher courses were organized by IASc on various topics of science. The Academy created a repository of recent articles of general interest authored by Fellows and Associates of the Academy, these articles are hosted on the Academy Home Page.

6.22 North East Centre for Technology Application and Reach (NECTAR), Shillong

North East Centre for Technology Application and Reach (NECTAR) is a S&T service organization mainly working for the development of North East India. The major area of focus of NECTAR include - Agriculture & Food Processing; Bamboo and allied Technologies; Communication and IT technologies; Geospatial and Drone technology Application; Livelihood Generation & Value addition of Natural Resources; Training & Skill Development; Health-related Technology and outreach activities; Organization of S&T Innovation & Entrepreneurship based Conclaves, Conferences and Workshops etc.

- During the financial year 2024-2025, NECTAR implemented various technology application projects on pilot and demonstrative basis and skill-based capacity building trainings across various sectors such food processing, Agri and allied sectors, bamboo and handicrafts, waste management, geospatial-drone technology, communication etc. which provided benefits to more than 5000 individuals with predominantly from the Scheduled Tribe and Scheduled Caste category with significant number of female beneficiaries.
- As part of the PM Devine scheme project to promote organic cultivation in the Northeast Region (NER), significant developments have been made across Assam, Arunachal Pradesh, Meghalaya, Mizoram, Tripura, and Nagaland. A total of 235 Master Trainers Training Programs has been successfully completed, with distribution of smart phones to trainers in Assam and Meghalaya underway. A Soil Testing Kit named 'Vasundhra' developed through a technology transfer agreement between NECTAR and BARC,

which was officially launched at the Northeast Startup & Entrepreneurship Conclave Guwahati. In addition, demo farm labs have been established in Assam (75 clusters) and Meghalaya (55 clusters).

- Under PM Devine scheme Project on Banana pseudostem utilization & value addition in Northeast India, significant progress has been made in developing Common Facility Centres (CFCs) across the region initially at six locations. NECTAR's saffron cultivation initiative has successfully introduced saffron farming in non-traditional areas of Northeast India, including Arunachal Pradesh, Meghalaya, Sikkim, and Mizoram.
- Under the project on "Aerial & Drone LiDAR and Hyperspectral Sensor-based Survey to Analyze Carbon Financing and Phyto-diversity Heat Map", NECTAR through its Geospatial division has successfully surveyed a total area of 633 square kilometers using LiDAR, Hyperspectral, and RGB sensors. The results include a comprehensive phyto-diversity map of the reserved forests in Meghalaya, an assessment of carbon sequestration, and an analysis of land use and land cover in the forest areas. This study provides a crucial benchmark and baseline for future research related to Meghalaya's forest ecosystems.
- NECTAR implemented the GIZ-sponsored project "Empowering Women in Assam through Bamboo-Based Value-Added Products,", which was launched in August 2024 and successfully completed on December 2024. The project conducted awareness programs for 200 women across Assam highlighting opportunities in bamboo-based value-added products. Hands-on training and handholding support were provided to 40 women at equipping them with practical skills. Trainees' products were showcased at the India International Science Festival (IISF) 2024, establishing marketing linkages, and tool kits were distributed to promising trainees to support their entrepreneurial endeavors.
- Two solar powered cold storage units of 2 MT capacity each successfully installed on pilot basis at East Khasi Hills District and South West Garo Hills District in Meghalaya respectively, in collaboration with Meghalaya New and Renewable Energy Development Agency, Govt of Meghalaya.

6.23 National Innovation Foundation (NIF), Ahmedabad

National Innovation Foundation (NIF) is another S&T service organization and the areas of focus of NIF are mainly the Incubation and promotion of technological grassroots innovations including those which stems from children creativity and to add value to India's outstanding traditional knowledge base. This is accomplished by providing an end-to-end support to innovators encompassing scouting, validation, value addition, product development, Intellectual Property Rights (IPR) protection, recognition to the innovators and dissemination of technologies through social and commercial channels.

- During 2024-25, improved prototypes of 25 technologies were developed in the Fab Lab of NIF. Few of these technologies include Walnut peeling machine, Pepper thresher, Vegetable deseeding machine, Eye exercising device, Manual flower tying device, Manual paddy transplanter, Solar ironing cart, Bamboo basket weaving device, Paper seed tape making and planting device etc. NIF facilitated in granting 139 Indian patents and filing of 50 Indian patents.
- Station trials for technology validation of 21 plant varieties and 07 herbal plant protection leads were carried out at 07 research institutes. Eight vegetables plant varieties were evaluated under the Advanced Varietal Trials and Initial Evaluation Trials (IET) of ICAR-All India Coordinated Research Project (AICRP) on vegetables. Farmers' participatory On-Farm Trials on Cauliflower, Onion and Mustard were also conducted at 425 farmers' field in 16 states.
- NIF organized programs/workshops on protecting IP rights and shared 26 herbal patent grants with outstanding knowledge holders from regions of Jammu & Kashmir and Gujarat. Custodians of traditional knowledge were recognized through various felicitation programs. Licensing arrangements were arrived with Bio Neutra Innovations Private Limited, a start-up enterprise for an Outstanding Traditional Knowledge based technology i.e. millet (nutrition) and existing arrangements were renewed for four herbal technologies: Anti-Diabetic; Anti-Obesity; Liver health; Osteoporosis. With the support of NIF, the NIFientreC had facilitated a technology transfer agreement for four plant varieties. NIFientreC, TBI hosted by NIF entered into an agreement with Veegen Diet Care Private Limited, a start-up entity for commercialization of herbal based food technologies.
- Under its social dissemination initiatives, NIF has facilitated widespread adoption of Grassroots Innovations (GRIs) to address local needs and promote sustainable livelihoods. For instance, cow dung product machinery was provided and demonstrated Maharashtra, Karnataka, and Gujarat, enabling the production of eco-friendly idols and puja items. Similarly, cotton wick-making machines were introduced in Sabarmati Jail and Nashik, providing inmates with skill development and income-generating opportunities. In the agricultural sector, several GRIs were introduced in states like Manipur, Arunachal Pradesh, Jammu & Kashmir, and Mizoram, addressing region-specific challenges and enhancing productivity. Additionally, sanitary napkin manufacturing machines were demonstrated and training were provided in Karnataka, Chhattisgarh, and other regions, fostering local entrepreneurship, promoting menstrual hygiene, and empowering women.

6.24 Technology Information Forecasting and Assessment Council (TIFAC), New Delhi

Technology Information Forecasting and Assessment Council (TIFAC) works in following areas related to Science & Technology: Technology foresight exercises, Technology Vision 2035, Technology Vision 2047, nurturing innovation, patenting support, IPR Management,

supporting MSME clusters, capacity building, Technology Assessment, Technology Pilot and Demonstration and International Collaboration. Areas include Advanced Materials, Clean Energy, Climate Change, Health Data generation, IT Tools for Agriculture, Sea Weed as model for Blue Economy, e-vehicles etc.

- The Technology Roadmap 2047 for the Defence Sector, prepared by TIFAC, envisions transforming India's defence sector into a self-reliant, globally competitive by the centenary of its independence. Anchored in the principles of Atmanirbhar Bharat, the roadmap prioritizes indigenous technological innovation, robust manufacturing capabilities, and a thriving export ecosystem. This roadmap provides a strategic framework to address current challenges and exploit emerging opportunities in defence technology. TIFAC prepared a document on Technology Needs for different sectors in the context of climate change mitigation and adaptation and submitted it to MOEF&CC to facilitate negotiations in COP 29. A comprehensive technology needs assessment report across various sectors, including Energy, Transport, Hard to Abate, Manufacturing, Habitat & City Dwelling, Agriculture, Water, and Waste—all critical to India's development and environmental sustainability are being prepared.

- Completed TRL assessment of 133 technologies in the domains of chemicals, pharmaceuticals & medical sciences developed and patented by R&D labs / academia in India and a compendium was prepared under the sponsor of A2K+ programme of DSIR. The study identified key barriers, challenges, and issues affecting the commercialization of these technologies and recommended actionable models, best practices from developed economies to enhance technology transfer.

- TIFAC in partnership with a start-up Atom 360, Bengaluru and in collaboration with AIIMS Delhi, AIIMS Jodhpur and Dr. Bhubaneswar Borooah Cancer Institute (BBCI), Guwahati initiated a project to evaluate oral cancer screening solution powered by AI and aims to screen ~20,000 individuals across India.

- The DST-TIFAC whitepaper titled "R&D Roadmap on Power Electronics, Machines and Drives: Technologies to Overcome Hindrances to E-Mobility" was released in October 2024. TIFAC led the preparation of this report. This whitepaper made a significant contribution towards formulation of the Mission for Advancement in High-Impact Areas -Electric Vehicle (MAHA- EV Mission).

- The technology foresight report of TIFAC on "Opportunities for Fruits & Vegetables processing for North Eastern Region of India" identified setting up "Mobile Processing Unit (MPU)" in NE areas aiming to reduce the losses of fruits and vegetables in North East areas. As a follow up of this recommendation TIFAC in association with CSIR-CFTRI and NECTAR launched a project for ground level assessment of Mobile Processing Unit at village level.

CHAPTER 7

ANUSANDHAN NATIONAL RESEARCH FOUNDATION (ANRF)

Anusandhan National Research Foundation (ANRF) - established through an Act of Parliament: ANRF Act, 2023, to provide high-level strategic directions for research, innovation, and entrepreneurship in the fields of natural sciences, including mathematical sciences, engineering and technology, environmental and earth sciences, health and agriculture, and scientific and technological interfaces of humanities and social sciences. ANRF has been established to promote research and development and foster a culture of research and innovation throughout India's Universities, Colleges, Research Institutions, and R&D laboratories. ANRF acts as an apex body to provide high-level strategic direction of scientific research in the country as per recommendations of the National Education Policy. ANRF forges collaborations among the industry, academia, and government departments and research institutions.

7.1 Major accomplishments:

- ANRF (Anusandhan National Research Foundation) has been established by ANRF act 2023 in February 2024. ANRF represents India's pioneering efforts to unleash Indian research and innovation talent to achieve global scientific and technological excellence.
- The first meeting of the Executive Council of Anusandhan. National. Research Foundation (ANRF) was held under the Chairmanship of Prof. Ajay K Sood, Principal Scientific Adviser to the Government of India on August 22, 2024 in Department of Science and Technology. The meeting was concentrated on different aspects like to reach the goals of Viksit Bharat, to achieve excellence in science including basic research, to set up national priorities oriented research & designing R&D blueprint, to stream line agencies in order to avoid overlap, to improve the global positioning of India in key sectors, to conduct research with ease and flexibility, capacity building including world-class infrastructure and a highly skilled workforce, industry aligned translational research and inclusive growth.
- Prime Minister Shri Narendra Modi chaired the first meeting of the Governing Board of Anusandhan National Research Foundation on 10th September, 2024. The meeting focussed on discussion about India's Science and Technology landscape and redesigning of research and development programmes. The board discussed several areas of strategic interventions of ANRF which include India's international status in important

sectors, aligning R&D with national priorities, promoting inclusive growth, capacity building, driving scientific advances and innovation ecosystem, as well as bridging the gap between academic research and industrial applications.

- ANRF has initiated the program, Prime Minister's Early Career Research Grant (PM ECRG) to assist young researchers to initiate their research career in a new institution with a flexible budget and progressive initiatives for ease of doing research. By supporting early-career scientists, the PMECRG will play a pivotal role in advancing scientific research, enabling recipients to undertake independent and impactful research.
- ANRF has launched EV-Mission program under MAHA (Mission for Advancement in High-impact Areas). The objective of the EV-Mission is to promote research & development of Electric Vehicle (EV) adoption in India, fostering an ecosystem that enables self-reliance and global competitiveness.
- New program Partnerships for Accelerated Innovation and Research (PAIR) has been launched in line of Hub and Spoke model. The motivation is to go beyond empowering researchers of higher education institutions through individual-centric research grants, to a more holistic approach of uplifting the research culture and excellence of the entire institution in a systematic manner.
- ANRF (erstwhile SERB) supported the establishments of three Cryo-EM facilities in IIT Bombay, IIT Kanpur and IIT Madras which are dedicated to the nation's scientific fraternity.

Figure: Secretary DST dedicated the National Cryogenic Electron Microscope facility to Indian Institute of Technology, Bombay

- Assistance to Professional Bodies & Seminars/Symposia: The programme extends partial support on selective basis for organizing seminar/symposia/training program/ workshop/conferences at national as well as international level. The support is provided to academic institutions, research laboratories, professional bodies and other non-profit organizations engaged in promoting scientific research. In the reporting period under Seminar/symposia scheme, 492 events were recommended for financial support across the country in various fields of Science and Technology.
- International Travel Support (ITS) Scheme provides an opportunity to emerging and eminent scientist to present the original research findings in the international events held abroad. In the reporting period, 1433 participants supported under the scheme.
- ANRF continued to support ongoing projects under various schemes of Science and Engineering Board (SERB)

7.2. Some research highlights of the projects:

7.2.1 Nanostructured Semiconductor-Conjugated Polymer based Hybrid Photocatalysts for Efficient Solar Water Splitting

A series of alternative, low band gap, multifunctional conjugated polymer nanostructures and integration with metal oxides or metal sulfide semiconductor nanomaterials have been developed by constructing p-n junction, type-II, Z-scheme heterojunctions, and S-scheme heterojunctions with superior catalytic activity for solar energy conversion achieved through photochemical and electrochemical processes for water splitting, and H_2 generation.

The research group developed the synthesis of morphology-controlled conjugated polymer using surfactant based oxidative template for polypyrrole (PPy) nanofibers and polyaniline (PANI) nanosheets (Figure 2 a&b). In a batch synthesis, nanofibers yield has been improved from 100 mg up to 10 gm at laboratory scale (Figure 2(c)). A set of six metal oxides have been impregnated onto PPy nanofibers to construct tunable band-aligned heterojunctions to improve the solar-to-fuel conversion efficiency (Figure 1 (d-h)). A new insight into the fabrication of low cost mixed-phase copper-cuprous oxides supported conducting polymer nanostructures demonstrated an exceptional high photocatalytic H_2 generation rate.

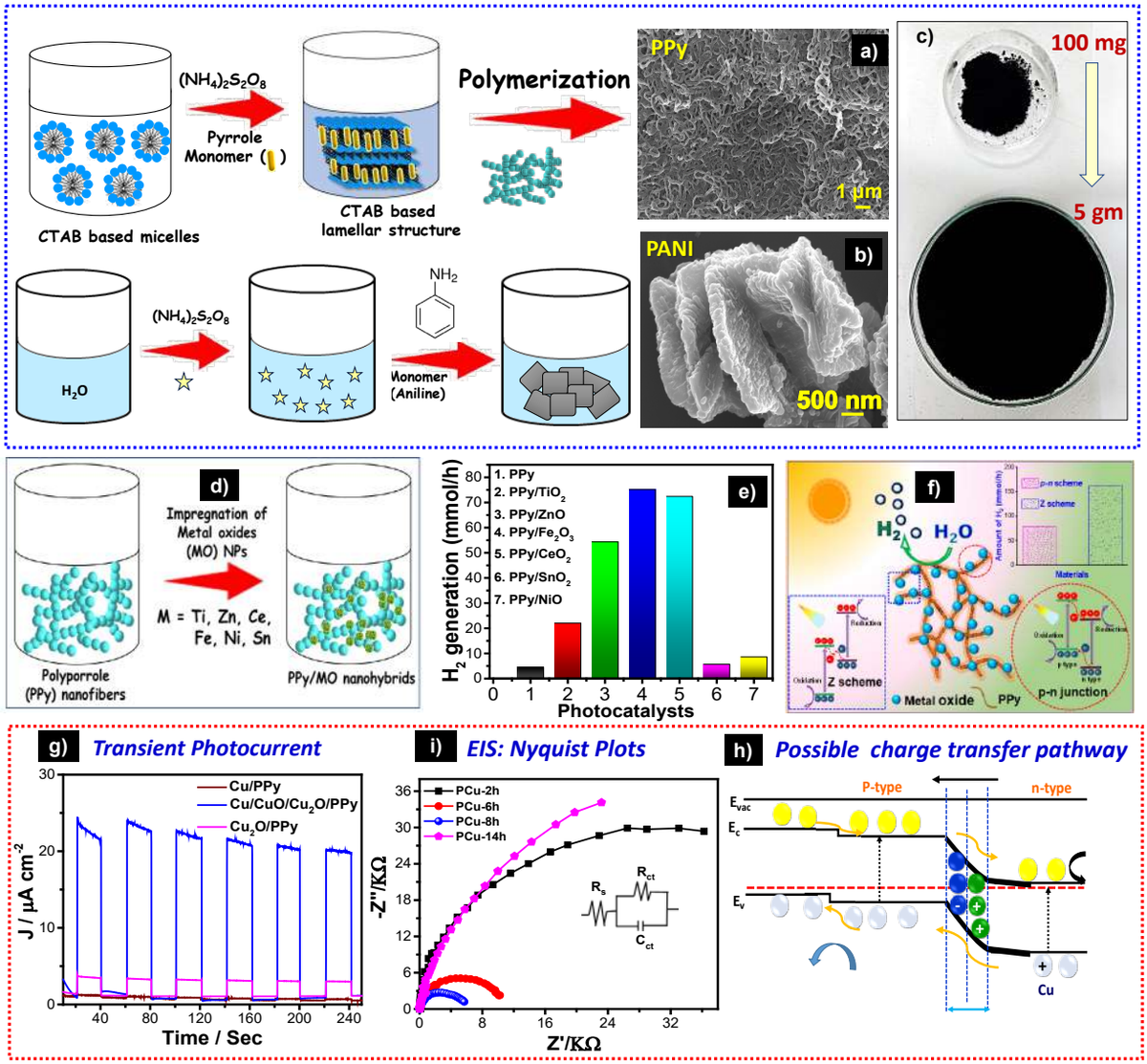


Figure: a-c) Flow chart for the aqueous based fabrication process for polymer nanostructures and metal oxides/sulfides based nanohybrids, developed at CSIR-CGCRI. FESEM images of PPy and PANI nanostructures. d)Schematic representation of PPy/Metal oxides nanohybrids synthesized, e) comparative performance of photocatalytic H_2 generation and f) mechanism. g-i) photoelectrochemical response and h) mechanistic details of p-p-n heterostructures of Cu-CuO-Cu_2O/Polypyrrole nanohybrids.

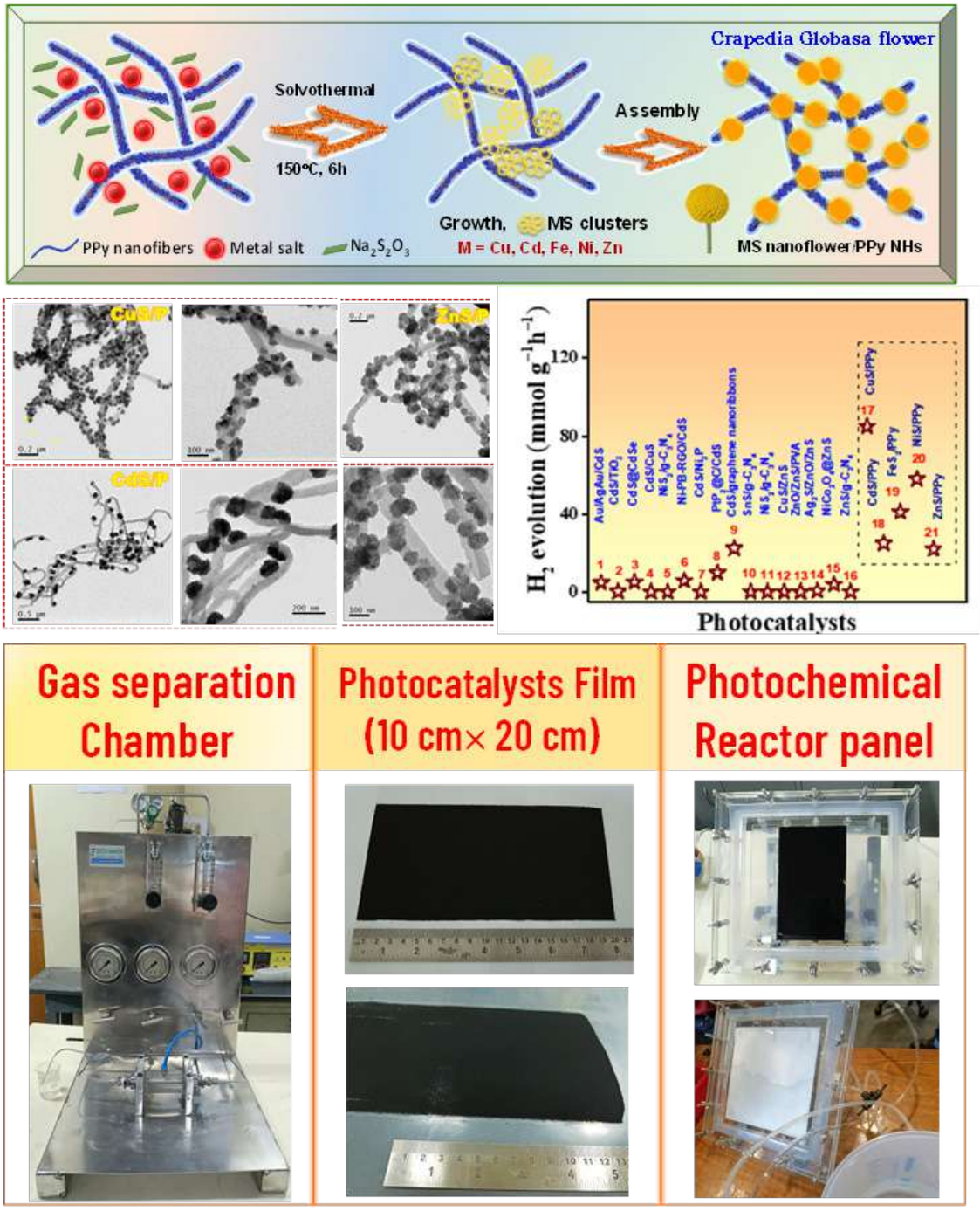


Figure: Schematic picture showing the formation of MS/PPy nanohybrids. TEM images and H_2 generation through photocatalytic water splitting. Photographs of Indigenous development of gas separation chamber for H_2 and O_2 separation from water splitting, slurry-based photocatalysts layer and photochemical reactor panel for scale-up of water splitting and H_2 generation.

A process developed for the synthesis of hierarchical metal sulfide (MS = CuS, FeS_2, NiS, CdS, ZnS, NiS) nanoflowers supported conducting polymer that display high photocatalytic H_2 generation (Figure 3 top and middle). An indigenous gas separation chamber for fuel separation and optimizations of slurry based photocatalyst layer utilized in photochemical reactor panels as prototype device have been designed (Figure 3 bottom). This work is being carried out at CSIR-Central Glass & Ceramic Research Institute, Kolkata.

7.2.2 Save-FeMom : Development of Machine Learning based Wearable Healthcare Device for Pregnant Women

The project aims to enhance educational support for illiterate pregnant mothers in remote villages and hill stations by developing a wearable device equipped with an AI-based, voice-enabled, content-curate personalized system. Future work involves creating a gynaecologist-approved health dataset to provide personalized education through this system. Key steps include designing communication and healthcare functionalities to securely collect and process data on a remote cloud via Bluetooth, WiFi, and cellular access. The wearable will collect health parameters from pregnant mothers and send the data to the cloud for analysis and health condition prediction. This work is being carried out at Nehru Institute of Engineering and Technology, Coimbatore.

7.2.3 Sustainable Technology for Smart Off-Grid Renewable Energy Transformation and Electrochemical Storage Management

The research group has carried out NVP/Hard carbon full-cell fabrication and optimization in Indian Institute of Technology, Bombay. The full-cell optimization for a Na-ion battery has been found as working, using NVP as the cathode and HC as the anode (made from biomass) based on the half-cell results. A synergistic stabilization effect in a Nb-doped P2-type single crystal cobalt-free layered oxide cathode material, $Na_{0.67}Ni_{0.31}Mn_{0.67}Nb_{0.02}O_2$ (SC_Nb-NMNO), offering remarkable cycling stability (~90% after 2000 cycles at 1 C, ~50% retention at 5 C) and high-power performance for Na-ion batteries in full-cell format has been unveiled. Figure 4 below summarizes the research conducted on SC_Nb-NMNO, with the details in the caption.

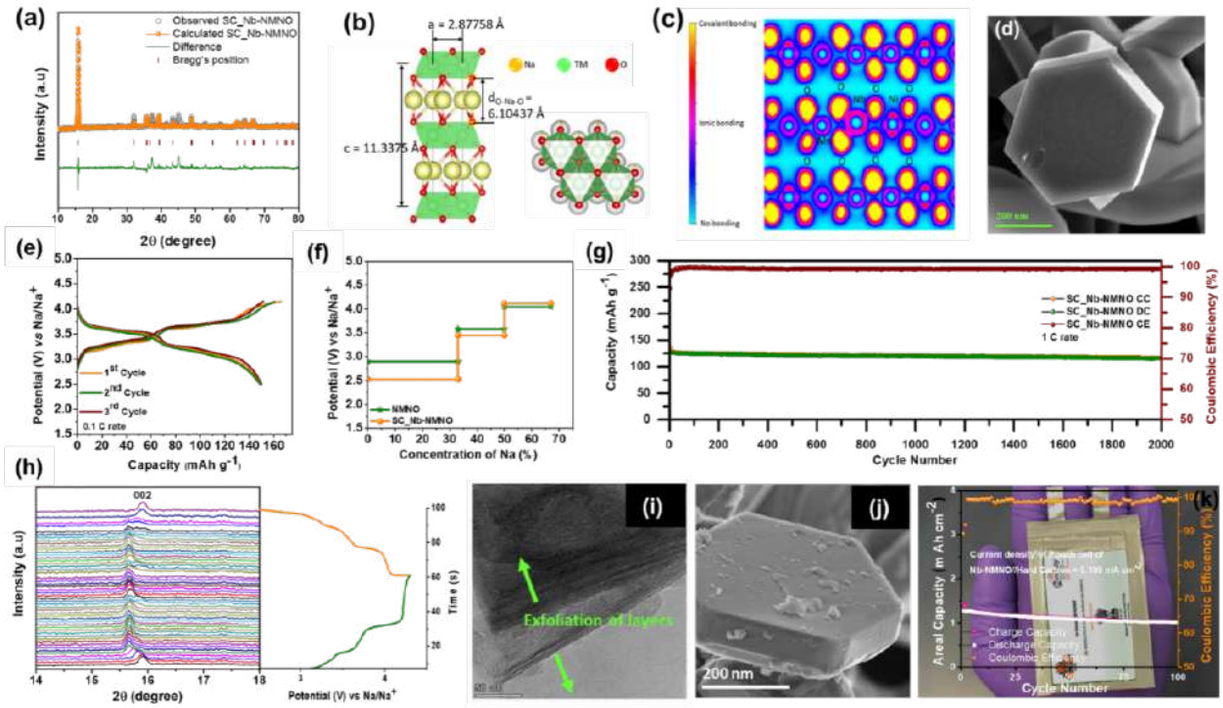


Figure: Mechanistic investigation on the synergistic effect of Nb doping and single crystal P2-$Na_{0.67}Ni_{0.31}Mn_{0.67}Nb_{0.02}O_2$(SC_Nb-NMNO). (a) XRD refinement using FullProf software of the SC_Nb-NMNO (b) Effect of Nb^{5+} doping on the crystal structure (c) Electron localization function (ELF) in Nb-doped NMNO indicates ionic bonding involving Mn-O and Nb-O orbitals, while Ni-O presents polar covalent bonding (d) Magnified view of the single crystal of SC_Nb-NMNO cathode material through SEM, scale bar, 200 nm (e) Typical galvanostatic charge-discharge profile of SC_Nb-NMNO at 0.1C within the potential window of 2.5 V – 4.2 V against Na/Na^+ (f) Theoretically calculated voltage profile of pristine and single crystal Nb-doped NNMO at different Na-concentrations (g) Cycling performance analysis through charge-discharge capacity and Coulombic efficiency versus cycle number plot of SC_Nb-NMNO at a high current rate of 1 C (h) In-situ X-ray Diffraction (XRD) patterns of SC_Nb-NMNO using Swagelok cell corresponding to the charge and discharge curves between 2.5 – 4.3 V at C/15, 20 °C focusing on the (002) plane (i) Ex-situ HR-TEM of pristine NMNO showing the phenomena of exfoliation parallel to the lower indexed lattice plane, scale bar, 50 nm (j) Ex-situ SEM of single crystal SC_Nb-NMNO electrode obtained after 100 cycles at 0.1 C, showing no evidence of cracks and delamination of layers, scale bar, 600 nm (k) Cycling performance of the fabricated pouch cell at 0.109 mA cm^{-2} for 100 cycles.

Fabrication of Lithium Ion Battery (LIBs) using LFP cathode and silicon-graphite composite anode has been done by researchers also. Si-C has been combined with commercial graphite to boost specific capacity and maintain coulombic efficiency. LFP cathode has been fabricated from rust composition: 97% LFP, 1% conducting carbon, 2% binder (NMO + PVDF), active mass loading 18.99 mg cm². Si-C/Gr anode is made with composition: 5% Si, 85% graphite (MCMB), 4% conducting carbon, 6% binder (CMC + SBR), active mass loading 5.2 mg cm².NTO has been synthesized via low-cost method by the Co-PI in National Institute of Technology, Durgapur which is scalable. Sodium ion hybrid capacitor with Mn-NTO anode shows 2.5 V window, 108 Wh/kg energy density, 27 kW/kg power density.

Cathode material has been synthesized from biomass precursor. Inexpensive peanut shell has been chosen as the precursor. Activated carbon has been synthesized via pyrolysis, scalable for commercialization. MATLAB/Simulink model has been made in Visvesvaraya National Institute of Technology (VNIT), Nagpur by other Co-PI for DC Microgrid and power converter design has been made as shown in Figure 5. In the model, components are used as Solar PV MPPT, battery control (SOC-based), dc control of active bridge rectifier at 10kHz, Stable 800V DC bus under varying load/irradiance, 2.5KW three-phase PFC control setup with FPGA Wave CT controller and L-filter which reduces THD <5% as per IEEE 519-2014 standards.

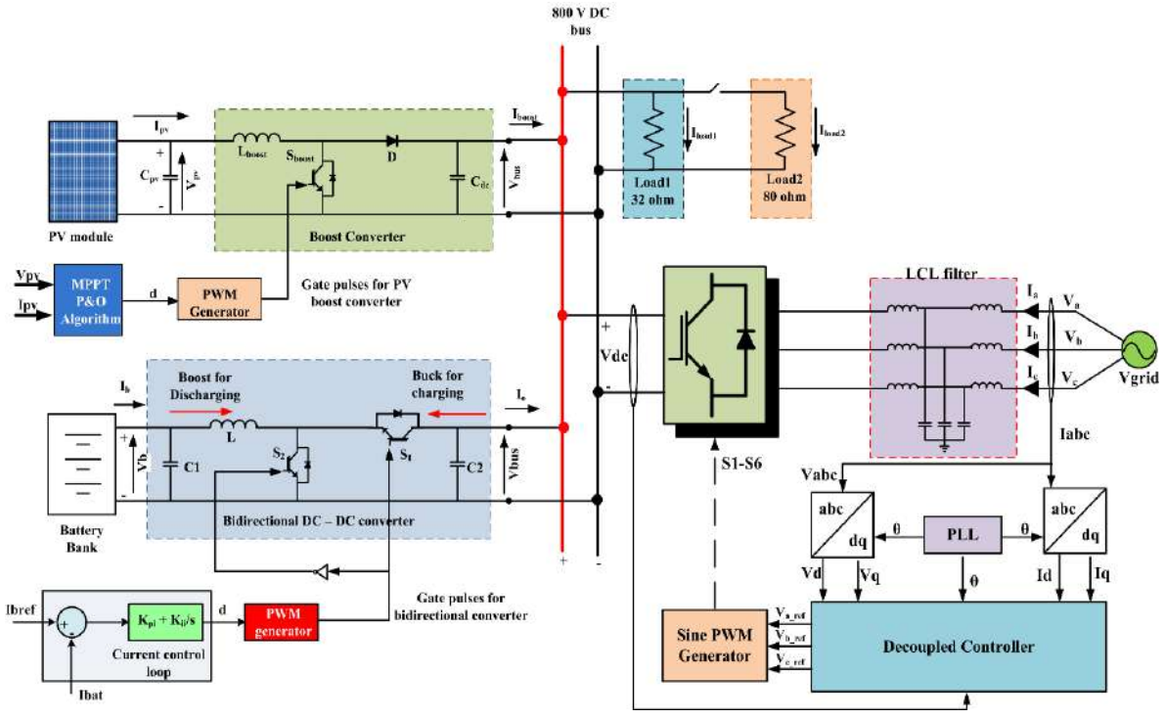


Figure: Solar PV, battery and grid integration

CHAPTER 8

AUTONOMOUS INSTITUTES (AI) AND TECHNOLOGY DEVELOPMENT BOARD (TDB)

Technology Development Board (TDB) is a statutory body under Department of Science & Technology with a mandate to provide financial assistance to the industrial concerns and other agencies attempting development and commercial application of indigenous technology or adapting imported technology for wider domestic application. The Board was constituted through Technology Development Board Act, 1995 and has commenced its activities from 1st September, 1996.

In pursuance to its mandate, TDB accepts application for financial assistance throughout the year from all sectors of economy such as Health & Medical, Engineering, IT, Chemical Agriculture, Telecommunications, Road Transport, Energy & Waste Utilization, Electronics, Defence, Civil Aviation, Textile etc.

8.1 Agreements signed during 2024-25

During the year 2024-25, TDB has signed five (5) national agreements and fifteen (15) International Bilateral Projects for providing financial support to various industrial concerns. The details of the same are as under:

8.1.1 National Agreements

(i) TDB has signed an agreement with M/s Sahajananad Medical Technologies Ltd., Surat (Gujarat), for the "Product Enhancement and Commercialization of TAVI (Transcatheter Aortic Valve Implantation)." The Board has agreed to provide financial assistance of Rs. 45.13 crores out of the total project cost of Rs. 90.27 crores. The agreement was signed on 15.04.2024.

(ii) TDB has signed an agreement with with M/s Dhruva Space Private Limited, Hyderabad, for establishing a "Space Grade Solar Array Fabrication and Test Facility." TDB will provide Rs. 14.00 crores as financial assistance against the total project cost of Rs. 29.49 crores. The agreement was executed on 23.04.2024.

(iii) TDB has signed an agreement with M/s Krishigati Pvt. Ltd., Pune, for the "Development of an Axle-Less Multipurpose Electric Vehicle for Modern and Precision Farming." Financial assistance of Rs. 2.50 crores has been sanctioned against the total project cost of Rs. 5.00 crores. The agreement was formalized on 27.05.2024.

(iv) TDB has signed an agreement with M/s Midwest Advanced Materials Private Limited, Pune, to support the "Commercial Indigenous Production of Neodymium Materials and Rare Earth Permanent Magnets for E-Mobility." TDB's assistance comprises Rs. 124.00 crores as a loan and Rs. 1.00 crore as equity, totalling Rs. 125.00 crores, against a project cost of Rs. 250.86 crores. The agreement was signed on 30.05.2024.

(v) TDB has signed an agreement with M/s Agnikul Cosmos Pvt. Ltd., Chennai, for the "Development and Commercialization of a Modular Configurable Launch Vehicle for 100 Kg Payload." The Board will provide financial assistance of Rs. 18.00 crores for the project, which has a total cost of Rs. 263.15 crores. The agreement was signed on 16.12.2024.

8.1.2 International Bilateral Projects

(i) TDB has signed an agreement with M/s Planys Technologies Private Limited, Chennai, to provide financial support for the "Online Tank Inspection Rover" project under the Indo-Israel CFP. The Board has agreed to provide financial assistance of Rs. 1.50 crores out of the total project cost of Rs. 3.00 crores to the company vide Grant Agreement dated 28.05.2024.

(ii) TDB has signed an agreement with M/s T M Patel Processing Pvt Ltd., Surat (Gujarat), to provide financial support for the "Zero Emission Steam for Textiles" project under the Indo-UK CFP. The Board has agreed to provide financial assistance of Rs. 0.43 crores out of the total project cost of Rs. 0.87 crores to the company vide Grant Agreement dated 18.07.2024.

(iii) TDB has signed an agreement with M/s Aadyah Aerospace Pvt Ltd., Bengaluru, to provide financial support for "LEO.AIM - Artificial Intelligence Driven Mission Planning for LEO" under the Indo-Israel CFP. The Board has agreed to provide financial assistance of Rs. 7.93 crores out of the total project cost of Rs. 15.86 crores to the company vide Agreement dated 26.07.2024.

(iv) TDB has signed an agreement with M/s NDDB Mridas Limited, Anand (Gujarat), to provide financial support for "Sustainable Biogas Plants via Valorisation of Digestate through Solar Drying (SuBiDi)" under the Indo-UK CFP. The Board has agreed to provide financial assistance of Rs. 1.21 crores out of the total project cost of Rs. 2.42 crores to the company vide Grant Agreement dated 08.10.2024.

(v) TDB has signed an agreement with M/s Uncharted Infolabs Pvt Ltd., Gurugram, to provide financial support for "Smart Harvests Secure Future: Revolutionizing Gig Farming in SE Asia" under the Indo-Singapore CFP. The Board has agreed to provide financial assistance of Rs. 1.00 crore out of the total project cost of Rs. 2.00 crores to the company vide Grant Agreement dated 18.10.2024.

(vi) TDB has signed an agreement with M/s MistEO Pvt Ltd., Thiruvananthapuram, to provide financial support for the "Unified Climate Risk Management and ESG Reporting Platform" project under the Indo-Singapore CFP. The Board has agreed to provide financial assistance of Rs. 1.30 crores out of the total project cost of Rs. 2.60 crores to the company vide Grant Agreement dated 21.10.2024.

(vii) TDB has signed an agreement with M/s Incore Semiconductors Pvt Ltd., Chennai, to provide financial support for the "RISC-V AIM Compute-Based CNN Accelerator Chip" project under the Indo-Singapore CFP. The Board has agreed to provide financial assistance of Rs. 1.10 crores out of the total project cost of Rs. 2.21 crores to the company vide Grant Agreement dated 21.10.2024.

(viii) TDB has signed an agreement with M/s Zydus Lifesciences Limited, Ahmedabad, to provide financial support for "Companion Diagnostics for Saroglitazar" under the Indo-Spain CFP. The Board has agreed to provide financial assistance of Rs. 1.50 crores out of the total project cost of Rs. 7.09 crores to the company vide Grant Agreement dated 24.10.2024.

(ix) TDB has signed an agreement with M/s 3K NANO Pvt Ltd., Delhi, to provide financial support for the "Cost-Effective Compact AEM Electrolyzer for Urban Mobility: Catalysts, Membranes, and Integration" project under the Indo-Singapore CFP. The Board has agreed to provide financial assistance of Rs. 1.50 crores out of the total project cost of Rs. 3.00 crores to the company vide Grant Agreement dated 06.11.2024.

(x) TDB has signed an agreement with M/s Waybiond Biotech Pvt Ltd., Mumbai, to provide financial support for the "Advancing Wastewater Treatment Strategies: Integrating Enzymatic Bioremediation for Sustainable Solutions" project under the Indo-Singapore CFP. The Board has agreed to provide financial assistance of Rs. 1.12 crores out of the total project cost of Rs. 2.24 crores to the company vide Grant Agreement dated 06.11.2024.

(xi) TDB has signed an agreement with M/s Pinnacle Mobility Solutions Private Limited, Pune, to provide financial support for "ALD - Advanced Lightweight Drivetrain" under the Indo-Israel CFP. The Board has agreed to provide financial assistance of Rs. 10.20 crores out of the total project cost of Rs. 27.95 crores to the company vide Agreement dated 06.12.2024.

(xii) TDB has signed an agreement with M/s Karo Sambhav Pvt Ltd., Gurugram, to provide financial support for the "Digitalized and Sustainable Approaches for Reusing, Repairing, and Recycling Permanent Magnets from Electronic Wastes (PermMag-DiSARE)" project under the Indo-UK CFP. The Board has agreed to provide financial assistance of Rs. 1.50 crores out of the total project cost of Rs. 2.59 crores to the company vide Grant Agreement dated 09.12.2024.

(xiii) TDB has signed an agreement with M/s Beebox Studios Private Limited, Chennai, to provide financial support for "AURA.I. (Augmented Reality Unified with Artificial Intelligence)" under the Indo-Sweden CFP. The Board has agreed to provide financial assistance of Rs. 1.24 crores out of the total project cost of Rs. 3.00 crores to the company vide Grant Agreement dated 04.06.2024.

(xiv) TDB has signed an agreement with M/s Biotic Waste Solutions Pvt. Ltd., New Delhi, to provide financial support for "Improved Urban Climate by Cooling from Waste Heat" under the Indo-Sweden CFP. The Board has agreed to provide financial assistance of Rs. 1.50 crores out of the total project cost of Rs. 2.60 crores to the company vide Grant Agreement dated 29.04.2024.

(xv) TDB has signed an agreement with M/s Logicease Techno Solution Pvt Ltd., Ambala, to provide financial support for "Text to Knowledge: AI-Enhanced Educational Support" under the Indo-Sweden CFP. The Board has agreed to provide financial assistance of Rs. 1.30 crores out of the total project cost of Rs. 3.00 crores to the company vide Grant Agreement dated 29.04.2024.

8.2 Call for Proposals

8.2.1 National

(i) CFP- "Empowering Indigenous Technologies for Sustainable Semiconductor Supply Chain"

Launched to promote self-reliance in semiconductor manufacturing, this call supports the development of indigenous technologies to reduce India's dependency on semiconductor imports, driving innovations in production, materials, and equipment, ultimately positioning India as a global leader in semiconductor technology.

(ii) CFP- "Advance Sustainable Energy Solution"

This call aims to foster the development of renewable energy technologies and energy-efficient solutions to address India's growing energy demand sustainably. Focusing on green energy, energy storage, and carbon emission reduction, it seeks to enhance India's energy security and environmental sustainability through innovation and global collaboration.

(iii) CFP- "Advancing Technology & Innovation In Indian Medical Devices And Allied Sectors"

Focused on enhancing India's medical device sector, this initiative supports the development of affordable, high-quality devices and allied technologies. It aims to reduce dependence on imports, improve healthcare access, and position India as a hub for medical device innovation and manufacturing.

8.2.2 International

(i) CFP "Israel – India (I4F) Strategic Call for Proposals 2024"

This collaboration aims to leverage India and Israel's technological strengths in sectors like defense, agriculture, and water management. The initiative fosters joint R&D to create innovative solutions that address global challenges, enhancing the technological capabilities of both nations.

(ii) CFP- "India-Singapore Collaborative Industrial Research & Development Programme – Request for Proposal (RFP) 2024"

This call promotes industrial R&D collaborations between India and Singapore, focusing on advanced technologies in manufacturing, smart cities, and green solutions. It aims to boost innovation and strengthen industrial capabilities, driving mutual economic growth and technological advancements in both countries.

(iii) CFP- "India-UK Collaborative R&D for Industrial Sustainability"

This initiative fosters joint R&D between India and the UK in sustainable industrial technologies, aiming to enhance energy efficiency, waste management, and green manufacturing practices. It promotes long-term industrial sustainability while advancing both nations' leadership in clean technologies.

(iv) CFP- "India-Spain Joint Call For R&D&I Projects 2024 under India – Spain Programme of Cooperation on Industrial Research and Development"

Focusing on renewable energy, industrial automation, and sustainable practices, this call strengthens India-Spain collaboration in R&D. It aims to drive innovation in high-tech manufacturing and environmental sustainability, accelerating industrial solutions that address global challenges in both nations.

8.3 National Technology Week-2024 celebration at INSA, New Delhi

TDB commemorated National Technology Day on 11th May, 2024. Themed 'Promoting Clean and Green Technologies for a Sustainable Future', the event brought together a distinguished gathering of scientists, policymakers, innovators, and industry leaders. The celebrations provided a platform to showcase India's progress in clean energy, green manufacturing, and sustainable technology solutions. TDB celebrated the achievements of individuals and organizations driving India's technological advancement. From defence innovations to clean energy solutions, the event highlighted TDB's funded projects as prime examples of how targeted support fosters impactful outcomes.

CHAPTER 9

STRENGTHENING SURVEY AND MAPPING ACTIVITY

9.1 Survey of India

Survey of India (SOI), the National Geospatial & Mapping Agency of the country under the DST, is the oldest scientific department of the Govt. of India and leading the development of the country's Geospatial Infrastructure and ecosystem. The Government of India notified the National Geospatial Policy (NGP) on December 28, 2022, aiming to position India as a global leader in the geospatial space. Survey of India (SOI), the national mapping agency, has been designated as the nodal agency for Geospatial Data and the generation/maintenance of foundational data. Under the NGP, SOI is responsible for the following Geospatial Data Themes:

a. Maintenance and Up gradation of National Geodetic Reference Frame

b. Ortho-imagery

c. Elevation (Digital Elevation Model)

d. Functional Areas (Administrative Boundaries)

e. Geographical Names (Toponymy)

To achieve the NGP's vision, the Government of India established the Geospatial Data Promotion and Development Committee (GDPDC), an apex body tasked with formulating strategies, guidelines, and programs to promote the geospatial sector and drive the development of the geospatial ecosystem. The Surveyor General of India, serves as the member secretary of GDPDC. Operation Dronagiri was launched on November 13, 2024, at FITT, IIT Delhi, as a flagship pilot initiative under the National Geospatial Policy 2022. This program aims to showcase the transformative potential of geospatial technologies in Agriculture, Livelihoods & Skilling, and Transportation & Infrastructure. In its first phase, the program will focus on the districts of Varanasi in Uttar Pradesh, Sonipat in Haryana, Kamrup Metropolitan and Rural in Assam, Vijayanagaram in Andhra Pradesh, and Washim in Maharashtra.

During the launch event, the Integrated Geospatial Data Sharing Interface (GDI) platform was also launched. This platform serves as a unified system for seamless spatial data sharing across various government departments, enabling innovation and responsible geospatial data utilization by public and private stakeholders involved in the project.

Key highlights under different components of the programme are as follows;

9.1.1 International Boundary

- The Joint Technical Level Meeting between the Survey Departments of India and Bhutan on India-Bhutan Boundary Task was held in Paro, Bhutan from 25-26 September, 2024. The Indian delegation was led by Sh. Rajiv Kumar Srivastava, Director, Meghalaya and Arunachal Pradesh GD, Shillong while Bhutan delegation was led by Mr Sangay Dorji, Director/ Specialist, International Boundaries.
- The 12th Meeting between the Heads of The Survey departments of India and Myanmar on Joint inspection, repair, restoration, reconstruction and maintenance of boundary pillars and construction of subsidiary boundary pillars on India- Myanmar boundary was held from 03-04 December, 2024, New Delhi.

Figure: SGI, at 12th meeting between Heads of Survey Departments of India and Myanmar

9.1.2 Functional Areas (Administrative Boundary Database): The Functional Areas (Administrative Boundaries) comprises of International Boundaries, State Boundaries, District Boundaries, Sub-district Boundaries, and Revenue Village Boundaries. It also includes other functional Areas – Municipal Corporation, Municipalities, Block, and Constituencies etc. SOI in collaboration with ORGI has initiated harmonization of Administrative Boundary Data Base (ABDB), till date 100 % discrepancy free harmonized data from 11 states and 06 Union Territories have been published on online maps Portal and data regarding remaining states will be soon made available on SoI's online maps Portal. https://onlinemaps.surveyofindia.gov.in/

9.1.3 Toponymy (Geographical names/ Topographical names): SoI has transliterated the Toponymy layer in 22 languages. This database shall be referred as base Geographical Name Data Base (GNDB). A National Geographical Name Information System (NGNIS) shall be developed, maintained and disseminated by SOI for access by all the users through a Geo-portal.

9.1.4 Geoid Model Development: SoI is developing the Geoid Model for the entire country with the accurate relationship between the geoidal surface and WGS-84 Ellipsoid, so that heights given by satellite-based technologies and products viz., GNSS, satellite imageries can be directly converted to the orthometric heights with sufficient accuracy.Geoid Model Development for 10 states (Uttar Pradesh, Bihar, West Bengal, Jharkhand, Punjab, Haryana, Goa, Telangana, Kerala, and Delhi) in India has been completed and Geoid Model for the entire country is likely to be completed soon.

9.1.5 SOI Online maps Portal (*https://onlinemaps.surveyofindia.gov.in/*): The Online maps portal provides a range of digital products – Topographical Maps in .pdf and shape file format. Other digital products - Geographical Maps, Railway Map, Political Map, Road Map, Physical Map of India and several other products. G2G data is free of cost and to other users at a fair and transparent pricing. Some of the products are free to all users.

9.1.6 Training & Capacity Building: National Institute for Geo-informatics Science and Technology (NIGST), Hyderabad is a premier institution providing training & capacity building in the field of Surveying & Mapping, Photogrammetry, and Geodesy & GIS. Besides training to officers and staff of Survey of India, NIGST also imparts training to other Government Organisations, Private Individuals, and Scholars from various Afro-Asian countries and for the students from the neighbouring developing countries.

NIGST is well equipped with modern technology / equipments for Surveying & Mapping, Geodesy, Conventional and Digital Cartography, Photogrammetry and UAV/ LiDAR. Courses for various Departmental /Extra Departmental / Private and Foreign trainees were conducted at NIGST during 2024. Below are the list of Memorandum of Understanding (MoUs) signed by NIGST;

a. Indian Institute of Technology Tirupathi, Andhra Pradesh

b. National Highways Authority of India

c. Andhra Pradesh State Training Academy, Samalkot, Andhra Pradesh

d. Radhanath Sikdar Institute of Geospatial Science & Technology, Kolkata, West Bengal

e. CSIR – National Geophysical Research Institute (NGRI)

In addition, Indian Tide Table-2025 & Hugli River Tide Table -2025 have been published.

9.1.7 Continuously Operating Reference Station (CORS) Network: SOI has undertaken modernization of Geodetic Reference Frame of the country by establishing Continuously Operating Reference Stations (CORS) network of more than 1000 CORS Stations across the country at the interval of 60 to 90 km. The CORS network services are available 24X7 through an online portal https://cors.surveyofindia.gov.in/. As on date, 6116 users are registered on the CORS Portal for availing different types of services.

9.1.8 Projects of National Importance:

i. **SVAMITVA:**The Govt. of India has launched SVAMITVA (Survey of Villages and Mapping with Improvised Technology in Village Areas) Scheme on 24th April 2020 for surveying the land parcels in rural inhabited areas using Drone technology. SVAMITVA scheme is a reformative step towards establishment of clear ownership of property in rural inhabited (abadi) areas. The scheme is a Central Sector scheme of Ministry of Panchayati Raj (MoPR) where Survey of India is the technology partner for the implementation of the scheme. The survey is being done across the country. About **3, 44, 344** villages are to be covered in a phase wise manner. As on date Drone Survey for about more than 3 Lakhs villages has been completed.

ii. **National Hydrology Project (NHP):** National Hydrology Project, an initiative of Govt. of India with financial assistance from World Bank, has been envisaged to improve the planning development and management of water resources as – well – as flood forecasting and reservoir observations in real time. The project is being implemented through various implementing agencies in which Survey of India (SoI) is one of the Central Implementation Agency in execution of NHP. The entire project is of eight years duration with two phases of four years each. SOI has been entrusted with the responsibility to generate, prepare and provide various types of Geo-spatial datasets - Digital Elevation Model (DEM) of 0.5m, 3-5m and GIS data. The project is near completion.

iii. **National Mission for Clean Ganga (NMCG):** This project is an integrated conservation mission, approved as flagship program by the Union Government. NMCG aims towards effective abatement of pollution and Conservation & rejuvenation of the national river Ganga. The National Mission for Clean Ganga has partnered with Survey of India to support Ganga rejuvenation using GIS technology.

Under this project, Survey of India has been requested to create GIS ready database for the part of river Ganga and river Hugli covering up to 10 km extent on either side of the river, High-Resolution Digital Elevation Model (DEM) of 0.5 metre resolution using LiDAR technology, to aid in Ganga River Basin management, sewerage, waste management, and pollution control.

The project is near completion

iv. **Large Scale Mapping (LSM):** Survey of India in collaboration with the State Government authorities is executing large scale mapping projects using Professional Survey Grade Unmanned Aerial Vehicle/ Drone, for generation of high resolution Ortho-rectified imagery, digital elevation model & GIS enabled data. Currently LSM is being carried out in states of Haryana, Karnataka, Andhra Pradesh and Andaman

v. **Atal Mission for Rejuvenation and Urban Transformation 2.0 (AMRUT 2.0):** Memorandum of Understanding (MoU) was signed between SOI and Ministry of Housing and Urban Affairs (MoHUA) for execution of drone survey using professional

survey grade Drone / UAV to generate the large scale urban geospatial data for small and medium towns having population 50,000- 99,000 (AMRUT 2.0) GIS Sub- Scheme towns. Drone Data acquisition of 2402.17 sq.km. (in 48 towns) has been completed.

vi. **National Geospatial Knowledge – based land Survey of urban Habitations (NAKSHA):** The Department of Land Resources has launched a pilot program "NAtional geospatial Knowledge' based land Survey of urban Habitations (NAKSHA)" for creation of Land Records in Urban Areas. Aerial (manned/ unmanned) data acquisition involves three different technologies i.e. (i) Nadir Camera, (ii) Multi-angle (1 nadir + 4 oblique) camera, and (iii) Multi-angle (1 nadir + 4 oblique) camera with LiDAR sensor. It will ensure that urban land records are accurate and up-to-date empowering urban citizens, improving ease of living and enabling better urban planning.

The one-year pilot programme NAKSHA would be implemented in 128 Cities across the country with Survey of India as Technical Partner under Digital India Land Records Modernization Programme (DILRMP).

9.1.9 International and National Memorandum of Understanding (MoUs) signed by SOI:

i. During the Hon'ble Prime Minister of India's visit to the Russian Federation, SOI Signed MoU with The Federal Service for the State Registration, Cadastre and Cartography (The Russian Federation) on 08 July, 2024 for the exchange of knowledge and experience in Geodesy, Cartography, Spatial Data Infrastructure, and Capacity Building.

Figure: Hon'ble Prime Minister of India visit to Russian Federation.

ii. During the visit of the Hon'ble Prime Minister of India, Sh. Narendra Modi, to the Federal Republic of Nigeria, when a historic Memorandum of Understanding (MoU) was signed on Survey Cooperation on 17 November, 2024. This MoU marks a significant step in focusing on the exchange of expertise in Geodesy, Cartography, and Spatial Data Infrastructure.

Figure: Hon'ble Prime Minister of India visit to Federal Republic of Nigeria

iii. Signed MoU with Geological Survey of India (GSI) on 08 February, 2024 for mutual data sharing and also for any R&D, training and capacity building as and when required for mutual benefit of both the departments.

iv. Signed MoU with National Highways Authority of India (NHAI) on 02 July, 2024 for developing SOPs and TOR for GIS – Based LAPs, capacity building programmes, CORS Network densification and creation of a Web Portal / Application.

v. Surveyor General of India, and Director General, IMD, have signed an MoU on 29 July,2024 for observation and study of various Earth system including CORS data sharing and to improve GNSS technology applications in the country

vi. Signed MoU with Delhi Development Authority (DDA) and Municipal Corporation of Delhi (MCD) on 29 August, 2024 for sharing Geospatial Data and mapping activities which will also help as base for integration of Data of DDA, MCD and various other departments in NCT of Delhi.

vii. Signed MoU with National High Speed Rail Corporation Limited (NHSRCL) on 25 November, 2024 for operation and maintenance of CORS Network established along Mumbai- Ahmedabad High Speed Rail Corridor.

9.1.10 Other Important Activities During the Year:

i. The Survey of India participated in the 3rd BRICS Working Group on Geospatial Technologies and their Applications, held on 16-17 September, 2024, in Moscow, Russia where discussions focused on national policies on geospatial technologies were held, with an aim to define a new vector of collaboration among BRICS nations.

ii. **44th INCA International Congress-2024** on the theme **"Smart Cartography for Viksit Bharat"** was hosted by Survey of India during 23-25 October, 2024, Kevadia, Narmada,

Gujarat. An exhibition was also organised during the congress showcasing Geospatial products, services and equipments for Cartographic surveying, remote sensing, GIS, GPS, Drones/ UAVSs etc. SOI also made live demonstration of the SOI Pubic Portal and CORS.

iii. **"13th Plenary Meeting of UN-GGIM-AP and UNGGIM Asia Pacific Conference on Geo- enabling data Economy for Sustainable Development"** was hosted by Survey of India from 26-29 November, 2024 at Bharat Mandapam, New Delhi, India. Approximately **90 International delegates** from **30 countries**, along with **120 delegates** from Indian attended this prestigious event. Delegates from reputed global organizations such as the International Association of Geodesy (IAG), the International Federation of Surveyors (FIG), and the United Nations Global Geospatial Knowledge and Innovation Centre (UN-GGKIC) were also in attendance.

9.2 National Atlas & Thematic Mapping Organisation (NATMO)

National Atlas and Thematic Mapping Organisation (NATMO), a Subordinate Office under the administrative control of the Union Ministry of Science & Technology (Department of Science & Technology), Government of India. NATMO is a pioneering organization engaged in Thematic Cartography, Atlas Cartography, Geographical Research and Training. NATMO extends its services to technocrats, professionals, research scholars, planners and students as well.

Thematic maps and atlases compiled by NATMO are popular across a large spectrum of stakeholders and also serve as the vital inputs for planning at various levels. The maps and atlases prepared by NATMO serve as visible tools to understand the changes and developments taking place in the domains of geo-environmental, political, socio-economic conditions in the country. NATMO covers almost all the themes pertaining to physical, political, economic, cultural, historical and other related environmental and societal issues that serve as the basic tools for a wide range of users including decision makers and the common public.

NATMO has a proven track record in urban mapping as well. Using high resolution satellite data rectified with GCPs (Ground Control Points) collected through detailed field survey using GPS, are being used as base information for the preparation of large-scale city maps. To promote tourism and related industry, maps on tourist places and routes including adventure tourism maps, maps on national parks and wild life sanctuaries are being prepared and updated.

The organization motivates the planners and decision makers to use maps as complimentary documents for development planning at national level, state/UT level and district and sub-district levels. District planning maps are being prepared to meet the planners' demand.

NATMO has the following mandates;

- Compilation of National Atlas in English, Hindi and other regional languages with timely updation.
- Preparation of School Atlases for all boards to provide accurate and standard base information for the educational institutions.
- Preparation of State Atlases and other special atlases.
- Generation of thematic maps and standardization of thematic information.
- Mapping of natural resource assessment towards sustainable socio-economic planning at district level.
- Large-scale mapping and development of digital cartographic base for utility-based services.
- Providing geographical education and training to visually impaired and low vision society through maps and atlases.
- Management of comprehensive Geo-informatics products for the service of the Nation through web portal.
- National and International cooperation on multidisciplinary geosciences through collaborative programmes.
- Providing unrestricted map service to all sections of the society.
- Other activities entrusted through the Administrative Ministry from time to time.

Major Activities and Achievements During the Year 2024-25

9.2.1 Extra departmental Projects: NATMO has made a significant achievement in collaborative projects with Department of Telecommunications, Government of India. Pilot project of Lohardaga District of Jharkhand State, including Gram Panchayat Boundary and Mobile tower mapping has been completed and submitted.

9.2.2 Technology Development Programmes

(a) Golden Map Service (GMS): On the occasion of Golden Jubilee Celebration of NATMO, this project was taken up with the aim to prepare large-scale map of the cities and towns of the country consisting minute level information relevant to the available utilities, communication, and land use. This map is very much useful for the planners, architects, tourists and the citizens as well. The basic objective of GMS is to map the physical connectivity between locations and all utilities spread across the cities and towns of the country. It also shows the locations with its

name, the drainage networks and general land use. GMS mainly intends to provide web map services and can cater the data requirements for Location Based Services (LBS). These maps are also useful for planners, tourists and the general citizens in the following segments;

i. Primary: To provide location maps of any site of the country in Black and white on web either by place-names or by Geographical co-ordinates.

ii. Secondary: To provide route maps between two points in the country.

iii. Tertiary: To provide a basis for a variety of social, economic, administrative operations related to elections, crime, rural marketing, relief and supply etc.

During the year, field work and data collection of Muzaffarpur GMS has been completed and the second stage of mapping is underway.

(b) District Planning Map Series (DPMS): As per the decision of DCUSPC, NATMO has been assigned this project by DST. Though initially this project was shared between NATMO and Survey of India, but later on NATMO has been assigned this project solely. The main objective is to provide a ready-reckoner to the planners, researchers, students in respect of complete geographical, geological, geomorphological, demographic, cultural information and features along with administrative boundary, blocks, specialty, etc. of a particular district both in paper format and in digitized format both in Hindi and English.

NATMO has already published 280 districts maps for the users. Digital version of the maps are also going on in the final stage and will be published for the users very soon. However, revision and updation work on account of formation of new districts, are in progress along with the rest project. This year NATMO has completed twenty (20) district maps till date and the same are awaiting for printing.

(c) Thematic Map: As a thematic mapping organisation, mapping on several themes of socio-political, cultural or economic importance are always under the purview of NATMO. The mapping of SDG Goal I and Goal II is currently under process.

(d) Thematic Atlas

i. Tribal Atlas: NATMO also prepares atlases on various themes. Now Tribal Atlas is one of the major projects of NATMO. The Atlas is now completed and ready for final printing.

ii. Commemorative Atlas: NATMO has taken up this task with fourteen different themes of contemporary importance. The atlas has been completed and scrutiny done. It is waiting for final approval for printing.

(e) National Atlas of India: In the year 1956, the Prime Minister of India, approved the formation of National Atlas & Thematic Mapping Organisation (then it was National Atlas Organisation) and granted the 'National Atlas Project' to NATMO. Hence, National Atlas is the

flagship publication of NATMO. Accordingly, 'भारत राष्ट्रीय एटलस' first published in the year 1957 and its English Version, 'National Atlas of India' was published in the year 1986. Since then, this publication is being updated and revised keeping pace with the administrative changes in respect of states, districts etc along with conversion in digital mode is under process. It has two main objectives;

i. To have India's National Atlas like the other countries of the world.

ii. To depict the country in respect of its geology, geography, geomorphology, demography, culture, administration, etc. in thematic map form.

National Atlas of India, both in English and in Hindi version, has been appreciated by the users of every corner. It is for the vertical demand of the users, NATMO is still publishing the editions of the Atlas till today and regular updation and revision of the same is going on. Revision of theme maps is a part of our mandate. Considering the situation National Atlas of one comprehensive volume is under preparation.

(f) Atlas For Visually Impaired (Braille): The visually challenged persons cannot use the traditional maps or atlases. Keeping the issue in mind, NATMO initiated the project to prepare Atlas for visually impaired in Braille script. Department of Science & Technology, Govt. of India provided financial support and approval for the same. And NATMO become the first ever in the country to publish 'Atlas for Visually Impaired' in Braille script, depicting all the continents and with special emphasis on India. The main objective is to disperse the technological development amongst the people who cannot get it due to their physical disability, i.e. blindness. Publishing Maps and Atlases in Braille Script will definitely provide the utility of maps to the visually challenged person.

'Atlas for Visually Impaired' has become an eye opener for the visually impaired students and several requests from all the states are being received by NATMO. Similarly NATMO has started preparing Braille atlas in different regional languages due to demand from different states schools and accordingly Atlas of Karnataka and Tamil Nadu is now in the final process of printing.

(g) Monographs: Monographs are published by NATMO on specific topics. NATMO's monographs on Geomorphology, Lakshadweep, are popular among the series. "Shaktipiths of India", a monograph on the historical review of the Shaktipiths that elaborates the historical events connected to Hindu religion through various thematic maps. Printing of the monograph is currently under process.

CHAPTER 10

ADMINISTRATION

The administration and finance divisions of the Department continued to provide support and necessary administrative support for smooth functioning of the Department as well as its subordinate offices.

10.1 General Administration

In the year 2024, the Department successfully achieved savings of **approximately Rs. 52.50 Lakh** in electricity costs through the utilization of solar energy generated by rooftop solar power plants. Additionally, the Department generated **revenue of around Rs. 1.47 Crore** through multiple channels, including license fees from commercial entities such as banks and post offices, as well as reimbursements for proportionate shares of MCD service charges, and electricity and water consumption from government organizations housed within Technology Bhawan.

DST's 54th Foundation Day was celebrated in Technology Bhawan on 03rd May 2024, marking a significant milestone in the department's continued journey of promoting scientific and technological advancements in India. The event was graced by Dr. Arogyaswami J Paulraj, Professor (Emeritus) at Stanford University, as the Chief Guest. Dr. Paulraj's contributions in India between 1970 to 1990 were in development of ASW sonar technology for the Indian Navy and founding three national research centers in Artificial Intelligence and Robotics, Advanced Computing and Military Electronics. He has received several recognitions in India including the Padma Bhushan, the country's third highest civilian honor. Dr. Paulraj delivered a lecture on deep learning.

Crèche Facility at DST Campus: Department recognized the significant demand from its officers, staff, and autonomous institutions located within the DST campus for a dedicated childcare facility. In response to this need, DST started a Crèche Facility from 01st May, 2024. The facility caters to the children of officers/ staffworking in Technology Bhawan, offering a safe and nurturing environment. Initially, the crèche has a capacity to accommodate up to 16 children.

Swachhata Hi Sewa 2024 and Special Campaign 4.0 for Institutionalizing Swachhata and minimizing Pendency in Government offices was organized in two phases – Preparatory Phase from 16th September, 2024 to 30th September 2024 and Implementation Phase from 2nd October 2024 to 31st October, 2024. Some of the activities organized under special campaign were:

- To spread Swachhata awareness among the children, a drawing/painting competition was organized on 17 to 18 September 2024 for students from various States/UTs on the topic “Clean India of my Dream”.
- Lecture cum Awareness Session on “Cleanliness & its Impact on Health” were organized during 20th to 30th September, 2024 in Government Schools nearby Technology Bhawan.
- Organized Safai Mitra Suraksha Shivir, and distributed the safety kits to the House Keeping Staff for their safety. During the shivir, department arranged a health check-up and health insurance camp for the outsourced employees and sanitary workers on the campus.
- In order to make a clean and female-friendly workspace, sanitary napkin vending machines were installed in 14 female washrooms in the Technology Bhawan as a part of Mission Shakti of the WCD Ministry.
- Installed vermicompost for waste generated in Department Canteen and office campus of DST.
- Conducted a plantation drive under the “Ek Ped Maa Ke Naam” in the nearby school and also in the DST campus.

Disposal of Waste:

- The e-waste accumulated at Technology Bhawan was disposed of in accordance with the prescribed procedures. This not only helped free up approximately 500 sq.ft. of valuable space but also generated a revenue of Rs. 2,66,176 for the government exchequer.
- Furthermore, scrap and obsolete items accumulated at the Vigyan Sadan Transit Hostel cum Guest House, located at Sector-10, RK Puram, New Delhi, were successfully disposed of. This process resulted in the reclamation of 800 sq.ft. of space and generated additional revenue of Rs. 20,000.

Rashtriya Ekta Diwas 31st October is observed as Rashtriya Ekta Diwas every year on the occasion of the birth anniversary of Sardar Vallabhbhai Patel, the architect of national integration of independent India. To mark the occasion, a pledge-taking ceremony was organised on 30th October, 2024 in the Reception Area of New Technology Bhawan-1.

10.2 Staff Position

	Group A							
	Category	General	OBC	SC	ST	EWS	Total	PH
Gazetted	Scientific	72	12	8	4	0	96	2
	Non-Scientific	36	7	10	1	0	54	1

	Group B							
	Category	General	OBC	SC	ST	EWS	Total	PH
Gazetted	Scientific	4	1	0	0	0	5	1
	Non-Scientific	35	8	4	2	0	49	1
Non Gazetted	Non-Scientific	36	17	6	1	1	61	3
	Group C							
Non Gazetted	Scientific	0	0	0	0	0	0	0
	Non-Scientific	50	33	46	8	6	143	7

10.3 Parliament Unit

Parliament Unit serves as central coordinating point for all parliamentary work of the Department. It is responsible for handling entire parliamentary work of the Department, viz. Parliament Questions, fulfilling assurances, analyzing reports of Parliamentary Committees, etc. It ensures that the parliamentary work pertaining to the Department of Science & Technology is accomplished as per the prescribed schedule and procedures.

The unit maintains liaison with the Ministry of Parliamentary Affairs, Secretariats of Lok Sabha/ Rajya Sabha, other Ministries/Departments (including Scientific Departments) with a view to fully discharge the parliamentary obligations of the Department of Science & Technology.

The Unit coordinates work relating to consideration of Detailed Demand for Grants by the Parliamentary Standing Committee and also coordinates the visits of the Parliamentary Committees to various scientific institutions which are under the administrative control of this Department. The Department related Parliamentary Standing Committee (DRPSC) on S&T & EFCC visited Institute of Advanced Study in Science and Technology(IASST), Guwahati in November, 2024 and inspected various activities being carried out by the Institute. This visit was successfully coordinated by Parliament Unit with Autonomous Institutions Division of DST and IASST.

The Unit has also developed an IT enabled searchable repository of Parliament Questions that were answered in the past for aid of officers and officials of Programme Divisions for easy retrieval and reference. Parliament Unit regularly updates this portal and till date, replies given to Parliament Questions up to Budget/Monsoon Session 2024 have been updated in the portal.

10.4 Implementation of Official Language Policy

The Department of Science and Technology continued to make concerted efforts to promote the use of Hindi in official work and to ensure compliance with the provisions of the Official Language Act, 1963 as amended in 1967 and Rules 1976 framed thereunder as also the various orders / instructions issued by the Department of Official Language from time to

time with a view to ensure proper implementation of the Official Language Policy of the Government.

DST has a full - fledged Hindi Division consisting of a Deputy Secretary, Deputy Director (O.L.), and other supporting staff which caters to the need of the Department of Science & Technology. Besides monitoring the implementation of the Official Language Policy and the Annual Programme, Hindi Division helps arranging for in-service training of the staff in Hindi Language, Hindi Typewriting and Hindi Stenography. It also undertakes translation of the material received from various Sections / Desks of the Department from English to Hindi as per need.

For promotion of use of Hindi in this Department and to create conducive environment for the officials to work in Hindi, various programmes are being undertaken in FY 2024-25. During the year, meetings of Departmental Official Language Implementation Committee and Hindi workshops were organized every quarter to encourage the officers / staff of the Department to execute most of their administrative work in Hindi.

Celebration of Hindi Pakhwara: Various Hindi competitions were organized during the Hindi Pakhwara of the Department, held from 13 to 27 September, 2024. During the Pakhwara, successful participants were given cash awards and certificates. This year some new events were organised, including an Essay Writing Competition exclusively for the scientists, Extempore Translation Quiz and Antakshri.

10.5 Right to Information

The Right to Information Act, 2005 was enacted by the Government of India to promote transparency and accountability in its functioning.

The Department of Science and Technology has been implementing the RTI Act in its letter and spirit. The DST has been regularly making suo-moto disclosures on its website to ensure transparency in its functioning, as required under Section 4(1)(b) of the RTI Act, 2005.During the period from 1st January 2024 to 20th December 2024, 870 RTI applications and 45 First Appeals were received by the Department out of which 836 RTI applications and 41 Appeals have been disposed of as per the provisions of the RTI Act, 2005.

10.6 Public Grievance Redress

The public Grievance redress mechanism is an instrument to gauge and measure the efficiency and effectiveness of an organization as it provides important feedback on its work. An essential pre-requisite to making the public service delivery system more accountable and responsive is to have a robust public grievance redress and monitoring mechanism.

The Department of Science and Technology has made concerted efforts to redress the grievances and appeals received from its stakeholders and the public at large.

1037 public grievances were received by the Department during the period from 1st January, 2024 to 20th December, 2024. In addition to this, there was a backlog of 77 grievances. Out of these 1114 grievances (1037+77), a total of 1081 grievances have been disposed of by 20th December, 2024.

Further, 154 appeals were received in respect of public grievances during the period from 1st January 2024 to 20th December 2024. In addition to this, there was a backlog of 13 appeals. Out of these 167 appeals (154+13), 165 appeals have been disposed of by 20th December, 2024.

10.7 Special Campaign 4.0

The Department of Science & Technology (DST), its subordinate offices and Autonomous Institutions vigorously participated in the Swachhata Campaign 4.0 which was carried out during 2nd-31st October, 2024. The Achievements/ Outcomes of DST including its subordinate offices and Autonomous Institutions during the Special Campaign 4.0 are as under:-

(i) DST, along with its subordinate and Autonomous Institutions carried out swachhata drives at 894 sites.

(ii) A total of 30,731 files were reviewed and out of them 14,090 files have been identified for weeding out. All 14,090 files identified for weeding have been weeded out during the Implementation phase of Special Campaign 4.0.

(iii) A total of 321 e-files have been closed after a review of 525 e-files.

(iv) All eight pending VIP references identified during the preparatory phase were disposed of.

(v) All the 42 Public Grievances which were identified during the preparatory phase were disposed of during the implementation phase.

(vi) All eight Public Grievance Appeals identified during the preparatory phase were also disposed of.

(vii) A total of Rs. 41,62,917 has been generated as revenue by DST, its Subordinate, and Autonomous Institutions by way of disposal of scrap, and 4,76,353 sq feet of space has been freed.

DST and its Subordinate and Autonomous Institutions have issued more than 50 tweets by using the Special Campaign 4.0 hashtag. Moreover, three press releases about the Special Campaign 4.0 conducted in the Department of Science and Technology have been issued.

10.8 Vigilance

1. The Vigilance Unit of the Department of Science & Technology (DST) is headed by a Chief Vigilance Officer (CVO), who is a Scientist 'G' of the Department. He is supported by a Deputy Secretary, an Under Secretary, a Section Officer and other Secretarial Staff.

2. Apart from handling vigilance related cases of the Department, its subordinate offices and autonomous institutions, it also deals with complaints received directly from complainants, the Central Vigilance Commission (CVC), Central Bureau of Investigation (CBI) and other sources. It plays an active role in ensuring the prompt disposal of these complaints. The Vigilance Unit also handles vigilance disciplinary proceedings and maintains a regular touch with the CVC and when necessary, with the CBI.

3. During 2024 (as on 31.12.2024), Vigilance Unit dealt with the following number of complaints:

Source	Opening Balance	Recd. During the year	Total	Disposed	Balance
CVC	0	26	26	26	0
Others	4	42	46	46	0

4. The Vigilance Unit also consolidates various reports/returns received from the Subordinate Offices and Autonomous Institutions on vigilance matters and furnishes these reports (monthly, quarterly and annual basis) to the Central Vigilance Commission and Department of Personnel and Training. The Department also maintains Agreed List in consultation with the CBI and List of Officers of Doubtful Integrity of Gazetted status.

5. Besides, CVO maintains close liaison with all Attached/Subordinate Offices/Autonomous Institutes under DST to ensure timely completion of various vigilance tasks. A Vigilance Portal has also been operating to provide vigilance status of the officials of DST.

6. In addition, 3 days "The Administrative Vigilance Training' Programme was organized by Department of Science and Technology at Indian National Science Academy (INSA), New Delhi during the period from 31.07.2024 to 02.08.2024 aiming to enhance the understanding and capabilities of Part-time Chief Vigilance Officers (CVOs), Vigilance Officers (VOs) and other officers involved in vigilance and disciplinary matters within Subordinate Offices and Autonomous Bodies under DST.

Figure: Group Photo of part-time CVOs of AIs under DST

7. In accordance with the directives of the CVC to spread awareness about transparency, accountability and corruption free governance, Vigilance Awareness Week was also observed in DST from 21st October to 28th October 2023. On this occasion an Integrity Pledge was administered to employees of DST & DSIR by Chief Vigilance Officer, DST and Joint Secretary (Admin.). Various events like Essay Writing Competition, Slogan Writing Competition, Drawing Competition for children of employees, Poster Making competition, Story Weaving Competition, Workshop on 'Ethics & Values' were also organized for DST employees during the celebration of Vigilance Awareness Week, 2024.

VIGILANCE AWARENESS WEEK 2024

Figure: Integrity Pledge administered in DST and Drawings made by the Children of DST employees

10.9 Status note on compliance of cyber security

Following activities/measures were undertaken towards strict compliance of cyber security guidelines during the period:

- Facilitated the formation of the NIC Cyber Security Team within the Department of Science and Technology (DST).
- A comprehensive inventory of all endpoints, including desktops, laptops, tablets, IoT devices, network components and security devices connected to DST's network were prepared.
- Conducted a physical verification of approximately 700 endpoints by a Committee comprising the NIC Network Team, Cyber Security Team, ICT Team, and DST Admin.
- Installed Unified Endpoint Management (UEM)/Endpoint Detection and Response (EDR) solutions on all endpoints and removed administrative rights to enhance security.
- Enforced robust password policies across all systems to strengthen access controls.
- Implemented MAC address binding for network ports to prevent unauthorized device access.
- Identified and removed potentially unwanted applications from all endpoints to minimize security risks.
- Developed High-Level Design (HLD) and Low-Level Design (LLD) documentation for the Technology Bhawan network to ensure structured and secure implementation.
- Initiated the replacement and deployment of outdated network switches to ensure optimal performance and security.
- Upgraded all outdated operating systems to their latest versions to ensure compatibility and mitigate security vulnerabilities.
- Started the phased replacement and deployment of outdated endpoints to maintain technological readiness and improve performance.
- Conducted regular Cyber Security Awareness Programs for DST officers and officials, enhancing their knowledge of cyber security risks and best practices.
- Facilitated an ICT infrastructure audit conducted by NIC and CDAC to assess and improve system security.
- Implemented recommendations from the Intelligence Bureau (IB) audit carried out in August 2022, addressing identified cyber security gaps.

- Regularly conducted Vulnerability Assessment and Penetration Testing (VAPT) for all departmental websites to identify and remediate vulnerabilities.
- Timely renewal of SSL certificates and security audits in collaboration with CERT-In empanelled agencies was conducted.
- Cyber security advisories to DST officers and officials, ensuring awareness of current threats and best practices were circulated time to time.
- Reviewed and enhanced implemented security policies by identifying potential threats and vulnerabilities and making necessary adjustments.
- Successfully mitigated all reported cyber security incidents ensuring continuous protection.
- Initiated the development of a Cyber Crisis Management Plan (CCMP) to improve incident response and disaster recovery capabilities.

10.10 Data & Strategy Unit

The Data & Strategy Unit (DSU) of the Department plays a pivotal role in fostering integration within the Department by developing robust monitoring and data systems, with a strong emphasis on data quality and security. The DSU's key responsibility includes coordinating with scheme divisions, external partners such as States, Ministries/Departments, research organizations, private players, and academic institutions, and overseeing the Data Governance Quality Index (DGQI) action plan under the guidance of NITI Aayog. The Unit also facilitates regular data analysis to support evidence-based policy decisions.

Key Achievements and Initiatives: -

- DGQI Leadership: DSU achieved the 1st rank in DGQI practices among Scientific Ministries/Departments with an outstanding score of 4.68/5.00.
- Engagement with Scientists: The Unit actively interacts with newly appointed scientists apprising them of Department's various activities, budget, and expenditure.
- Collaborative Spaces: The DSU has established a shared platform within the DST for open discussions on data management and its significance. Additionally, the DSU collaborates with other agencies such as ANRF, TDB, and others.
- Financial Oversight: The DSU coordinates financial data submissions for Budget Expenditure Review meetings.
- Annual Project Report: The DSU published the "Annual Project Report" for FY 2023-24, visually summarizing funding distribution across states, institutions, and gender categories for New Projects supported by the DST during FY 2023-24.

- Dashboard Development: Since 2017, the Unit has maintained interactive dashboards for all DST schemes and is developing program-specific dashboards to enhance monitoring, evaluation, and research.
- Internship Programme: The DSU runs a vibrant Internship Programme, encouraging students from diverse academic institutions to contribute innovative ideas toward achieving the Unit's objectives.
- Streamlining Data Processes: The DSU has optimized the data collection processes within the Department for creating thematic posters and data infographics at Technology Bhawan, which depict concise visual insights into DST's schemes.
- Capacity Building: The officials from the Unit participated in capacity-building sessions, including a workshop on the Hybrid-TSA model, Ministry of Rural Development, NITI Aayog etc. The officials from the Unit also attended the National Conference on Artificial Intelligence in Governance and Legalities Post GPT-4O, reflecting its commitment to innovation.

The DSU remains committed to enhancing the Department's data capabilities, fostering collaboration, and supporting informed decision-making for the advancement of science and technology in India. Some of works related to Dashboard, Report & Data Infographic are depicted below as examples.

Figure: Glance of DSU's Dashboard, Report & Data Infographic

DEPARTMENT OF SCIENCE & TECHNOLOGY

Data & Strategy Unit
DEPARTMENT OF SCIENCE & TECHNOLOGY
Government of India

DST @ 2024 REWIND

India's Achievements

- 3rd global ranking in **Scientific Publications 2023** (Scopus)
- 6th globally in **Intellectual Property Filings 2023** (WIPO)
- 39th rank in the **Global Innovation Index 2024** (GII)
- 49th rank in the **Network Readiness Index 2024** (NRI)

NQM

The Union Cabinet, approved **Rs.6003.65** crore National Quantum Mission (NQM) to foster Quantum Technologies in India.
These T-Hubs comprises of **14** Technical Groups having **17** Project Teams across India, involving nearly **152** researchers from **43** institutions.

Thematic Hubs

- **Quantum Computing** – IISc-Bangalore
- **Quantum Communication** – IIT-Madras & C-DoT
- **Quantum Sensing & Metrology** – IIT-Bombay
- **Quantum Materials & Devices** – IIT-Delhi

ANRF

Prime Minister Sh. Narendra Modi chaired the inaugural meeting of the ANRF Governing Body in Feb, 2024. Established under the ANRF Act 2023, the foundation aims to **harness India's research and innovation potential** for global scientific and technological excellence.
Launched Special Calls: Prime Minister Early Career Research Grant **(PMECRG),** Mission for Advancement in High-Impact Areas -Electric Vehicle **(MAHA-EV)** Mission, Inclusivity Research Grant **(IRG),** Partnerships for Accelerated Innovation & Research **(PAIR)**

Vigyan Dhara

The Union Cabinet, chaired by the Prime Minister Sh. Narendra Modi, approved continuation of the three umbrella schemes (S&T Institutional and Human Capacity Building, Research and Development & Innovation, Technology Development and Deployment.) merged into a unified central sector scheme namely 'Vigyan Dhara' of DST.

The primary objective of the scheme is to promote capacity building in science and technology (S&T), as well as to advance research, innovation, and technology development.

DST INTERNATIONAL

14th India-EU Science & Technology Cooperation meeting

Inauguration of India-French node

Golden Jubilee celebration of Indo-German S&T Co-operation

DST Delegation at BRICS STI Meeting

India-Finland Joint S&T Committe Meeting

Bilateral India-Italy collaboration

Hon'ble Prime Minister

- Announced **National Quantum Mission.**
- Chaired the **ANRF** Governing Board of meeting & launched **PM-ECRG.**
- Approved the unified central sector scheme **'Vigyan Dhara'** for DST.

EVENTS @ 2024

Dr. Jitendra Singh Hon'ble Minister S&T announced **8 startups** for funding in quantum technologies through NM-ICPS.

Inauguration of VR show on Digital Ajanta (SHRI).

IISF-EXPO (IIT Guwahati)

Startup Utsav event at IIT-D celebrating 8 Yrs of NIDHI (TTI).

The **11th NLEPC** at Vigyan Bhawan (INSPIRE-MANAK)

Samuhik Charcha organised by India_DST as part of the #NationalLearningWeek (NLW).

DST received **11000+** Scientific Proposals in **42** Call for Proposals including **7** Special Calls

AUTONOMOUS INSTITUTIONS

20 Institutions + 05 Professional Bodies provided grants in support.

Highlights Of 2024

- **CeNS** developed a high-performance **NOx sensor**
- **ARCI** collaborated with **M/s. Altmin Pvt Ltd., Hyd.,** making LFP cathode powder material for **li-ion batteries.**
- **IIA** fabricated the first **1.44-m mirror segment for TMT**
- **TIFAC** prepared the Technology **Roadmap 2047 for DRDO.**

DIVISIONS

INSPIRE

- Inspire Manak NLEPC Received **10k+** Visitors, **350** Participants and **1M+ entries.**
- **10** Japanese students along with 2 supervisors visited India & **9** INSPIRE Fellows visited Japan.
- **34343** INSPIRE Scholars, **3363** INSPIRE Fellows and **316** INSPIRE Faculty Fellows are supported

R&D SUPPORT

- Supported **115 Depts.** and **22 PG Colleges** under **FIST.**
- Established **3** new SATHI centers selected (**IIT-Hyd, ICT-Mumbai & BITS-Pilani**).
- Supported **9 new Univ.** under **PURSE**

WISE KIRAN

- Launched 2 new Programs **WINGS and WiSLP**
- **340** women scientists have been selected under 3 major fellowship programmes (WISE-PhD, WISE-PDF & WIDUSHI).
- Vigyan Jyoti benefitted **29k+** girls from **300** district & **34** states
- CURIE- **22** Women PG Colleges have been selected to establish state-of-the-art research facilities.

NATIONAL GEOSPATIAL PROGRAM

- **Spatial Thinking Program** in schools initiated covering **7**-States, **49**-District, **116**-Schools, **154**-Teachers and **6,205** Students.
- **Geo-Innovation Challenge** & various Summer/ Winter Schools impacted **575+** stakeholders.
- **Special call** for proposal in consortium of Academia, Industry/Start-up and User agency for **ground level geospatial solutions.**

SHRI

- Launched include **Kosh Shree,** a crowdsourced Sanskrit dictionary; **Sakshatkar,** a book on India's scientific heritage; and a Yoga Module (under SATYAM) for diabetes management.
- Introduced **Purple Himalayas Herbal Tea, HerbalHeal** wound care products inspired by tribal knowledge, and an **Advanced Electronic Jacquard** for enhancing handloom weaving.

TTI

- Established **8 new iTBIs.**
- Initiated **DST-GDC IITM I-NCUBATE** Program.
- Established **NIDHI CoE MedTech** at **IIT-Kanpur**
- Signed a Joint Declaration of Intent **JDI** with **DAAD Germany** for exchange of innovators.
- Supported **550 Innovators** for Prototype development (NIDHI program)

CEST

- India's **1st CO2-Methanol pilot plant** at Thermax Limited (Pune).
- DST, UNL, and IUSSTF launched Phase II of the **WARI Fellowship** program.
- 21-day District-level **Climate Risk Assessment program** benefited 20 doctoral and post-doctoral students nationwide.
- **White Paper on e-mobility** released during National Science Day.
- **DST & IIT Bombay** achieved **key milestones** in **Hydrogen** storage, purification, & vehicular applications.
- DST-EU pilot project for sustainable energy in West Bengal and Odisha.
- Launched the **"Transforming Aandhi Village"** project in Rajasthan, inaugurating **zero-waste plants** at key local sites.

NM-ICPS

- Supported **461** Start-ups, **417** Technologies developed, **188** Patent filled, **32k+** Manpower generated, **63k+** Beneficiaries trained, **54** International Collaborations.

CHAPTER 11

AUDIT

Annexure-I
Position as on 23.01.2025

Detailed position of Action Taken Notes (ATNs) as per Audit Para Monitoring System (APMS) portal to be included in the Annual Report of DST for the year 2023-2024 is given below:

Sl. No.	Year	No. of Paras/PA Reports on which ATNs have been submitted to PAC after vetting by Audit	Details of the Paras/PA reports on which ATNs are pending.		
			No. of ATNs not sent by the Ministry even for the first time.	No. of ATNs sent but returned with observations and Audit is awaiting their resubmission by the Ministry	No. of ATNs which have been finally vetted by audit but have not been submitted by the Ministry to PAC
	Nil	Nil	Nil	Nil	Nil

Annexure-II
Position as on 23.01.2025

Summary of important Audit Observations pertaining to DST:

----NIL----

CHAPTER 12

BUDGET

FINANCIAL STATEMENT

Summary of Financial Requirements					
S. No.	Head of Development Projects/ Programme Schemes	(Rs. In crore)			
		Expenditure 2023-24	BE 2024-25	RE 2024-25	BE 2025-26
1	Science And Technology Institutional And Human Capacity Building	367.73	900.00	523.85	Vigyan Dhara
2	Research and Development	67.87	391.00	164.05	
3	Innovation, Technology Development and Deployment	89.01	536.61	321.65	
4	Vigyan Dhara	---	----	240.45	1425.00
5	National Mission On Interdisciplinary Cyber Physical System (NM-ICPS)	435.00	564.46	815.00	900.00
6	National Quantum Mission	0.00	427.00	86.00	600.00
7	Super Computing			200.00	265.00
8	Secretariat	110.04	122.61	117.59	126.45
9	Survey Of India	446.33	533.64	544.39	597.49
10	NATMO	32.94	31.19	36.74	34.21
11	Science Counselors Abroad	7.39	8.50	12.53	13.70
12	Autonomous Institutions and Professional Bodies	1547.61	1612.20	1627.20	1746.80
13	Science and Engineering Research Board	1004.50	803.00	766.00	693.25
14	Technology Development Board	4.70	100.00	6.00	7.00
15	National Research Foundation (NRF)	0.00	2000.00	200.00	2000.00
	(C) Total- Other Central Expenditure	**4113.11**	**8030.21**	**5661.45**	**8408.90**

Annexure

Ministry of Science and Technology
Department of Science and Technology

Statement showing Grants-in-aid ranging from Rs. 10 lakh to Rs. 50 lakh (both recurring & non-recurring), sanctioned to private institutions/ voluntary organizations during the year 2024-25

Serial No.	Name of the institution / organization / individual	Ministry / Department giving the grant	Recurring (Rs. In thousands)	Non-recurring (Rs. In thousands)	Purpose of the grant
1.	Department of Mechanical, Bits Pilani Kk Birla Goa Campus, Zuarinagar, South Goa-403726	Department of Science and Technology		7500.000	Fund for Improvement of S&T Infrastructure in Universities and Higher Educational Institutions (FIST)
2.	Department of Electrical and Electronics Engineering, Bits Pilani Hyderabad Campus, Shameerpet Mandal, Hyderabad, Telangana, 500078	-do-		9000.000	Fund for Improvement of S&T Infrastructure in Universities and Higher Educational Institutions (FIST)
3.	Department of Control and Automation, Vellore Institute Of Technology, Vellore, Tamil Nadu- 632006	-do-		5775.000	Fund for Improvement of S&T Infrastructure in Universities and Higher Educational Institutions (FIST)
4.	Department of School of Chemical Technology, Kalinga Institute Of Industrial Technology (Deemed To Be University), Bhubaneswar, Khordha, Orissa -751024	-do-		6375.000	Fund for Improvement of S&T Infrastructure in Universities and Higher Educational Institutions (FIST)
5.	Department of Eied, Thapar Institute Of Engineering And Technology University, Patiala, Patiala, Punjab -147004	-do-		7500.000	Fund for Improvement of S&T Infrastructure in Universities and Higher Educational Institutions (FIST)

Serial No.	Name of the institution / organization / individual	Ministry / Department giving the grant	Recurring (Rs. In thousands)	Non-recurring (Rs. In thousands)	Purpose of the grant
6.	Sanatana Dharma College, Alappuzha, Alappuzha, Kerala-688003	-do-		5250.000	Fund for Improvement of S&T Infrastructure in Universities and Higher Educational Institutions (FIST)
7.	Centre for Nano and Material Sciences, Jain University, Kanakapura, Bengaluru Rural, Karnataka-562112.	-do-		16500.000	Fund for Improvement of S&T Infrastructure in Universities and Higher Educational Institutions (FIST)
8.	Department of Computer Engineering, R K University, Rajkot, Gujarat -360020	-do-		6375.000	Fund for Improvement of S&T Infrastructure in Universities and Higher Educational Institutions (FIST)
9.	Yashawantrao Chavan Institute Of Science Satara, Maharashtra - 415001	-do-		7500.000	Fund for Improvement of S&T Infrastructure in Universities and Higher Educational Institutions (FIST)
10.	Department of Space Engineering and Rocketry, Birla Institute Of Technology Mesra, Ranchi, Jharkhand-835215	-do-		7500.000	Fund for Improvement of S&T Infrastructure in Universities and Higher Educational Institutions (FIST)
11.	Department of Pharmacy, BIRLA Institute Of Technology And Science (Bits), Pilani Campus, Pilani, Jhunjhunu, Rajasthan -333031	-do-		15000.000	Fund for Improvement of S&T Infrastructure in Universities and Higher Educational Institutions (FIST)
12.	Rajarshi Shahu Mahavidyalya, Latur, Maharashtra- 413512	-do-		5625.000	Fund for Improvement of S&T Infrastructure in Universities and Higher Educational Institutions (FIST)

Serial No.	Name of the institution / organization / individual	Ministry / Department giving the grant	Recurring (Rs. In thousands)	Non-recurring (Rs. In thousands)	Purpose of the grant
13.	Arya Vidyapeeth College, Guwahati, Kamrup Metropolitan, Assam-781016.	-do-		5737.000	Fund for Improvement of S&T Infrastructure in Universities and Higher Educational Institutions (FIST)
14.	Department of Department of Chemistry, Karunya Institute Of Technology And Sciences, Coimbatore, Tamil Nadu - 641114	-do-		9000.000	Fund for Improvement of S&T Infrastructure in Universities and Higher Educational Institutions (FIST)
15.	Vimala College (Autonomous), Thrissur, Kerala - 680009	-do-		5625.000	Fund for Improvement of S&T Infrastructure in Universities and Higher Educational Institutions (FIST)
16.	M S Ramaiah Institute Of Technology, Bengalru, Bengaluru Urban, Karnataka -560054	-do-		6000.000	Fund for Improvement of S&T Infrastructure in Universities and Higher Educational Institutions (FIST)
17.	Siddaganga Institute Of Technology, Tumakuru, Karnataka -572103	-do-		5000	Fund for Improvement of S&T Infrastructure in Universities and Higher Educational Institutions (FIST)
18.	SRM Institute Of Science And Technology (Formerly Srm University), Chennai, Kanchipuram, Tamil Nadu -603203	-do-	11250.000		Support for Up-gradation Preventive Repair & Maintenance of Equipment (SUPREME)
19.	Birla Institute Of Technology And Science (Bits), Pilani, Pilani Campus, Pilani, Jhunjhunu, Rajasthan- 333031	-do-	5600.000	322500.000	Sophisticated Analytical & Technical Help Institutes (SATHI)

Serial No.	Name of the institution / organization / individual	Ministry / Department giving the grant	Recurring (Rs. In thousands)	Non-recurring (Rs. In thousands)	Purpose of the grant
20.	SRM Institute of Science and Technology, Srm Nagar, Potheri, Kattankulathur – 603 203	-do-	9260.000		Promotion of University Research and Scientific Excellence (PURSE)
21.	Manpower Management Ce, New Delhi	-do-	3515.000	0	Directories of Extramural R&D projects for the year 2021-22, 2022-23 & 2023-24
22.	Punjab Engineering College, Chandigarh	-do-	2529.000	0	National S&T survey for Higher Education Sector
23.	The Energy and Resources Institute, New Delhi	-do-	5721.000	0	National S&T survey on resources devoted to R&D activities 2024-25 for central sector & private sector
24.	Vishnu Institute of Technology, Bhimavaram, West Godavari, Andhra Pradesh	-do-	1482.000	0	Promoting innovations in rural entrepreneurs and artisans in Andhra Pradesh
25.	BITS Pilani Hyderabad Campus	-do-	1694.766	0	INSPIRE Faculty Fellowship
26.	Vellore Institute of Technology	-do-	1286.680	0	INSPIRE Faculty Fellowship
27.	Institute of Bioinformatics and Applied Biotechnology	-do-	2270.885	0	INSPIRE Faculty Fellowship
28.	TATA Institute for Genetics and Society	-do-	2133.333	0	INSPIRE Faculty Fellowship
29.	GLA University, Mathura, Uttar Pradesh	-do-	1120.000	0	INSPIRE Internship Science Camp
30.	Prayag Institute of Technology & Management, Prayagraj, Uttar Pradesh	-do-	1120.000	0	INSPIRE Internship Science Camp

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31.	ICFAI Foundation for Higher Education, Hyderabad, Telangana	-do-	1120.000	0	INSPIRE Internship Science Camp
32.	Amity University, Noida, Uttar Pradesh	-do-	1120.000	0	INSPIRE Internship Science Camp
33.	M C Saxena Colleges of Engineering & Technology, Lucknow, Uttar Pradesh	-do-	1120.000	0	INSPIRE Internship Science Camp
34.	Amity University, Mohali, Punjab	-do-	1120.000	0	INSPIRE Internship Science Camp
35.	Midnapore City College, Midnapore, West Bengal	-do-	1120.000	0	INSPIRE Internship Science Camp
36.	Shoolini University of Biotechnology and Management Sciences, Solan, Himachal Pradesh	-do-	1120.000	0	INSPIRE Internship Science Camp
37.	Invertis University, Bareilly, Uttar Pradesh	-do-	1120.000	0	INSPIRE Internship Science Camp
38.	Raghunath Prasad Degree College, Banda, Uttar Pradesh	-do-	1120.000	0	INSPIRE Internship Science Camp
39.	Kamaraj College, Tuticorin	-do-	1120.000	0	INSPIRE Internship Science Camp
40.	G. Narayanamma Institute of Technology & Sciences, Hyderabad	-do-	1120.000	0	INSPIRE Internship Science Camp
41.	Bharti Vidyapeeth Deemed University, Institute of Environment Education and Research, Pune, Maharashtra	-do-	2,813.680	--	To promote and build Geospatial Capabilities by conducting awareness and multi-level training programmes throughout the Nation.
42.	Anusandhan National Research Foundation (ANRF)	-do-	1026000 (Released)	50300 (Released)	Research and Development

Serial No.	Name of the institution / organization / individual	Ministry / Department giving the grant	Recurring (Rs. In thousands)	Non-recurring (Rs. In thousands)	Purpose of the grant
43.	Amrita Vishwa Vidyapeetham, Kochi, Kerala	-do-	3888.000		
44.	Kalinga Institute of Industrial Technology School of Biotechnology Bhubaneswar, Odisha	-do-	1364.000		
45.	Thapar Institute of Engineering and Technology Patiala, Punjab	-do-	2513.000		
46.	Bits Pilani Campus Jhunjhunu, Rajasthan	-do-	1066.000		
47.	Global Innovation and Technology Alliance (GITA),Delhi	-do-	5284.000		
48.	Association of Hydrologists of India, Visakhapatnam, Andhra Pradesh	-do-	1922.000		
49.	Maharaja Agrasen Institute of Technology Delhi	-do-	1225.000		
50.	Birla Institute of Technology and Science (BITS), Pilani, Hyderabad	-do-	1348.000		
51.	Graphic ERA(Deemed to be University), Dehradun, Uttarakhand	-do-	1674.000		
52.	Vellore Institute of Technology, Tamil Nadu	-do-	4506.000		
53.	KIIT Technology Business Incubator, Bhubaneswar, Khordha, Orissa, 751024	-do-	1738.960	--	KISS Science and Technology Innovation Hub for Tribals

Serial No.	Name of the institution / organization / individual	Ministry / Department giving the grant	Recurring (Rs. In thousands)	Non-recurring (Rs. In thousands)	Purpose of the grant
54.	KG Reddy College of Engineering and Technology, Hyderabad, Ranga Reddy, Telangana, 501504	-do-	1127.918	2300.000	Enhancing Livelihood of ST Farmer Community in Bheelyanaik Thanda by Development of Post-harvest Preservation Ecosystem for horticultural crops and flowers
55.	Utkalika Samiti, Jajpur, Jajpur, Orissa, 755051	-do-	1065.559	--	Survival of Surviving-A Project to Enhance Livelihood of PVTGs Through Introduction of Tuber Crop (Cultivation & Processing) in Sukinda Block of Jajpur District, Odisha
56.	EMRC FEEDS, Senapati, Senapati, Manipur, 795129	-do-	3557.298	3310.020	Production, scaling up and formulation of antiviral and anti-inflammatory herbal plant varieties by modern agricultural technology in the state of Manipur, A handholding program with farmers from backward communities for their economic growth
57.	World Wide Fund of Nature, India., Lodhi Estate, South Delhi, Delhi, 110003	-do-	2879.146	--	People and Protected Areas: Conservation and sustainable livelihoods in partnership with local communities-3rd Phase

Serial No.	Name of the institution / organization / individual	Ministry / Department giving the grant	Recurring (Rs. In thousands)	Non-recurring (Rs. In thousands)	Purpose of the grant
58.	Mutanchi Lom Aalshezum, Dzongu, North Sikkim, Sikkim, 737116	-do-	3841.454	1875.424	Promoting Natural Resource Base Integrated Livelihood Approaches Through Science Technology And Innovation Hub For Socio-Economic Development Of The Primitive Tribe In Dzongu Amp Kabi Blocks Of North District, Sikkim
59.	Society For Humanitarian Advancement with Key Technological Initiative (SHAKTI), Simulia, Balasore, Orissa, 756168	-do-	1049.482	--	S&T Intervention in Pottery Technology for Capacity building of Women potters in Bahabandha village of Siadimal Gp, Nilagiri block of Balasore district in Odisha
60.	Utkal Sevak Samaj, Cuttack, Cuttack, Orissa, 753003	-do-	1026.440	--	Organic Goat Milk and Meat as a means of income generation for coastal tribals
61.	Thakur College of Engineering and Technology, Mumbai Suburban, Maharashtra, 400101	-do-	--	2922.561	Utilization of Clay Brick Waste for Manufacturing of Eco-Friendly Building Materials to Improve Livelihoods of Katkari Tribals
62.	Anubhav Prathisthan Trust, Khopoli, Raigad, Maharashtra, 410203	-do-	1380.238	--	Introduce scientific technique to conserve and enhancement of indigenous knowledge and traditional skills, practices of katkari community to sustain their livelihoods

Serial No.	Name of the institution / organization / individual	Ministry / Department giving the grant	Recurring (Rs. In thousands)	Non-recurring (Rs. In thousands)	Purpose of the grant
63.	Amrita Vishwa Vidyapeetham, Coimbatore, Coimbatore, Tamil Nadu, 641112	-do-	1639.400	1183.408	Tribal empowerment through scientific validation of Indigenous Traditional Knowledge in agriculture through Land-Lab-Land cycle of scientific refining
64.	Bannari Amman Institute of Technology, Sathyamangalam, Erode, Tamil Nadu, 638401	-do-	1250.000	--	Technological Interventions for Enhancing Productivity, Scalability and Value Addition to Obtain Fiber from a Local Plant Urtica Dioicafor Tribals in Nagaland A Waste to Wealth Programme
65.	Gandhi Institute of Technology and Management (GITAM), Visakhapatnam, Visakhapatnam, Andhra Pradesh, 530045	-do-	3172.599	--	Science Technology and Innovation Hub in Paderu Division Paderu Mandal and Araku Valley Mandal, Alluri Sitharama Raju District, Andhra Pradesh State
66.	Ramakrishna Mission Vivekananda Educational and Research Institute, Belur Math, Howrah, West Bengal, 711202	-do-	2500.000	--	Science, Technology and Innovation Hub for Creating Sustainable Livelihood Opportunities of Scheduled Tribes in Angara Block, Ranchi District, Jharkhand

Serial No.	Name of the institution / organization / individual	Ministry / Department giving the grant	Recurring (Rs. In thousands)	Non-recurring (Rs. In thousands)	Purpose of the grant
67.	M S Swaminathan Research Foundation, Chennai, Chennai, Tamil Nadu, 600113	-do-	4400.000	2055.000	STI-Hub Up-scaling sustainable technological solutions and replicable models for ensuring food amp nutrition, livelihood and social security of Scheduled Tribes in selected Gram Panchayats of Koraput district, Odisha
68.	Kottayam Social Service Society, Thellakom, Kottayam, Kerala, 686630.	-do-	1793.340	--	Introduction and Popularization of Technologies suitable for Rejuvenation of the Aged Coffee plants for enhancing the growth and yield from Coffee cultivation in Idukki district of Kerala state
69.	KG Reddy College of Engineering and Technology, Hyderabad, Ranga Reddy, Telangana, 501504	-do-	1902.720	--	Empowering ST Women Folk by Upgrading Traditional Banjara's Embroidery Skill and Improving Livelihood of Rural ST Community of Kamareddy District by Standardising Mobile Milk Storage Facility

Serial No.	Name of the institution / organization / individual	Ministry / Department giving the grant	Recurring (Rs. In thousands)	Non-recurring (Rs. In thousands)	Purpose of the grant
70.	Marri Laxman Reddy Institute of Technology & Management, Hyderabad, Medchal Malkajgiri, Telangana, 500043	-do-	4710.000	3000.000	Agri Innovation Hub for Development of Scheduled Tribe ST Community in Narsampet Block, Warangal District, Telangana State
71.	Anurag University, Hyderabad, Hyderabad, Telangana, 500088.	-do-	1147.000	2084.670	To empower sustainable development for Scheduled Tribe community of Dupahad cluster, Suryapet District, State Telangana
72.	Assam Down Town University, Guwahati, Kamrup Metropolitan, Assam	-do-	1835.558	3800.000	Strengthening ST community of Anini, Arunachal by empowering indigenous knowledge and skills for socioeconomic development and sustainable Livelihood
73.	Thakur College of Engineering and Technology Thakur Village, Kandivali East, Mumbai, Maharashtra	-do-	--	2922.561	Utilization of Clay Brick Waste for Manufacturing of Eco-Friendly Building Materials to Improve Livelihoods of Katkari Tribals
74.	Amrita Vishwa Vidyapeetham Ettimadai Campus Coimbatore – 641112, Tamil Nadu	-do-	1639.400	1183.408	Tribals empowerment through scientific validation of Indigenous Traditional Knowledge in agriculture through Land- Lab-Land cycle of scientific refining

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75.	Anubhav Prathisthan Trust Survey No 6, 183/2/D Jakhotia Arcade, Shilphata Khopoli – 410203, Maharashtra	-do-	1380.238	--	Introduce scientific technique to conserve and enhancement of indigenous knowledge and traditional skills, practices of katkari community to sustain their livelihoods
76.	Malla Reddy Engineering College (Autonomous) Maisammaguda, Dhulapally, Hyderabad – 500100, Telangana	-do-	--	1191.343	Addressing different challenges of Konda Reddy Tribe through sustainable interventions
77.	Sophitorium Engineering College Odisha state	-do-	4000.000	--	Science Technology and Innovation STI Hub in Khurda Block STI – HUB KHURDA, Odisha STI HUB KHURDA District, Odisha State
78.	Vels Institute of Science, Technology and Advanced Studies (Vistas) Chennai, Tamil Nadu 600117	-do-	4800.000	--	STI-Hub for Technology enabled Production and Marketing of Value-added Agricultural products to enhance the Livelihood of SC Community in Thellur Block
79.	Search and Research Development Society Bhopal, Madhya Pradesh 462002	-do-	2390.585	--	Socio-economic upliftment of SC/ST beneficiaries through S and T based eco-friendly integrated intervention in Timarni Block of Harda District

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80.	Marri Laxman Reddy Institute of Technology and Management Telangana State 500043	-do-	1800.000	--	Economic and Social upliftment of Masons through Eco-friendly Construction Materials and Skill Development with Special Focus on SC Community in Medchal Mandal, Medchal-Malkajgiri District, Telangana State
81.	Anurag University Hyderabad, Telangana 500088	-do-	--	2000.000	Technical education on Programmable wood processing tool for Mancherial District, Telangana SC Category
82.	Birla Institute of Technology and Science- Pilani, Hyderabad Campus	-do-	--	1250.134	IoT enabled Solar-VRFB storage integrated smart charging station for sustainable e-mobility
83.	Centre for Nanoscience and Nanotechnology Sathyabama Institute of Science and Technology, Chennai – 600 11	-do-	1048.835	--	Superhydrophobic Coated 3D Printed Temporary Implants – A boon to the Patients.
84.	Dr. D. Y. Patil Institute of Pharmaceutical Science and Research, Pune	-do-	--	1308.897	Development and fabrication of biomarker-based diagnostic tool for early detection of neurological disorders.

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85.	PSG College of Technology, Coimbatore, Tamil Nadu-641004	-do-	1281.020	--	Design and Development of a system for Objective Assessment of Neonatal Hearing Loss
86.	Sathyabama Institute of Science and Technology Deemed to be University Jeppiaar Nagar, Rajiv Gandhi Salai, Chennai - 600 119.Tamil Nadu	-do-	1225.268	--	AI - Powered Non - Invasive Point of Care Device for Detection of Hormones for Prediction of Menstruation in Physically and Mentally Challenged Women
87.	Vigyan Ashram, Pune	-do-	4000.000	--	Livelihood Generation for Rural Youth through Innovation, training & Entrepreneurship
88.	NB Institute for Rural Technology, Tripura	-do-	2600.000	--	Ensuring Energy security and green livelihood of rural communities of Tripura using affordable Solar Energy and local resources
89.	Society for Development alternatives, Delhi	-do-	3500.000	--	Core support project
90.	Himalayan Environmental Studies and Conservation Organization (HESCO), Dehradun	-do-	3000.000	--	Core support project
91.	Foundation for Environment & Economic Development Services (FEEDS), Kangpokpi, Manipur	-do-	3000.000	--	Core support project
92.	Himalayan Research Group, Shimla	-do-	3000.000	--	Core support project

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93.	Sardar Patel Renewable Energy Research Institute Vallabh Vidyanagar - 388 120, Gujarat	-do-	4150.000	--	Technology Interventions to Strengthen Livelihood Generation for EWS of Selected Areas of Gujarat
94.	Gayatri Vidya Parishad College of Engineering, Andhra Pradesh	-do-	3503.520	1097.400	Enhancing Sustainable Livelihood in Rural Areas by Empowering Tribal Women through Bamboo Fusion using Emerging 3D Printing Technology for Crafts
95.	Malla Reddy Engineering College, Telangana	-do-	3645.280	1315.000	Empowering Women Artisans and textile traditions
96.	JSS University, Noida	-do-	2555.840	1194.962	Organic Farming using AI, Robotics and IoT for Women Entrepreneurship in KOT Village, Dadri, Gautam Buddha Nagar, Uttar Pradesh
97.	Sethu Institute of Technology, Tamil Nadu	-do-	2277.460	--	Ultrasound based low cost Belt for the detection of Osteoporosis in Postmenopausal women

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98.	Foundation of Agricultural Resources Management and Environmental Remediation, New Delhi-110065	-do-	1447.080	--	Development and scale up of technology for in vitro (fermentation) and in vivo production of Entomopathogenic Nematodes (EPN) and comparative studies of efficacy of local strain of EPN & comparative studies of efficacy of local strain of EPN & other bio-agents including training and demonstration program
99.	University of Petroleum & Energy Studies, Dehradun	-do-	-	1820.000	R&D
100.	VIT University, Tamil Nadu	-do-	1657.844	-	R&D
101.	Amrita Vishwa Vidyapeetham, Amrita School of Engineering, Amritanagar, Coimbatore, Tamil Nadu	-do-	2367.449		R&D
102.	APCHEMI PVT. LTD, Navi Mumbai, Maharashtra	-do-	1665.873		R&D
103.	TERI School of Advanced Studies (TERI SAS) Vasant Kunj, New Delhi – 110 070	-do-	2132.024		R&D

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104.	The Energy and Resources Institute (TERI) India habitat center, Lodhi road, New Delhi – 110 003	-do-	1646.976		R&D
105.	Dr. B. Lal Institute of Biotechnology 6 –E Malviya Industrial Area, Malviya Nagar Jaipur, Rajasthan – 302 017	-do-	2500.000		R&D
106.	Exstemplar Education Linkers Foundation, South Delhi,Delhi	-do-	10000.000	Nil	Initiative for Research and Innovation in STEMM (IRIS) 2023-24
107.	Rural Agriculture Development Society AnantaPur,Andhra Pradesh	-do-	3180.000	Nil	Science on wheels mobiles exhibtion bus reaching the rural stuedents and remote locations of andhra pradesh
108.	MLR Institute of Technology Hyderabad,Telangana	-do-	1625.000	Nil	Prerna- To Kindle Interest in science and technology
109.	Divya Jyoti Shiksha Samiti Kushi Nagar,Uttar Pradesh	-do-	2000.000	Nil	Scientific and technological tour and industrial visit of students for understanding the science and technology
110.	Science Centre Gwalior Bhopal,Madhya Pradesh	-do-	2650.000	Nil	Organization of District and State Level Children Science Congress 2023 for Madhya Pradesh

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111.	Science For Society Patna,Bihar	-do-	2100.000	Nil	District and State Level Children Science Congress 2023 for Bihar
112.	Jammu and Kashmir Student Welfare society Srinagar,J & K	-do-	1000.000	Nil	District and State Level Children Science Congress 2023 for Kashmir Ladakh
113.	Indian Science Communication Society Lucknow,Uttar Pradesh	-do-	2100.000	Nil	District and State Level Children Science Congress 2023 for UP West
114.	Haryana Vigyan Manch Rohtak,Haryana	-do-	1120.000	Nil	District and state level children Science Congress 2023 in haryana
115.	Dr. MC Saxena College of Pharmacy Lucknow,Uttar Pradesh	-do-	1850.000	Nil	With help of effective learning and industrial tour to excite and support SC/ ST and BPL difefferent learning approaches graduation in science topics from institution in central eastern UP to continue establishing their careers in science fileds for a fav
116.	R N Memorial Educational and Research Trust west Delhi,Delhi	-do-	1750.000	Nil	Scientific Industrial Tour for students

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117.	Jidnyasa Trust Thane Thane,Maharashtra	-do-	1980.000	Nil	District and State Level Children Science Congress 2023 for Maharashtra
118.	Eco Genesis Madhepur,Bihar	-do-	2500.000	Nil	Low- Cost Teaching aids for hands-on science activities and awareness
119.	Gitam Institute of science, Gitam University Visakhapatnam,Andhra Pradesh	-do-	2000.000	Nil	Let Us DO Science LuDos- Embarking scinetific innovation by school children
120.	Krishna Path Incubation Society TBI, KIET Group of Institution Ghaziabad,Uttar Pradesh	-do-	2250.000	Nil	Ensure to prevent community from cyber crime and create awareness on cyber security through dissemination and adoption of best practices and technology
121.	Tamil Nadu Science Forum Chennai,Tamil Nadu	-do-	1800.000	Nil	District and State level Children Science Congress 2023 for Tamil Nadu
122.	Sri venkateshwar College of Engineering & Technology (Autonomous) Chittor,Andhra Pradesh	-do-	1000.000	Nil	Educational in the only way to change the society - popularization science and technology

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123.	Aakarsha Foundation Vijayawada,Andhra Pradesh	-do-	1160.000	Nil	Science Scientific wonders & How it works. To improve curiosity & interst among science & technology among students
124.	Mahila Evam Nal Vikas Sansthan Gopalganj,Bihar	-do-	1651.200	Nil	Science awareness mela
125.	Vasireddy Venkatadri Institute of Technology Guntur,Andhra Pradesh	-do-	2100.000	Nil	Demostration and popularization of science and engineering design products for the young students and teachers of guntur region
126.	Indian Resource and Development Association Kurukshetra,Haryana	-do-	2286.000	Nil	Vigyan Jyoti Science Fair
127.	S and T Sri Voluntary Organization Mahabubabad,Telangana	-do-	2067.000	Nil	Awareness Generation of Science Through Exhibition/ Mela and Activities in Four District of Telangana State
128.	Dronacharya college of engineering Gurgaon,Haryana	-do-	2000.000	Nil	Basic knowledge of science and technology through role of artificial inteligence based lot devices innovative ideas for school children

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129.	Chitkara University Patiala,Punjab	-do-	2000.000	Nil	Awareness program on engineering technology using augmented reality and virtual reality for school students of the region of mohali district punjab
130.	Brij boomi education and welfare society Mathura,Uttar Pradesh	-do-	1790.000	Nil	Science awareness mela for building the foundation of scinetific outlook among students teachers and common people in rural area of mathura
131.	GLA University Mathura,Uttar Pradesh	-do-	2488.000	Nil	Science and Technology Mela
132.	Engineering College and Research Centre Jaipur,Rajasthan	-do-	1707.700	Nil	Up Skilling Science and Logic Learning for the youth of jaipur rural Area an Endevour to enhance training through scientific convention
133.	Vardhaman College of Engineering Hyderabad,Telangana	-do-	2227.000	Nil	Creation of Scientific Awareness for thr School children about web developemnt and block chain rechnology for the region of shamshabad Mandal Rangareddy District Telangana

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134.	Sathyabama Institute of Science and Technology Chennai,Tamil Nadu	-do-	2300.000	Nil	Awareness on cyber threats security for online safety among school children
135.	Pragati Engineering College East Godavari,Andhra Pradesh	-do-	2280.000	Nil	Awareness and hands on Experience technolgies in the areas of AI Cyber securti and mobile application for the children of rural background schools in east godavari district
136.	National Institute of Technology Manglore, Karnataka	-do-	1303.412	Nil	Creating awareness in the field of Artificial Intelligence through hand on activities for secondary school children in select district of karanataka kerala and Tamil Nadu
137.	Science For Society Jamshedpur, Jharkhand	-do-	1230.000	Nil	State and Distrcit level children Science congress 2023

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138.	Sree Vidyanikethan Engineering College Tirupati Chittoor, Andhra Pradesh	-do-	1800.000	Nil	Nurturing Young Minds with Foundations in Artificial Intelligenece and Data Science; An Awareness Apraoch For the region of Chittoor in Andhra Pradesh
139.	Matrix Society for Social Services South West Delhi,Delhi	-do-	1235.000	Nil	Science Awareness Exhbition SAE
140.	Late Mahatam Singh Siksha Niketan Gorakhpur,Uttar Pradesh.	-do-	1270.000	Nil	Science Mela and Exhbition
141.	Vidyanikethan Engineering College Chittoor,Andhra Pradesh	-do-	1720.000	Nil	Cloud Gyan Creating Awareness on Foundations of Cloud computing platforms for nurturing in young mind for the region og tirupati district
142.	Narasimha Reddy Engineering College Malkajgiri,Telangana	-do-	1400.000	Nil	Awareness and Exploration of cyber security to the rural schools of chittor distrcit, Andhra Pradesh
143.	JP College of Engieneeing Tenkasi,Tamil Nadu	-do-	1200.000	Nil	Outreach Programme on Science Robotics, Cyber Security Skill Enhancement for Rural School Children

Serial No.	Name of the institution / organization / individual	Ministry / Department giving the grant	Recurring (Rs. In thousands)	Non-recurring (Rs. In thousands)	Purpose of the grant
144.	Sri Venkatesa Perumal College of Engineering and Technology Chittoor,Andhra Pradesh	-do-	1800.000	Nil	Awareness of hands on learning experience to the students in the area of cloud E-leaarning
145.	Makers Foundation Imphal,West Manipur	-do-	964.000	Nil	Awareness on Promotion of Science and Technology and its Importance in Rural Areas of Imphal West District, Manipur
146.	Alagarsamy Chennai,Tamil Nadu	-do-	1765.000	Nil	Awareness programs to the school children on AI, machine learning JOT and Cyber security through beehive type training BTT for the region of virudhunagar district Tamil Nadu
147.	Neeta Foundation Trust New Delhi,Delhi	-do-	2400.000	Nil	Efforts to increase girl students' interest in purusing science teachnology engineering mathemtics and medicine (STEMM) careers"

Serial No.	Name of the institution / organization / individual	Ministry / Department giving the grant	Recurring (Rs. In thousands)	Non-recurring (Rs. In thousands)	Purpose of the grant
148.	Movement for Economic Reconstruction and Community Bengaluru Urban,Karnataka	-do-	2970.000	Nil	Science Inspire Mobile Exhibition Bus Reaching the rural students and remote locations of Karnataka
149.	Shri Vishnu College of Pharmacy West Godavari,Andhra Pradesh	-do-	1920.000	Nil	Demonstration to nculcate Scientific Spirit in STEMM among School Students in Rural Areas of West Godavari District, Andhra Pradesh
150.	Thakur Ramrati Shiksha Samiti Dewas,Madhya Pradesh	-do-	2300.000	Nil	Enhancing scientific Temperament of Rural People of East Nimar (Khandwa) Apirational District through science awareness mela
151.	ARCA Educational Society Hyderabad,Telangana	-do-	2100.000	Nil	Science awareness camp in in rural and tribal areas of telangana State
152.	Raman Science Research Foundation Bhind,Madhya Pradesh	-do-	3400.000	Nil	Science popularization & Communication through science on wheels in SC/ ST Area of Madhya Pradesh

Serial No.	Name of the institution / organization / individual	Ministry / Department giving the grant	Recurring (Rs. In thousands)	Non-recurring (Rs. In thousands)	Purpose of the grant
153.	Mittal Yuvak Mandal Korba Korba,Chhattisgarh	-do-	1015.000	Nil	Industrial Tour for Technology & Scientific Advancement of Tribal Students
154.	Shweta Mahila Mandal Samiti Bhind, Madhya Pradesh	-do-	1760.000	Nil	Science Awareness Mela for Primitive Tibal Group Shahriya in the Sheopur District of M.P.
155.	Birla Institute of Technology, Jharkhand	-do-	-	19900.000	R&D
156.	RV University Mailasandra, Karnataka	-do-	-	1491.565	R&D
157.	Chitkara University, Chandigarh	-do-	-	1290.186	R&D
158.	Reva University, Karnataka	-do-	-	3099.463	R&D
159.	Sophitoruim Institute of Technology & Life Skills, Orissa	-do-	1727.272	-	R&D
160.	Rajalakshmi College of Engineering, Tamil Nadu	-do-	3078.441	-	R&D
161.	Saveetha Institute of Medical and Technical Sciences, Tamil Nadu	-do-	2813.880	1500.000	R&D
162.	Jan Sewa Ashram, Uttar Pradesh	-do-	1247.400	-	R&D
163.	Amrita University, Kerala	-do-	4000.000	-	R&D
164.	Birla Institute of Technology and Science, Rajasthan	-do-	6000.000	-	R&D
165.	Dystrophy Annihilation Research Trust, Karnataka	-do-	13891.625	2500.000	R&D

Serial No.	Name of the institution / organization / individual	Ministry / Department giving the grant	Recurring (Rs. In thousands)	Non-recurring (Rs. In thousands)	Purpose of the grant
166.	Gandhi Institute of Technology and Management (GITAM) University, Andhra Pradesh	-do-	4500.000	-	R&D
167.	Karunya Institute of Technology and Sciences, Tamil Nadu	-do-	1266.00	3000.000	R&D
168.	Kalinga Institute of Industrial Technology, Odisha	-do-	5000.000	-	R&D
169.	Kongu Engineering College, Perundurai, Erode, Tamil Nadu	-do-	1400.107	-	R&D
170.	NITTE University, Karnataka	-do-	7000.000	-	R&D
171.	Pandit Deendayal Energy University, Gujarat	-do-	4799.642	-	R&D
172.	PSG College of Technology, Tamil Nadu	-do-	2181.298	-	R&D
173.	SRM Institute of Science and Technology, Tamil Nadu	-do-	-	1000.000	R&D
174.	The Energy and Resources Institute, New Delhi	-do-	2000.000	-	R&D
175.	Thapar Institute of Engineering and Technology, Punjab	-do-	1055.480	-	R&D
176.	Vellore Institute of Technology, Tamil Nadu	-do-	1700.000	-	R&D
177.	ABES ENGINEERING COLLEGE, Gaziabad, Uttar Pradesh	-do-	Not Applicable	4732.000	iTBI Setup in Host Institute

Serial No.	Name of the institution / organization / individual	Ministry / Department giving the grant	Recurring (Rs. In thousands)	Non-recurring (Rs. In thousands)	Purpose of the grant
178.	G H RAISONI UNIVERSITY SAIKHEDA, CHHINDWARA, Madhya Pradesh	-do-	Not Applicable	4625.000	iTBI Setup in Host Institute
179.	PRANVEER SINGH INSTITUTE OF TECHNOLOGY KANPUR, Uttar Pradesh	-do-	Not Applicable	4000.000	iTBI Setup in Host Institute
180.	UPES Dehradoon, Uttarakhand	-do-	Not Applicable	4550.000	iTBI Setup in Host Institute
181.	Sona College of Technology, Salem , Tamil Nadu	-do-	Not Applicable	3500.000	iTBI Setup in Host Institute
182.	KL Technology Business Incubator (TBI) - Foundation at Koneru Lakshmaiah Educational Foundation (KLEF), Guntur, Andhra Pradesh	-do-	8250.000	0	To support the various activities w.r.t Innovation & entrepreneurship under NIDHI TBI Program
183.	The Indus Entrepreneurs, Delhi (TiE-Delhi)	-do-	1000.000	-	TiECoN entrepreneurship event -for Promotion of innovation and entrepreneurship
184.	Coimbatore, innovation and business incubator (Forge)	-do-	5000.000	-	To support the various activities w.r.t Innovation & entrepreneurship under NIDHI TBI Program
185.	Symbiosis International (Deemed University), Pune	-do-	1300.000		WOS-A Project
186.	GITAM Deemed to be University	-do-	1021.080		WOS-A Project

Serial No.	Name of the institution / organization / individual	Ministry / Department giving the grant	Recurring (Rs. In thousands)	Non-recurring (Rs. In thousands)	Purpose of the grant
187.	Kakatiya Institute of Technology & Science, Warangal	-do-	1250.000		WOS-A Project
188.	Assam Don Bosco University, Guwahati	-do-	1400.000		WOS-A Project
189.	REVA University, Bangalore	-do-	1500.000		WOS-A Project
190.	Dr Mahalingam College of Engineering and Technology Pollachi, Coimbatore	-do-	1100.000		WOS-A Project
191.	Auxilium College (Autonomous) Vellore	-do-	1050.000		WOS-A Project
192.	Hislop College, Nagpur	-do-	1500.000		WOS-A Project
193.	JSS College of Pharmacy, Mysuru	-do-	1100.000		WOS-A Project
194.	Manipal College of Pharmaceutical Sciences, Manipal	-do-	1125.000		WOS-A Project
195.	Kasturba Medical College, Manipal Academy of Higher Education, Manipal	-do-	1350.000		WOS-A Project
196.	GITAM Deemed to be University, Hyderabad	-do-	1250.000		WOS-A Project
197.	Institute of Bioinformatics and Applied Biotechnology, Bengaluru	-do-	1450.000		WOS-A Project
198.	Yenepoya Dental College, Mangalore	-do-	1299.911		WOS-A Project
199.	Birla Institute of Technology and Science (BITS), Pilani	-do-	1300.000		WOS-A Project
200.	Amity University, Noida	-do-	1145.075		WOS-A Project
201.	Birla Institute of Technology, Mesra	-do-	1248.720		WISE-PDF Project

Serial No.	Name of the institution / organization / individual	Ministry / Department giving the grant	Recurring (Rs. In thousands)	Non-recurring (Rs. In thousands)	Purpose of the grant
202.	Birla Institute of Technology and Science-Pilani, Hyderabad	-do-	1321.080		WISE-PDF Project
203.	Symbiosis International University, Pune	-do-	1321.080		WISE-PDF Project
204.	IIS University (Deemed to be University), Jaipur-302020, Rajasthan	-do-	1772.925		CURIE Project Grant
205.	Stanley College of Engineering and Technology for Women, Hyderabad- 500001, Telangana	-do-	1655.120	7000.000	CURIE Project Grant
206.	Think Through Consultancy Pvt. Ltd.	-do-	1149.100		Report & Publication

ABBREVATION

AI	Autonomous Institute
AMRUT	Atal Mission for Rejuvenation and Urban Transformation
AMT	Advanced Manufacturing Technologies
ANRF	Anusandhan National Research Foundation
ARCI	International Advanced Research Centre for Powder Metallurgy and New Materials
ARI	Agharkar Research Institute
ARIES	Aryabhatta Research Institute of Observational Sciences
ASEAN	Association of Southeast Asian Nations
BDTD	Biomedical Device an d Technology Development
BI	Bose Institute
BIMSTEC	Bay of Bengal Initiative for Multi-Sectoral Technical and Economic Cooperation
BNL	Brookhaven National Laboratory
BRICS	Brazil, Russia, India, China, and South Africa
BSIP	Birbal Sahni Institute of Palaeosciences
CBI	Central Bureau of Investigation
CC	Climate Change
CCMP	Cyber Crisis Management Plan
CCUS	Carbon Capture Utilisation and Storage
CDSCO	Central Standard Drug Control Organization
CeNS	Centre for Nano and Soft Matter Sciences
CERI	Clean Energy Research Initiative
CERN	European Organization for Nuclear Research
CMS	Compact Muon Solenoid (CMS) Experiment
CoE	Centre of Excellence
CORS	Continuously Operating Reference Stations
CPR	Centre for Policy Research
CSRI	Cognitive Science Research Initiative
CSS	Central Sector Scheme

CURIE	Consolidation of University Research for Innovation & Excellence
CVO	Central Vigilance Commission
DGQI	Data Governance Quality Index
DST	Department of Science and Technology
DSU	Data & Strategy Unit
ECU	Electronic Control Unit
EDR	Endpoint Detection and Response
EU	European Union
FAIR	Facility for Antiproton and Ion Research
FAIR	Facility for Antiproton and Ion Research (FAIR) in Germany
Fermilab	Fermi National Accelerator Laboratory
FICCI	Federation of Indian Chambers of Commerce & Industry
FIST	Fund for Improvement of S & T Infrastructure in Universities and Higher Educational Institutions
FMC	Facility Management Committee
FSSAI	Food Safety and Standards Authority of India
GDPDC	Geospatial Data Promotion and Development Committee
GERD	Gross Expenditure on R&D
GLP	Good Laboratory Practice
GRIs	Grassroots Innovations
HEI	Higher Educational Institutes
HGCAL	High Granular Calorimeter
HLD	High-Level Design
IACS	Indian Association for the Cultivation of Science
IASc	Indian Academy of Sciences
IASST	Institute of Advanced Study in Science and Technology
IB	Intelligence Bureau
IIA	Indian Institute of Astrophysics
IIG	Indian Institute of Geomagnetism
INAE	Indian National Academy of Engineering
INSA	Indian National Science Academy

INSPIRE	Innovation in Science Pursuit for Inspired Research
INSPIRE -MANAK	Million Minds Augmenting National Aspiration and Knowledge
INST	Institute of Nano Science and Technology
IPR	Intellectual Property Rights
ISCA	Indian Science Congress Association
ITS	International Travel Support
JJM	Jal Jeevan Mission
JNCASR	Jawaharlal Nehru Centre for Advanced Scientific Research
JSPS	Japan Society for the Promotion of Science
LHC	Large Hadron Collider
LIGO	Laser Interferometer Gravitational-wave Observatory
LLD	Low-Level Design
LLM	Large Language Model
LSM	Large Scale Mapping
MAHA	Mission for Advancement in High-impact Areas
MCTT	Manual Cognitive Training kit
MGC	Mekong Ganga Cooperation
ML	Machine Learning
MoU	Memorandum of Understanding
MRI	Magnetic Resonance Imaging
NAKSHA	NAtional Geospatial Knowledge – based land Survey of urban HAbitations
NAMD	Nano and Advanced Materials Divisions
NASI	National Academy of Sciences
NATMO	National Atlas & Thematic Mapping Organisation
NBC	Nuclear Biological and Chemical
NCG	National Centre for Geodesy
NCSTC	National Council for Science and Technology Communication
NECTAR	North East Centre for Technology Application and Reach
NGP	National Geospatial Programme
NHP	National Hydrology Project

NIC	National Informatics Centre
NIDHI	National Initiative for Developing and Harnessing Innovations
NIF	National Innovation Foundation
NIGST	National Institute for Geo-informatics Science and Technology
NLEPC	National Level Exhibition and Project Competition
NMCG	National Mission for Clean Ganga
NMICPS	National Mission on Interdisciplinary Cyber Physical Systems
NMR	Nuclear Magnetic Resonance
NMSHE	National Mission for Sustaining the Himalayan Ecosystem
NMSKCC	National Mission on Strategic Knowledge for Climate Change
NNetRA	Nanoelectronics Network for Research & Applications
NQM	National Quantum Mission
NSDI	National Spatial Data Infrastructure
NSM	National Supercomputing Mission
NSTMIS	National Science &Technology Management Information System
PAb	Polyclonal Antibodies
PAC	Program Advisory Committee
PAIR	Partnerships for Accelerated Innovation and Research
PAU	Pay-as-Use
PG	Post-graduate
PM ECRG	Prime Minister's Early Career Research Grant
PPP	Public Private Partnership
PRC	Policy Research Cell
PSA	Principal Scientific Adviser
PURSE	Promotion of University Research and Scientific Excellence
RRI	Raman Research Institute
RTI	Right to Information
S&T	Science & Technology
SAIF	Sophisticated Analytical Instrument Facilities
SATHI	Sophisticated Analytical & Technical Help Institutes

SATYAM	Science and Technology for Yoga and Meditation
SCD	Sickle Cell Disease
SCSP	Scheduled Caste Sub Plan
SCTIMST	Sree Chitra Tirunal Institute for Medical Sciences and Technology
SERB	Science and Engineering Research Board
SHE	Scholarship for Higher Education
SHG	Self Help Group
SHRI	Science and Heritage Research Initiative
SNBNCBS	S. N. Bose National Centre for Basic Sciences
SoI	Survey of India
SSR	Scientific Social Responsibility
SSTP	State Science and Technology Programme
STEM	Science Technology Engineering and Mathematics
STI	Science Technology and Innovation
STUTI	Synergistic Training program Utilizing the Scientific and Technological Infrastructure
SUPREME	Support for Upgradation Preventive Repair and Maintenance of Equipment
SVAMITVA	Survey of Villages and Mapping with Improvised Technology in Village Areas
TCP	Therapeutics Chemicals Program
TDB	Technology Development Board
TDP	Technology Development Programs
TEC	Technology Enabling Centres
TIFAC	Technology Information Forecasting & Assessment Council
TIHs	Technology Innovation Hubs
TMT	Thirty Meter Telescope
TRC	Technical Research Centres
TSP	Tribal Sub Plan
UAV	Unmanned Aerial Vehicle
UEM	Unified Endpoint Management
USISTEF	US-India S&T Endowment Fund
UTM	Unmanned Traffic Malmanagement

VAIBHAV	Vaishvik Bharatiya Vaigyanik
VAPT	Vulnerability Assessment and Penetration Testing
VJ	Vigyan Jyoti
WIDUSHI	Women's Instinct for Developing and Ushering Scientific Heights and Innovation
WIHG	Wadia Institute of Himalayan Geology
WINGS	Women in International Grant Support
WISE-KIRAN	Knowledge Involvement in Research Advancement through Nurturing) Scheme as Women in Science and Engineering
WISE-PDF	WISE Post-Doctoral Fellowship
WISE-SCOPE	Women In Science and Engineering -Societal Challenges with Opportunities
WiSLP	Women in Space and Allied Science Leadership Program
WLCG	Worldwide Large Hadron Collider Computing Grid
WMT	Waste Management Technologies