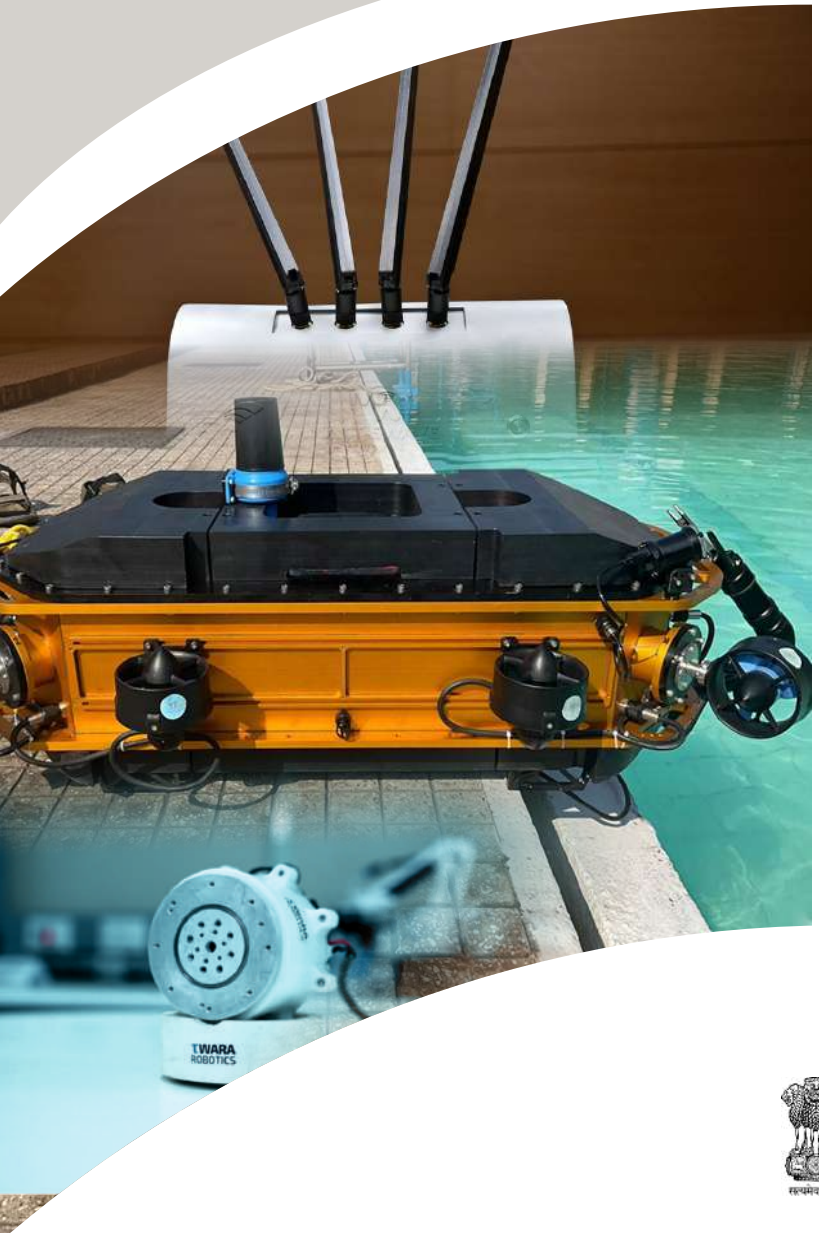
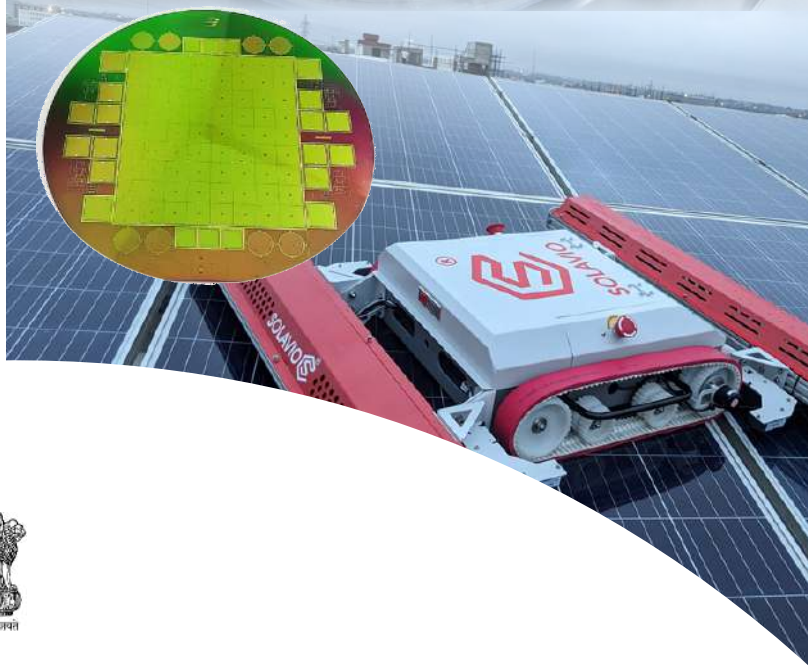
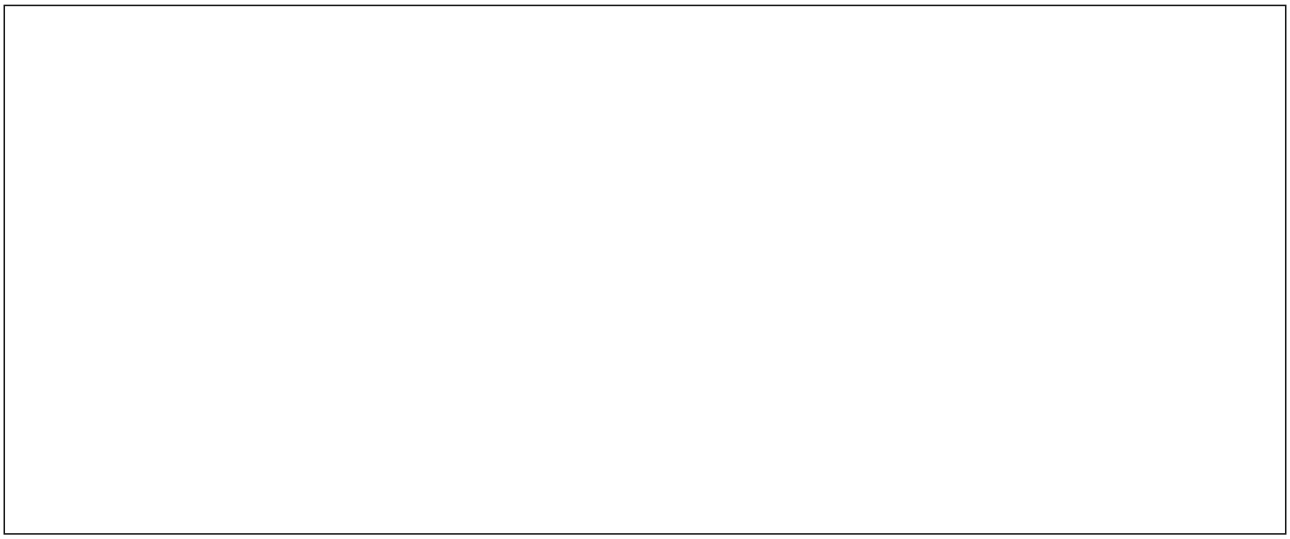
ANNUAL REPORT
2023-24





सत्यमेव जयते

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



The Department of Science & Technology (DST) and its various Institutions made some sincere efforts towards boosting the research, technology development and innovation ecosystem. These pictures represent some of the significant achievements, outcomes of indigenous technology development in the areas of Robotics, Automation, 5G Applications, Astronomy and Clean Energy Initiatives, etc.

Annual Report
2023-24

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

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OVERVIEW

The Department of Science & Technology (DST) is the nodal agency in the country for strengthening science, technology and innovation, identifying gap areas in S&T sectors, promoting new and emerging areas of S&T making planning and policy. DST also serves in connecting the science and technology sectors with different Government horizontals and verticals, academia, R&D labs/institutions and industries. DST provides extramural research and development support in the country to scientists cutting across institutions and disciplines through a competitive mode reinforcing the education system, scientific and industrial R&D and the overall Science, Technology and Innovation landscape of the country.

The Department has been continuing its efforts towards strengthening the national STI ecosystem to emerge as a forerunner to play a critical role in science and technology for bringing positive transformations towards a safe, secure, better society, and the nation preparing for future disruptions. Some of the key success stories during the year 2023-24 are as follows:

- **India's ranking in global S&T indices continues to rise:** India retained 40th position in Global Innovation Index among the top innovative economies globally as per Global Innovation Index (GII) 2023. As per WIPO Indicator Report 2023, India is ranked at 6th position both in terms of Resident and Non-Resident Patent Filing activity in the world. India improves its ranking to 60th position (2023) from 79th position (2019) as per Network Readiness Index (NRI) 2023 report. NRI is one of the leading global indices on the application and impact of information and communication technology (ICT) in 134 economies around the world.

- **The Anusandhan National Research Foundation (ANRF) 2023** Bill has been passed by the Parliament in its monsoon session to provide high level strategic direction for research, innovation and entrepreneurship in the fields of natural sciences and scientific and technological interfaces of humanities and social sciences and also to promote, monitor and provide support as required for such research.

- 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). This will accelerate QT led economic growth, nurture the ecosystem in the country and make India one of the leading nations in the development of Quantum Technologies & Applications (QTA).

- The 9th edition of India International Science Festival (IISF) – 2023 was organized at the combined campus of THSTI- RCB, DBT in Faridabad, Haryana during 17-20 January, 2024.

While a detailed account of achievements of activities during the year is presented in relevant chapters, some of the major achievements and initiatives during 2023-24 are briefly presented in the following sections:

- **Fund for Improvement of S&T Infrastructure (FIST)** in University departments and Higher Educational Institutions is supported in competitive mode. The programme has been restructured to orient it towards the goal of Atmanirbhar Bharat by creating R&D infrastructure not only for R&D activities in academic organizations but also for use by the start-ups/ manufacturing industries/ MSMEs. During the year, 703 fresh proposals have been received in seven subject areas out of which 121 projects have been recommended.

- **Promotion of University Research and Scientific Excellence (PURSE**): The main objective of the scheme is to pro-actively support for strengthening the R&D base of the performing Universities. During the year, four new Universities identified for support. A special call for the unserved regions in the country to provide basic infrastructure and enabling the facilities for promoting R&D activities in new and emerging areas of Science & Technology has been announced through which 13 new universities are selected for support through an open call in addition to special drive support to 11 universities in underserved regions.

- **Sophisticated Analytical Instrument Facilities (SAIF)** have been established in different parts of the country to provide the facilities of sophisticated analytical instruments to the researchers in general and specially from the institutions which do not have access to such instruments to enable them to pursue R&D activities. There are at present 15 Nos. SAIF Centres in the country. Approximately 2800 research papers were published with the support provided by the SAIFs during the year and about 23,000 users from Pan India, belonging to all sectors have utilized and benefitted from the facilities at SAIF. An average of 1,25,000 samples were analyzed by all the SAIF centres.

- **Sophisticated Analytical & Technical Help Institutes (SATHI),** a shared, professionally managed service and strong S&T infrastructure facilities for intensifying the base of S&T infrastructure and manpower, S&T led innovation and start-ups, technology development and futuristic areas of S&T. Three SATHI facilities have been hosted in first phase. Initiatives have been launched to set up 3 new SATHI centers at IIT Hyderabad, ICT Mumbai, and BITS, Pilani.

- **Synergistic Training program Utilizing the Scientific and Technological Infrastructure (STUTI)** is intended to boost human resource and its capacity building through open access to S&T Infrastructure across the country. A total of **248** training &

132 awareness programs were organized under this Scheme during the year 2023-24 and around **8573** researchers have been trained under STUTI.

- **Support for Upgradation Preventive Repair and Maintenance of Equipment SUPREME)**, a new initiative for the revival of major facilities established by DST Projects has been announced. The support would be provided for repair/ upgradation/ maintenance/ retrofitting or acquiring additional attachment to increase functional capabilities of existing analytical instrumentation facilities (AIFs) supported by DST in various Institutions/laboratories/academic institutions.

- **Policy Research Cell (PRC)** under Policy, Coordination and Programme Management (PCPM) division in Department of Science and Technology (DST) is mainly focused to promote STI policy research in the country and gather evidence-based input for future policy making in STI related areas. In the current year, 8 **Centres for Policy Research (CPRs)** & 6 **Satellite-Centres for Policy Research (SPRs)** are being supported under the programme.

- **National Science & Technology Management Information System (NSTMIS)** continued conducting national surveys to generate and make available information on manpower as well as financial resources devoted to S&T activities. The National S&T Survey on resources devoted to research and development activities, 2021-22 and National Manufacturing and Innovation Survey, 2021-22 have been completed. Based on these surveys, seven national publications were prepared and published. Science, Technology and Innovation Indicators brought out for evidence-based policy planning for S&T sector of the country.

- **WISE-KIRAN (Knowledge Involvement in Research Advancement through Nurturing)** embraces women-exclusive schemes of DST with the mandate to bring gender parity in S&T through various mechanisms. During the current year, five (5) new programmes viz. WISE-IPR, WISE-PhD, WISE-PDF, WIDUSHI and WISE-SCOPE have been launched to promote women in different sectors. 128 women have been supported under WOS-A and financial support has also been extended for 143 ongoing projects under WOS-A and 25 ongoing projects under WOS-B. The Vigyan Jyoti programme extended in Phase-IV to 250 districts of 34 states/UTs of the country.

- **Cognitive Science Research Initiative** (CSRI) encourages research in highly interdisciplinary area of cognitive science that try to address various questions through combining ideas, principles and methods of psychology, computer science, linguistics, philosophy, neuroscience etc.

- **Innovation in Science Pursuit for Inspired Research (INSPIRE)** is a flagship scheme of DST to attract talent to the study of science from an early age and build the required human resource pool for strengthening and expanding the R&D base of the country. The

INSPIRE- Scholarship for Higher Education (SHE) component supported the fellowship to 10,045 selected candidates. In addition, 440 INSPIRE scholarships have been offered to the selected candidates through institute mode. Under INSPIRE Fellowship component, evaluation of the 2,038 applications received is under progress and so far, 1282 INSPIRE Fellowship applicants have been offered INSPIRE Fellowship. Out of the awarded/offered INSPIRE Fellows 67% are female and 33% are male. Of the total INSPIRE Fellowship beneficiaries, about 32% are SHE Scholars who have joined doctoral degree program in science and technology after availing 5 years INSPIRE Scholarship. During the year, 342 INSPIRE Faculty Fellowships were offered the fellowship. Out of the awarded/offered INSPIRE Faculty Fellows 42% are female and 58% are male.

- The **INSPIRE-(MANAK) Million Minds Augmenting National Aspirations and Knowledge** 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.

- **International Cooperation** programme mandated of (i) negotiating, concluding and implementing Science & Technology Agreements between India and partnering countries; (ii) support scientific research and development activities through various regional and multilateral platforms, (iii) providing interventions on S&T aspects in international forums. Active bilateral S&T programs of cooperation has been continued with more than 45 countries including dedicated regional and multilateral program. The multilateral cooperation was served with Asia Cooperation Dialogue (*ACD*), Africa, Association of Southeast Asian Nations (ASEAN), Bay of Bengal Initiative for Multi-Sectoral Technical and Economic Cooperation (BIMSTEC), Brazil, Russia, India, China, and South Africa (BRICS), European Union (EU), *Indian Ocean Rim Association* (*IORA*), *Indo-Pacific Oceans Initiative* (*IPOI*), *Shanghai Cooperation Organisation* (*SCO*). Supported around 350 bilateral, multilateral and regional R&D joint projects. VAIBHAV Fellowship was announced, covering 18 thematic research areas, wherein 22 proposals were recommended for support.

- **National Mission on Nano Science & Nano Technology** promotes basic research and focuses on Nano Technology adaptation and transfer to industry for use by masses. During the year, 16 technologies were transferred to suitable start-ups and industries. Similarly, 7 start-ups have been nucleated, 50- patents filed, 522 publications and 336 manpower trained.

- The **Mega Facility for Basic Research** supported various activities including the participation in FAIR, Germany, Thirty Meter Telescope (TMT) in USA and Square Kilometer Array (SKA) in Australia and South Africa enabling Indian researchers for using such state-of-the-art research facilities for their research work.

- **Climate Change Programme (CCP)** includes implementation of 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). Both these missions aim at building S&T capacity in the area of CC and adaptation strategies. A new Centre of Excellence (CoE) has been launched at University of Allahabad along with strengthening of 11 State Climate Change Cells.

- **National Supercomputing Mission (NSM)** jointly implemented with MeitY targets to set up high performance systems ranging from a few 100 Tera FLOPS to Ten's of Peta FLOPS in the country. In the current year, an indigenous server called Rudra 1.0 has been developed using Intel Cascade Lake processor platform.

- **Technology Development Programme** supports R&D for development of innovative technologies in identified areas. The **Advanced Manufacturing Technology (AMT)** component supported 50 technology development projects. Four **Technology Enabling Centers (TEC)** created to strengthening the technology development ecosystem, a Centre for Marine Therapeutics at NIPER, Kolkata under **Therapeutic Chemicals**, 4 **Biomedical-hubs** have been supported and Three brainstorming workshops organized for sensitization and awareness of technology development.

- **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. The initiatives include Research & Development on Clean Coal Technologies, Materials for Energy Storage, Solar Energy, Mission Innovation, Mission Innovation Challenge, Cross-cutting Innovation Challenges, Energy Storage Solutions, Mission Innovation (MI) 2.0, smart grid and clear air. During the year, India hosted Mission Innovation (MI8) and Clean Energy Ministerial (CEM14) a global event focusing on clean energy solutions, with participation from several countries and organizations. The programme also prioritized efficient and affordable solar energy solutions, supporting five National Challenge Grant projects on High-efficiency PV cells and modules.

- **Water Technology Initiative (WTI)** is a pro-active India – centric 'solution science' endeavor that aims to strengthen the R&D capacity and capability to develop research-based solutions for existing and emerging water challenges faced in the country. The overarching goal of the scheme is to promote R&D activities that enable the winning of water from sustainable sources, augmentation of water quality for specific applications, and recycling and reuse of water. During the year, 21 projects were supported under 'Optimal Water Use in Industrial Sector'. The projects have resulted in 92 publications, 10 book chapter and filing of 15 patents.

- **National Geospatial Programme (NGP)** aims at promoting R&D in emerging areas of Geospatial technologies and applications. Several projects have been carried out under the programme. A tripartite MoU has been signed between DST, NIGST & TiH IIT Tirupati for establishment of a Geospatial Innovation Hub (Centre of Excellence) in pilot mode to create a robust geospatial innovation ecosystem in the country. A CORS station has been established at the National Centre for Geodesy, IIT Kanpur, which is part of Asia-Pacific Reference Frame (APREF) and IGS network and supported 14 projects under "Geospatial Science Development".

- **National Initiative for Developing and Harnessing Innovations (NIDHI)** focuses on nurturing start-ups and individual innovators. This program exemplifies DST's commitment to translating research into practical applications, fostering innovation and promoting entrepreneurship in technology. Supported 9 NIDHI Centre of Excellences (NIDHI - CoE), supported 30 Inclusive TBI (i-TBI). Seed support has been provided to 14 TBIs during the year. NIDHI's PRomoting and Accelerating Young and ASpiring technology entrepreneurs (PRAYAS), supported 13 new PRAYAS centres across the country, NIDHI's Entrepreneurs-in- Residence (EIR) programme supported 10 new EIR centres.

- **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 amongst them. Conferred 6 National Awards for S&T Communication and Popularization on National Science Day and 6 scholars (PhD & PDF) were given AWSAR prize. More than 200 static and mobile exhibitions were organized in different parts of the country under STEMM India**.**

- **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. Under Technology Interventions for Disabled and Elderly (TIDE), 15 various assistive tools and technologies focusing on various disabilities and for improving the quality of life for elderly were developed. Released a **Compendium of Technologies developed under SYST and supported** 10 Women Technology Parks (WTPs) benefitting more than 900 women.

- **Scheduled Caste Sub Plan (SCSP) & Tribal Sub Plan (TSP):** The department has been implementing two Schemes, viz Tribal Sub Plan (TSP) and Scheduled Castes Sub Plan(SCSP), since 1991-92 and 1992-93 respectively, to empower SC/ST population through the input of Science and Technology. Interventions through the **Tribal Sub-Plan** had directly benefited peoples, in addition to improved socio-economic status there had been a significant improvement in skills, building on local innovation & local knowledge. The projects implemented (completed) through the **Scheduled Caste Sub Plan** during the year directly benefited people and there has been a significant

improvement in the socio-economic conditions of people. 12 Science Technology and Innovation (STI) Hubs established and supported establishment of Heritage Food and Beverage Research Centre in North-Eastern states under Scheduled Caste Sub Plan and Tribal Sub Plan.

- **Good Laboratory Practice (GLP)** as on date, there are 61 GLP certified test facilities in the country. 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.

- Five **Technical Research Centres (TRCs)** are being supported since 2015-16 in 5 DST institutions 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, Kolkata. The TRCs have developed and transferred some significant technologies to industry during the period. The facility, featuring indigenous equipment, was inaugurated on August 18, 2023. These TRCs provide techno-legal-commercial and financial support to scientists, entrepreneurs, and business fraternity to achieve translation of research into products and processes for greater economic and societal benefits.

- **National Spatial Data Infrastructure (NSDI)** has been demonstrating the National Data Registry (NDR) Geo-portal and the individual organisational Data Nodes; provisioning a proof-of-concept Geospatial Cloud based Infrastructure (NSDI Geo-platform) services for hosting geospatial data/ applications; maintaining the NSDI Clearinghouse Node. 14 State Spatial Data Infrastructure (SSDI) were established through cost-sharing between DST and State/ UT Governments in 70:30 mode.

- **National Mission on Interdisciplinary Cyber-Physical Systems (NM-ICPS)**: 25 Technology Innovation Hubs setup in top-ranking national institutions almost in all states covering the entire country. Till date, Mission has developed 311 technologies, 549 technology products, 63000+ Human Resource, 1200 Jobs creation and nearly 124 international collaborations.

- The Department of Science and Technology nurtures 24 Autonomous Bodies (ABs). These include 16 research institutions, 03 specialized knowledge and S&T service organizations and 05 professional bodies. 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. **DST's autonomous institutions contribute to multifarious research ranging from Health, Medical devices, Energy to unraveling the mysteries of the Universe.** Following is a glimpse of some of the key achievements:

- **Aryabhatta Research Institute of Observational Sciences (ARIES), Nainital**: 4m International Liquid Mirror Telescope (ILMT) has started regular science observations and the ILMT data has been made publicly available to the scientific community through its online portal.
- **Maharashtra Association for the Cultivation of Science (MACS)- Agharkar Research Institute (ARI), Pune:** Fungal genera *Kevinia* and *Groenewaldia* and eleven new species were discovered from the Western Ghats, Maharashtra. Whole genome sequencing of *Fusarium indicum* and *Alanomyces manoharacharyi* revealed metabolite profiles for industrial applications. *Cladosporium*, *Alternaria*, and *Pseudohumicola* genera were found to be efficient melanin producers.
- **Jawaharlal Nehru Centre for Advanced Scientific Research (JNCASR), Bengaluru**: Theoretical Sciences Unit identified a quantum-based model system for a better understanding of new materials. The Chemistry and Physics of Materials Unit have identified a unique mechanism of electric polarization via magnetic ordering in a novel mineral named "$MnBi_2S_4$", which can be useful for energy-efficient data storage.
- **Sree Chitra Tirunal Institute for Medical Sciences and Technology (SCTIMST), Trivandrum**: AG Chitra Tuberculosis diagnostic kit developed by Sree Chitra Tirunal Institute for Medical Sciences and Technology (SCTIMST), Trivandrum was launched at a formal function held at its Biomedical Technology wing campus. This kit is developed as an open platform system to provide affordable, fast, and accurate diagnosis of pulmonary tuberculosis. The technology has been licensed to M/S Agappe Diagnostics in Kochi.
- **North East Centre for Technology Application & Reach (NECTAR), Shillong**: The Centre has established a Skill Development Centre & Geospatial Lab in Guwahati with advanced technology and acquired complete in-house resource capacity on Remote sensing and GIS application including Drone Technology having indigenous, high endurance and type certified drones along with high resolution sensor systems.

❖ **ANRF (Erstwhile SERB)** serves as a premier national funding agency and the mandate is to promote R&D activities through appropriate policy interventions and to provide extramural funding to the researchers associated with various academic institutions, research laboratories and other R&D organizations for carrying out competitive basic or fundamental research in all frontier areas of Science and Engineering. ANRF strives to serve the needs of the researchers by making timely funding decisions and responding to their queries.

❖ **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 domain services.

- **Technology Development Board (TDB)** provides financial assistance to the industrial concerns and other agencies attempting development and commercialisation 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 twelve (12) national agreements and three (03) International Bilateral Projects for providing financial support to various industrial concerns. Organised the **National Technology Week 2023** to commemorate the 25th anniversary of India's landmark technological achievements.

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

S&T INSTITUTIONAL & HUMAN CAPACITY BUILDING

1.1 Research and Development Infrastructure

The scheme is devoted to enriching the nation's Science and Technology (S&T) ecosystem through establishment of advanced research and development facilities in academic institutions and universities. The facilities not only enhance the technological capacities of universities and research institutes but also cultivate a vibrant atmosphere for collaborative research initiatives. Achieving this objective involves a strong emphasis on promoting research collaboration, building synergies among institutions and encouraging interdisciplinary cooperation. Key achievements of the programme categorized by scheme are outlined below:

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

Fund for Improvement of S&T infrastructures in Universities and Higher Educational institutions (FIST) Program is standalone infrastructure augmentation program of Government which provides support for Scientific Infrastructure Building at the department level. FIST is an unparalleled infrastructure program across all the S&T funding agencies. The supports under the Program is basically for improving quality of research through modernization of laboratories by acquiring basic/state-of-the-art major research facilities, associated infrastructure facilities including modernization of labs, setting up of specialized research facilities for conducting internationally competitive and contemporary research as per global standards.

The FIST Program has consistently provided reliable funding for over two decades, resulting in profound impacts across numerous departments nationwide. The sustained support has enabled advanced research in cutting-edge areas of science and technology, as well as the establishment of modern teaching facilities. Notably, the FIST Program has greatly benefited basic sciences departments, strengthened the Engineering Sciences research along medical, veterinary, and paramedical departments in Universities/institutions throughout the country. Furthermore, this initiative plays a crucial role in enhancing the quality of research publications.

The FIST Program is being implemented in six broad subject areas i.e. Life Sciences, Physical Sciences, Chemical Sciences, Engineering Sciences, Earth & Atmospheric Sciences and Mathematical Sciences. In the last twenty-two rounds, support has been provided to 3221

Departments and PG Colleges at a total budget of about Rs. 3378.9 crores.

In the year 2023, the announcement for submission of fresh proposals under the FIST Program was made, 703 proposals in four levels have been received online from departments of universities, academic institutions and Colleges. In the current cycle, 121 new proposals with a budget of ₹ 192.42 crores for five years duration were approved for support under the Program, in which 61.48% funds was recommended towards Colleges & Universities sector.

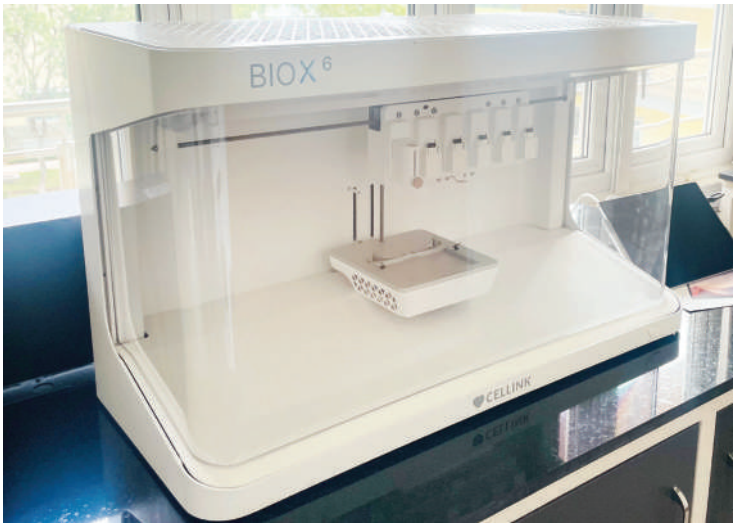


Fig.: 3D Bioprinter facility supported out of DST FIST at School of Biosciences and Bioengineering IIT, Mandi

The first installment of grant was disbursed to 143 departments in various academic institutions and postgraduate colleges.

Monitoring and review of ongoing projects is an important features of FIST program, enabling department to implement the project effectively. In the reported period 342 projects (ongoing and completed) were reviewed by the respective Subject Expert Committees.

The FIST Call for the year 2024 was announced. A total of 987 have been received in different subject areas, which are now being processed. A new level SHAKTI (Supporting High-End Advanced Knowledge and Technology Infrastructure) is introduced in the current call, which comprise institutional level of funding under FIST which comprise boarder participation of STEM departments.

1.1.2 Promotion of University Research and Scientific Excellence (PURSE)

“Promotion of University Research and Scientific Excellence (PURSE)” is an exclusive program for the Indian University sector to build the research capacity of performing Indian Universities. The main objective of the scheme is to provide the support for strengthening

the R&D base of the performing Universities in the country with adequate financial support to nurture the research ecosystem in universities.

In the recent past, the PURSE program has been restructured and re-oriented. Provisions for safety infrastructure, scientific social responsibility (SSR) and industry collaboration have also been included in the restructured programme. Encouraging collaboration between universities, industry and international partners can facilitate the exchange of knowledge and resources, leading to more impactful research outcomes. Universities have been encouraged to carry out Mission mode research activities to focus on thrust areas which align with National priorities of Excellence in Manufacturing, Waste processing, Clean Energy, Water and Startup India. Universities are encouraged to harness their areas of excellence into thematic effort of an accomplished team, with clearly articulated objectives. The broad objective is to support potentially high-impact, interdisciplinary research (both basic and applied) aligned to national priorities and missions.

On April 24, 2023, the "Vishwavidyalaya Anusandhan Utsav 2023" was organized in New Delhi to highlight the research capabilities of universities supported by the DST-PURSE scheme. Each university showcased its unique expertise and dedication to advancing S&T knowledge, while also supporting sustainable solutions within their respective domains. A publication spotlighting the successes of various universities supported through the PURSE initiative was released during the event. Also, a scientific documentary on the DST-PURSE program, showcasing advancements and research infrastructure was released. This event was attended by diverse participants including researchers, faculty, entrepreneurs, industry leaders, and officials.

Fig.: Hon'ble Minister S&T inaugurated the event and addressed the scientific gathering during the Viswavidyalaya Anusandhan Utsav

In 2023, 13 new universities were supported through an open call in addition to special drive support to 11 universities in underserved regions. This special drive initiative specially targeted to UGC-recognized state-funded and private universities in regions like NE-India, Jammu & Kashmir, and several other states to enhance scientific excellence and fostering

research capabilities, demonstrating a strategic vision for inclusive growth and emerging scientific landscape.

Fig.: PURSE grant felicitation during Vishwavidyalaya Anusandhan Utsav 2023

The PURSE has supported a wide array of scientific themes across various institutions, now the ongoing projects in the universities are reflecting a commitment to addressing critical issues through interdisciplinary research. One focus is on achieving self-reliance through sustainable and high-yielding processes and technologies. Another area of engagement includes understanding the molecular basis of prevalent gastrointestinal cancers, climate change studies, and designing novel materials to combat water pollution. Emphasis is also placed on additive manufacturing for fostering transdisciplinary research and pioneering in developing theranostic agents for cancer treatment, sensor systems for rapid disease diagnosis via exhaled breath analysis, and waste-to-energy technologies. Other notable projects include work on molecular therapeutics and devices to improve human health, the development of materials for energy harvesting and organic synthesis and the initiative to establish a comprehensive electric mobility infrastructure to spur research and startups in this field. These themes underscore the PURSE program's role in fostering cutting-edge research and technological advancements across diverse scientific domains.

1.1.3 Sophisticated Analytical Instrument Facilities (SAIF)

The SAIF program is being implemented regionally with the objective to provide facilities of sophisticated analytical instruments to the research workers in general and especially from the institutions which do not have such instruments to enable them to pursue R&D activities. This enables the institutions acquiring such facilities to keep pace with development taking place globally.

At present 15 SAIFs are being supported by DST at IIT Chennai; IIT Mumbai; CDRI, Lucknow; Punjab University, Chandigarh; NEHU, Shillong; IISc Bangalore; AIIMS, New Delhi; Guwahati University, Guwahati; C.V.M., Vallabh Vidyanagar; STIC, Kochi; Shivaji University Kolhapur; IIT Patna; IIEST Shibpur; M.G. University, Kottayam and Karnataka University Dharwad.

The SAIFs are equipped with high-end analytical facilities such as Cryo-Transmission Electron Microscope, X-ray Diffractometers, Thermal Analysis Systems, Transmission Electron Microscopes, Mass Spectrometers, Nuclear Magnetic Resonance (NMR), ICP etc to meet the need of researchers. SAIF facility is accessible to all the users from various academic institutes, R&D laboratories industries, MSME and start-ups, irrespective of whether they belong to the host institute or not.

Fig.: Focused Ion Beam-Scanning Electron Microscope (FIB-SEM) installed at SAIF Centre at IIT Bombay

Major Highlights

- **Facility Management Committee Meetings & SAIF centre visits:** FMC meeting were organized for all the 15 SAIF centres SAIFs portray their requirements, achievements, performance etc in these meetings. These centres are also visited physically by the expert committee to oversee their functioning.
- **Analysis Provided/Usage of facility:** The facilities at SAIF are meeting analytical needs of researchers, scientist and industries for material characterization including qualitative/ quantitative analysis, structure determination, surface topographic studies etc.
- Approximately 2800 research papers were published with the support provided by the SAIFs during the year

- About 23,000 users from pan India, belonging to all sectors have utilized and benefitted from the facilities at SAIF
- Approximately 70% of the users utilizing the SAIF facility were from outside the host institute
- An average of 1,25,000 samples were analyzed by 15 SAIF centres.
- **Workshop & Training Programs :** Around 110 webinars, workshops, training programs, and seminars were conducted over the year on NMR, ICP-AES, TEM, SEM, spectroscopy and related topics. These events aimed at creating awareness about SAIF centres facilities and generate skilled personnel for equipment handling, repair, maintenance, and data interpretation.

1.1.4 Sophisticated Analytical & Technical Help Institute (SATHI)

The objective of SATHI program is to establish shared, professionally managed services and strong science and technology infrastructure facilities at national level. SATHI is envisaged to be functional with efficiency, accessibility and transparency of highest order under one roof to cater services to the demands of researchers, scientists, students, start-ups, manufacturing units, industries and R&D Labs. In terms of “help” it will dealt with knowledge generation and its dissemination by adopting best practices of similar facility. This initiative aims to expand the knowledge continuum by linking R&D to applied science and then to translational research, facilitating progress to subsequent stages for greater societal impact.

The usage of these facilities will be guided by the basic principle of maximum and effective utilization and accessibility to all; viz: 80% to external users by booking the slots on web based platform. Largely SATHI scheme aims for : (a) procurement and maintenance of high-end equipment and infrastructure facility necessary for research/ testing/ manufacturing/ fabrication, (b) to cater service by understanding the demands of researchers, scientists, students, start-ups, manufacturing units, industries and R&D Labs, (c) to provide access and sharing of scientific equipment and infrastructure, (d) For capacity building of engineers and technocrats for efficient operations and interpretations of results/ outcome, (e) Monitoring of usage pattern of expensive scientific research infrastructure for its maximum utilization by applying infrastructure management with efficient operations and to be a part of ‘Atma Nirbhar Bharat Abhiyan’ (Self Reliant India Campaign).

Since September 2019, three SATHI facilities at IIT Delhi, IIT Kharagpur, and BHU-Varanasi have been operating towards a self-sustainability model. On National Science Day, February 28, 2024, three more SATHI facilities at IIT Hyderabad, ICT Mumbai, and BITS Pilani were announced to be setup which will expand national-level research infrastructure facilities further.

These new centers will operate under a Public-Private Partnership model, receiving funding and support to develop distinct verticals based on their unique expertise and capabilities. The following SATHI will be established:-

- SATHI BITS-PILANI- Centre for Advancement of Smart Systems IoT and Sensor Technologies, a facility to enable advanced nanomaterial development followed by characterization and device, fabrication for fundamental & industrial R&D,
- SATHI- IIT Hyderabad Cluster to establish Centre on In-Situ Correlative Microscopy (CISCoM) - A real-time characterization across multiple length scales for fundamental & industrial R&D
- SATHI-ICT Mumbai - Drug Manufacturing, Biopharmaceutical R&D and Biopharmaceutical GMP Manufacturing.

The incorporation and registration of Section-8 companies under the name SATHI FOUNDATION at IIT Kharagpur, IIT Delhi, BHU-Varanasi, IIT Hyderabad, and BITS-Pilani have been completed.

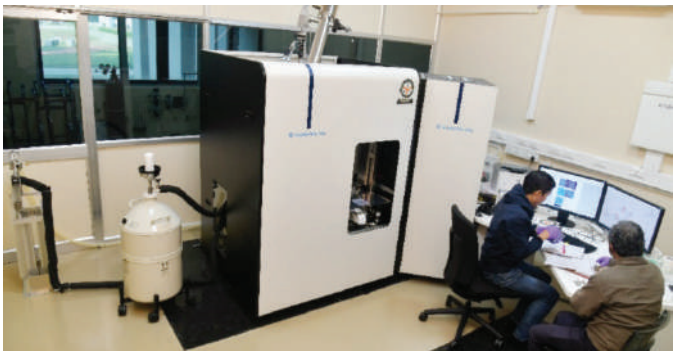


Fig.: State-of-art Secondary Ion Mass Spectrometer – Time of Flight (SIMS-ToF) Facility Unveiled at SATHI Centre of Indian Institute of Technology -Kharagpur

A significant milestone includes the installation of a 300 keV Cryo Transmission Electron Microscope at IIT Delhi, funded through a SATHI grant, providing state-of-the-art infrastructure for the northern part of the country.

All advanced infrastructure installed at the respective SATHI facilities is listed and accessible via the I-STEM portal for broad usage. The establishment of SATHI facilities nationwide adopts a collaborative strategy, involving academia, research institutions, non-governmental organizations, science and technology councils, and industries.

1.1.5 Synergistic Training Program Utilizing the Scientific and Technological Infrastructure (STUTI)

STUTI is a new initiative of the Department started in the year 2021 which would cater to build human resource and its knowledge capacity through open access S&T Infrastructure across the country. As a complement to the various schemes of DST funding (FIST, PURSE, SAIF, CURIE and SATHI) for expansion of R&D Infrastructure at academic institutions, STUTI scheme envisions a hands-on training program and sensitization of the state-of-the art equipment. The primary objectives are as follows:

- Conducting training programs on DST-supported R&D equipment aimed at scientists, professors, PhDs, and PDFs actively engaged in research across various institutions nationwide.
- Organizing awareness programs on R&D equipment/facilities for high school students (Science stream) in surrounding areas through short training sessions and popular science events.

Under the scheme, 248 training and 132 awareness programs were organizedthrough 13 Project Management Units (PMUs) in central and state universities, IITs, NITs, IISERs, IISc, colleges, and private universities, to ensure diverse geographical representation.

The training programs featured demonstrations of various high-end research facilities in STEM fields. A total of 8,573 researchers from different educational backgrounds and subject areas have been trained. Among these participants, there were 4,589 male and 3,984 female candidates from various institutions participated. Additionally, 1154 candidates from the North-East and Jammu & Kashmir regions participated, along with over 600 participants from underrepresented regions such as Bihar, Odisha, and Chhattisgarh.

The 132 awareness programs were attended by nearly 11,441 school students, who learned about various state-of-the-art instruments and technologies.

Fig.: Glimpses of the STUTI Training programs

1.1.6 Support for Upgradation Preventive Repair and Maintenance of Equipment (SUPREME)

A new program, 'Support for Up-gradation Preventive Repair & Maintenance of Equipment (SUPREME)' was launched during the year to facilitate repair, up-gradation, maintenance, retrofitting, or acquiring additional attachments to enhance the functional capabilities of existing DST-supported analytical instrumentation facilities in various institutions, laboratories, and academic institutions. The department has recommended seven projects under the Support for Up-gradation, Preventive Repair, & Maintenance of Equipment (SUPREME) program, with a budgetary outlay of Rs. 13.02 Crores. Facilities benefiting from this program include upgrading and repairing various advanced equipment such as Confocal Laser Scanning Microscope, Field-Emission Scanning Electron Microscope (FE-SEAM), Nuclear Magnetic Resonance (MRI) machines, Single Crystal X-ray diffraction facility, Tandetron accelerator, and a 3 Tesla functional MRI facility for cognitive neuroscience research.

Fig.: Launching of SUPREME Scheme during Viswavidyalaya Anusandhan Utsav

To facilitate access for researchers, startups, and MSMEs, all institutions supported under the aforementioned schemes were sensitised to link their facilities with the I-STEM portal (Indian - Science Technology and Engineering Facilities Map) ensuring optimal utilization of the facilities.

1.2 State Science and Technology Programme (SSTP)

State Science and Technology Programme (SSTP) nurtures Centre-State S&T cooperation through budgetary support to Science & Technology Councils across 28 State/Union Territories. The role of these S&T Councils is to catalyse the Science Technology and Innovation (STI) ecosystem within respective State/UTs 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 program also extends support to Patent Facilitation Centre (PFC) established at TIFAC and Patent Information Centres established at the State S&T Councils to facilitate Intellectual Property Rights (IPR) related activities. Some of the significant achievements under the SSTP programme are summarised below:

- **Punjab State Council for Science and Technology**

  Punjab State Council for Science and Technology in partnership with AIIMS-Bathinda piloted two low cost healthcare interventions namely Non-Pneumatic Anti- Shock Garment and Uterine Tamponade Balloon for managing critical Postpartum Haemorrhage (PPH) in women in Bhatinda and Faridkot districts of Punjab. The initiative led to saving of 75 lives, a step towards reduction of Maternal Mortality Rate in the state.

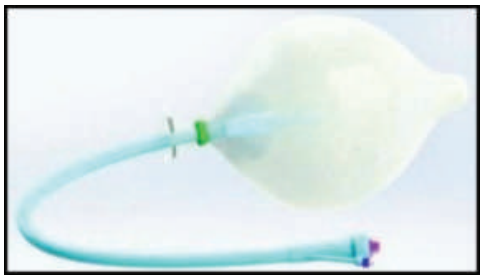


Fig.: Uterine Tamponade Balloon

Fig.: Non-Pneumatic Anti- Shock Garment

- **Uttarakhand State Council for Science and Technology (UCOST)**

  State Aroma Mission was launched in Uttarakhand with the joint effort of Uttarakhand State Council for Science and Technology (UCOST) and CSIR- Central Institute of Medicinal and Aromatic Plants (CIMAP). The launching of the State Arora Mission sets the stage for a transformative journey, empowering local communities, fostering economic growth, and harnessing the rich potential of the state's resources. Further, UCOST organized 6th World Congress on Disaster Management (WCDM) on the theme "Strengthening

Climate Action & Disaster Resilience with special focus on Mountain Ecosystems and communities". During the event, extensive discussions were held centered around the challenges, solutions and best practices within the realm of Disaster Management, drawing the participation of experts, scholars, researchers, policymakers, and practitioners from esteemed institutions such as UN Bodies, Universities, Corporations, and Government organizations.

Fig.: Launching of State Aroma Mission in Uttarakhand

Fig.: Inauguration of 6th World Congress on Disaster management by Hon'ble Chief Minister of Uttarakhand, Shri Pushkar Singh Dhami

- **Madhya Pradesh Council of Science & Technology (MPCST)**

  Madhya Pradesh Council of Science & Technology (MPCST), in collaboration with IIT Gandhinagar, inaugurated the Centre for Creative Learning (CCL). This centre aims to offer educational demonstrations that showcase and teach STEM concepts. Vibrant artifacts have been crafted to engage and inspire students, educators, and the wider community, fostering a sense of curiosity and amazement. Further, MPCST established a biomass-based pellet production unit at the Rural Technology Application Centre in Obaidullahganj in collaboration of Madhya Pradesh State Bamboo Mission Bhopal. This unit enables the conversion of various biomass sources such as bamboo or bamboo waste, sawdust, wheat straw, paddy husk, eucalyptus bunches, weeds, acacia tree bark, and stalks into pellets.

Fig.: Visuals from Centre for Creative Learning

Fig.: Biomass-based pellet production unit

- **Assam Science Technology & Environment Council (ASTEC)**

  Assam Science Technology & Environment Council (ASTEC) supported and facilitated the development of a King Chilli Drier. The advantages of this drier include no intermittent handling of material during the whole drying process, ease of operation, lower operational and maintenance costs compared to conventional dryers. The patent for the drier was facilitated by the Patent Information Centre at ASTEC. It has been empanelled with Spices Board, Government of India. More than 40 units of the driers sold within the Assam and shipped to Maharashtra, Manipur, Telangana, Nagaland and Arunachal Pradesh.

Fig.: King Chilli Drier

- **The Goa State Council for Science & Technology**

  The Goa State Council for Science & Technology launched a campaign aimed at recycling old clothes to combat single-use plastic in the state. As part of the initiative, over 5,000 students from 33 schools across Goa were educated about the harmful effects of single-use plastic and trained in crafting cloth bags. Additionally, with the involvement of over 40 Parent-Teacher Associations, more than 1.25 lakh cloth bags were made by upcycling of old clothes and distributed among residents and shopkeepers.

Fig.: Press clipping of campaign on Recycling of Old Clothes for eradication of Single Use Plastic

- **West Bengal State Council of Science & Technology**

  West Bengal State Council of Science & Technology, as a part of Post Geographical Indication (GI) activities, undertaken initiatives like introduction of QR coding and digitalization for identification/ verification of the authentic registered GI products for socio-economic benefit of the authorized producers in the State.

- **Gujarat Council on Science and Technology**

  Gujarat Council on Science and Technology prepared a calendar featuring 365 days of scientific events. This calendar encompasses important scientific days and weeks, significant inventions and discoveries that have changed the society, and commemorations of the birth and death anniversaries of esteemed scientists who serve as role models for aspiring minds.

- **Karnataka State Council for Science and Technology**

  Karnataka State Council for Science and Technology prepared the Village information System (VIS) atlas for Ragihalli Gram Panchayath of Anekal taluk, Bengaluru Urban District. The VIS atlas provides digital spatial data encompassing demography, natural resources, land use, land cover, socio-economic aspects, and more to assist decision makers and planners in making well-informed decisions at the village and cadastral levels.

- **Patent Facilitation Programme (PFP)**

  The Patent Facilitation Programme (PFP), sub-scheme under SSTP is being

implemented through Patent Facilitation Centre (PFC) established at TIFAC, and the Patent Information Centers (PICs) established at the State S&T Councils. Additionally, IP Cells are also supported at institute/university level through the PICs to enlarge the network. The program aimed at creating awareness and extend assistance on protecting Intellectual Property Rights (IPR) including patent, copyright, geographical indication etc. at State/UT level.

During the period, the PFC at TIFAC, Patent Information Centers (PICs) at the State S&T Councils, and IP Cells at the Institute/University level facilitated the filing of 1273 patents and the granting of 313 patents. Additionally, they facilitated the filing of 29 copyrights, with 18 granted; filing of 74 industrial designs, with 53 registered; filing of 29 trademarks, with 14 registered; and filing of 42 geographical indications, with 32 registered. Further, 111 new IP cells were established at Institute/University level. Moreover, 450 awareness programmes/workshops/trainings were organised to facilitate Intellectual Property Rights (IPR) related activities.

Patent Information Centre at Tamil Nadu State Council for Science and Technology was awarded with “National Intellectual Property Award 2023” under the category of “Special Citation for PIC” conferred by the Office of the Controller General of Patents, Designs and Trademarks, Ministry of Commerce and Industry, Govt. of India

1.3 Policy Research Cell

The Policy Research Cell (PRC) is mainly focused to promote STI policy research in the country for strengthening the policy research mechanism in STI domains. Under the programme, Centres for Policy Research (CPRs) have been established in academic institutions across the country with the objective of generating evidence-base for policy planning. A new initiative has been taken up to expand the DST STI policy 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. Similarly, a Policy Fellowship Programme (PFP) is being supported with the aim to generate a pool of critical mass of the policy researchers in the country.

During the current year, Eight CPRs and Six SPRs are being supported under the programme: 1) Panjab University, Chandigarh, 2) Indian Institute of Science, Bengaluru, 3) Indian Institute of Technology, Bombay, 4) Indian Institute of Technology, Indore, 5) National Institute of Science Education and Research, Bhubaneswar, 6) University of Hyderabad, Telangana, 7) Central University of Rajasthan, Ajmer, and 8) Central University of Gujarat, Gandhinagar. The Satellite-centres for Policy Research (SPRs) are not provided with any financial assistance and list is given below. Currently, the 5th Cohort Policy Research Fellows are working under the DST STI Fellowship programme and the selection of the 6th Cohort has also been done.

Table.1: List of Satellite Policy Research (SPRs) Centre

Sl. No.	Satellite-centres for Policy Research (SPRs)
1	Amity University, Uttar Pradesh
2	Amrita Vishwa Vidyapeetham, Kerala
3	Centre of Bio-Medical Research (CBMR),Uttar Pradesh
4	Institute for Studies in Industrial Development (ISID), New Delhi
5	Science and Technology Park University of Pune, Maharashtra
6	Jawaharlal Nehru Technological University, Hyderabad

Centres for Policy Research (CPRs)

In the FY 2023-24, all CPRs (Centres for Policy Research) have made remarkable achievements and successfully attained their objectives and goals. Here is a brief overview of the activities carried out by the various CPRs, with specific details provided for DST-CPR Punjab University and IISCs, Bangalore.

- **DST-CPR at Punjab University, Chandigarh:**

  DST-CPR, Punjab University, Chandigarh was established in the FY 2013-2014 and has been continuously contributing in the policy research in different S&T sectors. During the FY 2023-2024, the broad activities and key outcomes of the CPR are as follows:

Activity 1:*Conducting the research for the Development of a new country specific model for promotion of Public Private Partnership (PPP) for R&D*

Studies in the domain of Industry-Academia (I-A) collaborations and public-private partnerships (PPPs) were initiated by collating data pertaining to resources and initiatives in India which fostered collaboration amongst the public and private sectors. This study provided evidence based recommendations for developing a robust and vibrant I-A R&D ecosystem. *Establishing an Apex Level [National Industry-Academia Centre (NIAC)]; Creation of national level Industry-Academia Web-Portal; Establishment of Translational Research Ecosystem (TRE) in Universities; Establishment of Industry Research Assistance Council in funding agencies; Mandating the partnership of Universities with DSIR Accredited R&D Units and National Research Labs*, etc. were a few of the prime recommendations of the study.

Studies of PPP initiatives globally were undertaken and a suggestive Roadmap for strengthening R&D ecosystem through PPP, especially for developing countries based on the best practices followed world over was developed. The study on international models of PPP generated key recommendations, such as *Remodelling NRLs for enhancing PPP in R&D (on the lines of Fraunhofer and Catapult Institutes); 'Fast-Track R&D Fund' for Assistance to Micro-Industries; Cluster Programme' for Risky & High End Innovations; Establishing Industry-Academia Chairs; Introduction of Vouchers; Mobilising Researchers/Scientists*

from Academia to Industry and vice versa; Positioning Moderators between Industry and Academia, etc. a few of which have materialized into entities such as Technology Enabling Centres, Biomedical Hubs, etc.

Activity 2: Identify areas of policy gaps for stimulation of private sector investment in R&D and suggest changes in policy environment:

India's aspiration to enhance its Gross Expenditure on R&D from current 0.7% to at least 2% requires more than 50% of private sector contribution (current nearly 36% levels (NSTMIS, 2020-21)) to the national R&D ecosystem. The study of public private partnership and policy interactions in the agricultural innovation system of India aimed to find the policy gaps, and addresses the issues related to the knowledge and technology transfer in agriculture. Despite an enhancement of 33 times in private investment in agricultural R&D, India is still unable to achieve its target of 1 % agriculture GDP. This indicates the requirement to study the detailed policy gaps in the current agriculture R&D system to stimulate private investment and utilization of resources in a systematic and transparent manner.

In addition, regulatory norms associated with provision related to R&D tax incentivization and patent box regime should be streamlined for attracting the private sector to the national R&D ecosystem.

Activity 3: Carry out research to develop evidence-based approaches for promoting generation of intellectual properties and technology transfers

The Centre has conducted various studies and activities to understand the IP ecosystem in India. As per the findings of the studies, there is lack of awareness on IP issues and because the process of seeking the protection of IPs is time consuming and costly affair, the inventors opt for publishing their research in public domain instead of securing legal rights over it. Further Indian patentees are reluctant to file working statements (Form-27) of the patents granted to them and those who are submitting the form are mentioning infirm reasons for non-working status of the patent. To resolve the issues of working of the patents granted it is recommended to create a dedicated body to look after the causes hampering the working of the patents and make patentees aware about the seriousness of commercialization of their research. In addition, region wise studies are being conducted to understand the impact of parameters like innovation, IP filings/grant and technology commercialization in each of these universities/institutes in the Northern region of India. The ultimate aim is to suggest a model for enhancing the translational research ecosystem through technologies generation, I-A collaborations and the triple helix model.

Other detailed outcomes of the CPRs can be accessed at https://ppprnd.puchd.ac.in.

- **DST-CPR at Indian Institute of Science, Bangalore:**

  It was established in the FY 2014-2015 and has been contributing in the policy research

in different S&T sectors. During the FY 2023-24, the CPR was focusing on the following activities:

Activity 1: Open Science

Open science is an umbrella term referring to verticals like open access, open research data, open research protocols, sharing of research infrastructure, and citizen science. In continuation of the Centre's research on studying the knowledge dissemination component, especially the ongoing transition in scholarly communication practices, this work focuses on critically examining strategies and policy choices for open access publishing and open science practices in India. Use of scientometric method is a key feature of the project. Another focus of this project is on preparing a policy framework for citizen science in the country.

Activity 2: STI Diplomacy

Science, Technology, and Innovation (STI) Diplomacy is being increasingly used by countries around the world as an important instrument in foreign policy and diplomacy activities. The Centre's research on STI diplomacy is focused on (a) studying the role of STI, particularly in emerging technologies, in India's foreign policy agenda, and (b) examining relationships between India's STI capabilities and foreign policy goals, and (c) developing policy options for India's efforts in STI diplomacy.

Activity 3: Higher Education

Higher education institutions play a central role in developing the human, social, and knowledge capital of the STI ecosystems. The Centre's work on higher education is focused on: (a) Scientometric studies of publications from Indian institutions with a view to elucidate their research productivity and strengths in different fields of science and technology, and (b) a study on doctoral education in India whose aim is to assess the level and quality of training received by doctoral students to prepare them for both academic and non-academic careers.

Activity 4: Significant achievements of the centre can be summarized as fellows;

Open Science: The project on Open Science deals with four verticals, Open Access, Open Research Data, Responsible Research Assessment and Citizen Science. The main tasks undertaken under this project are; Identifying the barriers and opportunities in achieving an open science ecosystem, and possible policy instruments for facilitating the transition towards an open science paradigm; Current status of open access and open research data (ORD) policies at the national and international level, and recommended policy actions in the Indian context; Policy actions to transform the present research assessment criteria towards a robust, flexible, and more practical approach;

STI Diplomacy work in this period focused on two aspects: 1) Conceptual understanding of motives and mechanisms of tech diplomacy (section 11b iii), and 2) Emerging technologies as foreign policy instruments (section 11b iv, x, xi). Together, these working papers explore

the interface of technology and foreign policy and highlight different trends. Especially, the contrast between the Global North and Global South is analysed in this research.

Research and Innovation: The work on informal innovations in India revolves around two aspects: 1) The desk research is done to identify the published studies on the topic of grassroots innovations and informal sector innovations. 2) The empirical work is concerned with the innovations in informal settings by taking the case study of makerspaces in India. The objective of the desk research was to search the research articles using scientometric methods to identify the research communities working in the domain of informal and grassroots innovations. Similarly, the empirical study (undergoing) aims to analyse the funding, networking, knowledge sharing, and knowledge appropriation mechanism of informal innovation communities in India.

Additionally, the centre has published the articles/reports, conducted week seminars, symposium series & workshop, developed few collaborations and trained the personals towards the capacity building. The detailed centre's activities may be see through the Web Portal, via www.dstcpriisc.org.

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

  DST-CPR at the Indian Institute of Bombay, Mumbai has collaborated with the National 'Jal Jeevan Mission (JJM)' to assess the effectiveness of the Mission's Management Information System (MIS) and propose enhanced solutions. The institute conducted primary surveys and compiled a comprehensive database for this purpose. Based on the findings, it was recommended that further detailed analysis be conducted to draw actionable policy insights. The current JJM MIS has demonstrated significant improvements in terms of data availability compared to its predecessor program.

  The JJM database and IMIS provides detailed information about the program progress like the status of physical and financial progress, but it fails to provide information about the program output that are crucial for decision making for the policy makers. For instance, the village profile gives detailed information about the scheme design along with the stakeholders associated, household details, water quality status, water source and village action plan (VAP). However, VAPs have been designed with the focus on financial integration across different programs and not specifically as per source sustainability and water security as areas of concern. Further, the aggregated information about water source dependency is not reflected and is difficult to extract, at the block/ district/ state levels. Since source sustainability has been a major challenge in this sector (considering the high rate of slip-back in NRDWP), information about source dependency and year-wise status of water availability can help identify pockets of areas that require attention for ensuring drinking water security.

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

  The Centre has developed expertise in the water sector and focused on assessing the

effectiveness of current water policies. It has evaluated the existing Science, Technology, and Innovation (STI) policy interventions aimed at promoting sustainable environmental and water management practices. Additionally, the institute is actively engaged in promoting the application of Big Data in integrating STI with water management governance.

The CPR activities includes defining the analysis scope, gathering patent data, and conducting comparative analysis to identify trends and emerging technologies in the field of water management.

- **DST-CPR at National Institute of Science Education and Research, Odisha**

The CPR has been focusing on policy research concerning just energy transitions and tribal education. The CPR conducted a National Level Brainstorming exercise to assess the Energy Transition status of five eastern states, namely Odisha, Bihar, Chhattisgarh, Jharkhand, and West Bengal, aiming to understand the progress made by these states in transitioning to sustainable energy sources.

A policy dialogue on theme 'Tribal Education' was conducted to brainstorm on policies and programs under implementation in different states in the Eastern India. The participants involved included researchers, senior officials from SCST Research and Training Institute, Government of Odisha, UNICEF, NGOs working on tribal education, experts from Chhattisgarh and Jharkhand, faculty members from Maa Manikeshwari University in Bhawanipatna, Kalahandi, and representatives from Ashram Schools. These stakeholders participated in different sessions and provided valuable insights and comments.

- **DST-CPR at University of Hyderabad, Telangana**

The CPR has focused on three important objectives: S&T Entrepreneurship/ Industries/Start-ups, STI Policy & Governance, and Science Communication: Science Communication, Public Engagement. Under the objective of S&T Entrepreneurship/ Industries/Start-ups, the institute has organized various discussions and workshops on the topic of 'National Innovation and Start-up Policy - Benefits and Challenges for Academia and Start-ups.' As an outcome, a policy framework has been developed for Virtual Technology Business Incubators, aiming to foster a collaborative ecosystem between universities and central entrepreneurial initiatives.

Regarding STI Policy & Governance, the institute has organized a conference titled 'STI India: Towards Innovating Futures' with the aim to explore and learn from grassroots innovators, understanding the motivating factors behind their innovations, the challenges they face, and the existing policies that support them in scaling up their innovations and entrepreneurship journey.

In the area of Science Communication & Public Engagement, the institute has conducted a series of round table discussions involving stakeholders such as science communicators, senior scientists engaged in public outreach and science popularization,

science historians, and science educators. These discussions have facilitated knowledge sharing and collaboration among experts in the field.

- **DST-CPR at Central University of Rajasthan, Rajasthan**

  The center focuses on addressing important policy issues related to science and innovation (STI) financing and sectoral STI within the Western Region of India. Its primary objective is to analyze the current STI funding landscape, identify gaps and inefficiencies, and propose recommendations to enhance the allocation and utilization of funds for STI development.

  Furthermore, the centre aims to identify priority sectors for targeted STI interventions, assess existing STI capabilities and challenges, and develop strategies to foster collaboration among academia, industry, and government for sectoral STI advancement.

- **DST-CPR at Central University of Gujarat**

  Gujarat focused on gender equity and inclusion in STI as its core theme. It focused on the STI sector in Western India (four states: Gujarat, Maharashtra, Goa, Rajasthan and Union Territory of Diu) and has divided whole STI sector into formal sector and informal sector. Formal Sector consists of higher Education institutions and government agencies. Informal sectors refer to the segments of the unorganised economy that are directly linked to advancements in the STI Sector.

- **Satellite Centres for Policy Research (SPR)**

  The department has taken a new initiative to expand policy research by establishing Satellite Policy Research Centres (SPRs) in various institutions. It is important to note that the department has not provided financial assistance to these institutions. However, based on the performance and outcomes of the SPRs, the department may consider upgrading their status or providing special projects to support their research activities. SPRs have performed very well and have been recommended for short-term projects. DST-SPR at Amity University, UP to work on 'public procurement policy enabling innovation and indigenous technology development' and DST-SPR at Amrita Vishwa Vidyapeetham Amritapuri, Kerala to work on the topic of research on 'Analysis and mapping of women empowerment initiatives in STI by Government of India.'

- **STI Policy Fellowship Programme**

  Apart from the CPR & SPR activities, a DST-STI policy fellowship programme has been supported since 2016. The fellowship is supported in three categories: Senior Policy Fellows (SPF), Post-doctoral fellows (PDF) and Young Policy Professionals (YPP). These policy fellows are being assigned with a defined research topic in the area of STI policy domain. During the year, fellowships were supported to the fifth & Sixth cohorts of the fellows.

1.4 National Science and Technology Management Information System (NSTMIS)

The National Science and Technology Management Information System (NSTMIS) programme is being implemented since inception of the department. It 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 are published, providing vital information on national R&D indicators which serve 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 on resources devoted to research and development activities, 2021-22 completed during the period. Based on this survey, two national publications i.e. **"Research and Development Statistics at a Glance, 2022-23"** and "**Science & Technology Indicators Tables, 2022-23**" were prepared and published. The latest data on the S&T indicators brought out thus reflect the status of national STI ecosystem. The salient findings of this survey are:

- The Gross Expenditure on R&D (GERD) in the country has more than doubled from Rs. 60,196.75 crore in 2010–11 to Rs. 127,380.96 crore in 2020–21.
- India's GERD as percentage of GDP remained at 0.66% and 0.64% during the years 2019–20 and 2020–21, respectively.
- GERD is mainly driven by the Government sector comprising Central Government (43.7%), State Governments (6.7%), Higher Education (8.8%) and Public Sector Industry (4.4%) with Private Sector Industry contributing 36.4% during 2020–21.
- India's per capita R&D expenditure has increased to current PPP$ 42.0 in 2020–21 from current PPP$ 29.2 in 2007–08.

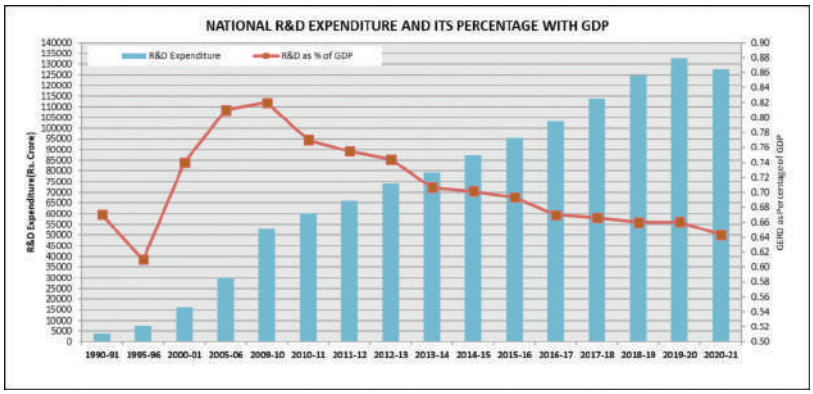


Fig: Trends in National R&D Expenditure

- Amongst the 12 Central Government major scientific agencies, DRDO accounted for the maximum share of 30.7% of R&D expenditure followed by DOS (18.4%), ICAR (12.4%), DAE (11.4%), CSIR (8.2%) and DST (6.8%), DBT (4.4%) and ICMR (3.1%), MeitY (2.2%), MoES (1.5%), MoEFCC (0.8%), and MNRE (0.1%) during 2020–21.

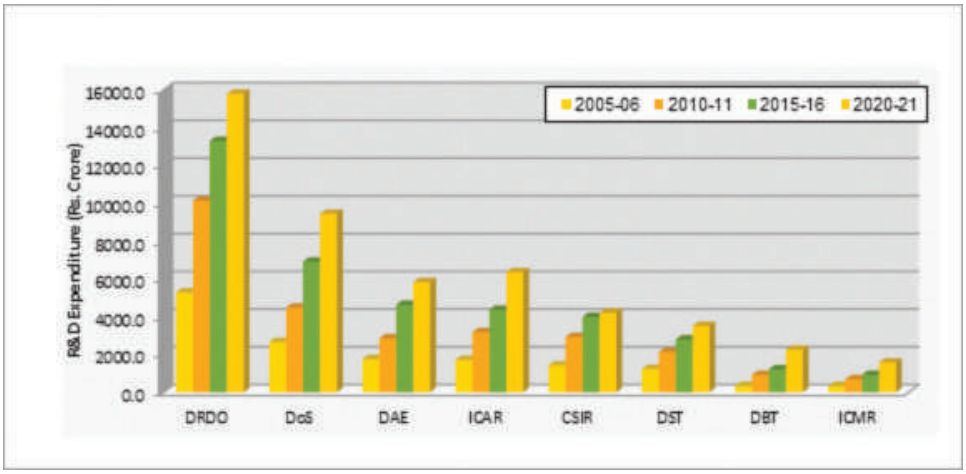


Fig. R&D Expenditure by Select Scientific Agencies

- Nearly 5.55 lakh personnel were employed in the R&D establishments in the country including in-house R&D units of public and private sector industries. Out of which, 3.62 lakh were performing R&D activities, which was 65.3% of total personnel employed in the R&D establishments.
- There were 67,441 women directly engaged in R&D activities, which was 18.6% of the total R&D manpower employed in the R&D establishments.

A **National Manufacturing Innovation Survey (NMIS) 2021-22,** in collaboration with UNIDO, Austria was completed during the period. Based on the survey, 7 reports (5 Sectorial Reports, 1 Firm Level Report & 1 Summary Report) were brought out and are available on DST website. The salient findings of this survey includes:

- First India Manufacturing Innovation Index (IMII) was created, for comparing innovation performance across the 28 states and 6 union territories of India
- 25.01% of the 8,074 firms surveyed were innovative - they have successfully implemented either new or significantly improved products or processes
- One-fifth of the firms surveyed indicated successful innovation outcomes
- The NMIS study of Sectorial Systems of Innovation identified the urgent need for participation of Arbitrageurs (banks, financial institutions, venture capital and angel investors) and Intermediary organisations (industry associations, institutions supporting technical change and incubators) and a well-diffused ICT in the context of the fourth

industrial revolution (I4.0), to improve the sectorial systems of innovations.

- Further, the SSI study presents sector specific findings on knowledge and resource flows within and between the actors (Linkages) for fostering innovation is presented in the report. The survey provides barriers' analysis to innovations within each of the sectorial system of innovation

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 **2019-20 and 2020-21** have been published together. The key highlights of Directory of Extramural R&D projects, 2020-21 are:

- A total number of 3180 extramural projects supported with a cost of Rs. 2002.70 crore in 2020-21.
- The two departments under Ministry of Science and Technology i.e. DST & DBT together contributed to 73% of the total extramural R&D funding in India.
- The women participation in extramural R&D projects has increased significantly to 21% in 2020-21 from 13% in 2000-01 due to various initiatives undertaken by the Government in S&T sector. In absolute terms, 660 women Principal Investigators (PIs) during 2020-21 availed extramural R&D support as against 232 in 2000-01.

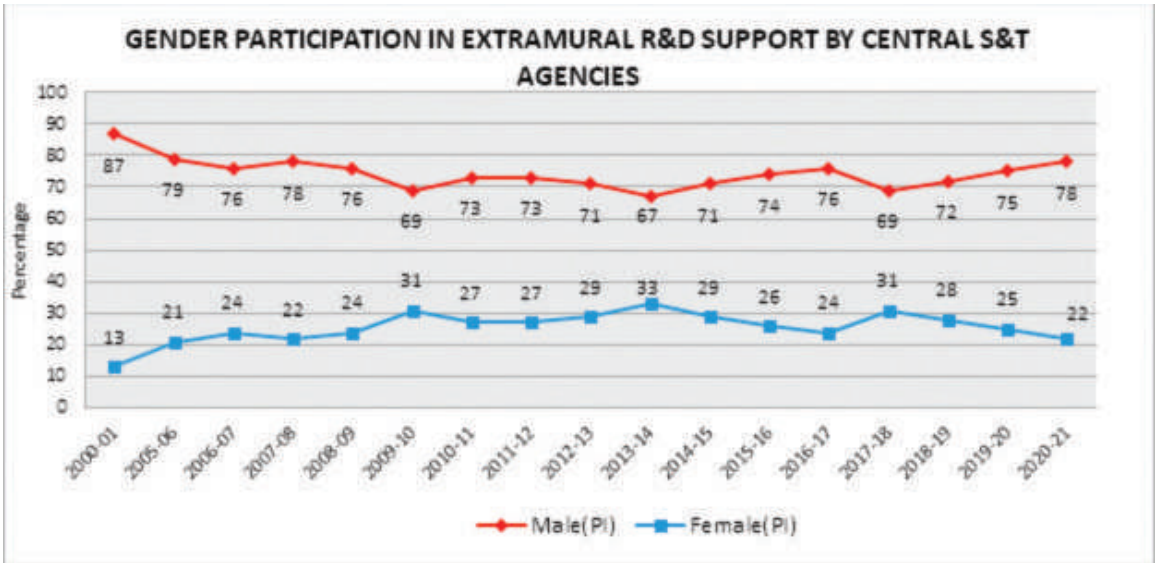


Fig: Gender Participation in Extramural R&D Support by Central S&T Agencies

1.4.3 NSTMIS Sponsored Studies

As a part of its outreach research programme, 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 25 ongoing projects are being implemented under the programme. The completed project reports/studies are available in public domain through a web-based digital repository (http://www.nstmis-dst.org/NSTDRepository.aspx).

1.4.4 International Collaboration

The Department has actively participated and contributed in the UNESCO Institutes of Statistics (UIS) and Organization for Economic Cooperation and Development (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) continues its programme of Human Resource Development namely 'National Programme for Training of Scientists & Technologists working in Government Sector' for scientific and technical personnel during 2023-24 as well. The programme strives to achieve better understanding about professional requirements, enhancing professional knowledge and skills needed for better performance of individuals and organizations in the domain 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." 26 training programmes were approved in the FY 2023-24 under this scheme and 625 scientists benefitted from these training programmes.

Government of India launched the National Programme 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 and same has been launched by Hon'ble MOS(I/c)- S&T on 17.08.2023.

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

The Department of Science and Technology is implementing a dedicated scheme 'Women in Science and Engineering-KIRAN (WISE-KIRAN)" to promote girls and women in Science & Technology. WISE-KIRAN Scheme aims to bring gender parity in S&T and has several windows to cater to women from all walks of life. This year several new programmes have been initiated under the WISE-KIRAN Scheme. The achievements under WISE-KIRAN during 2023-24 are as follows:

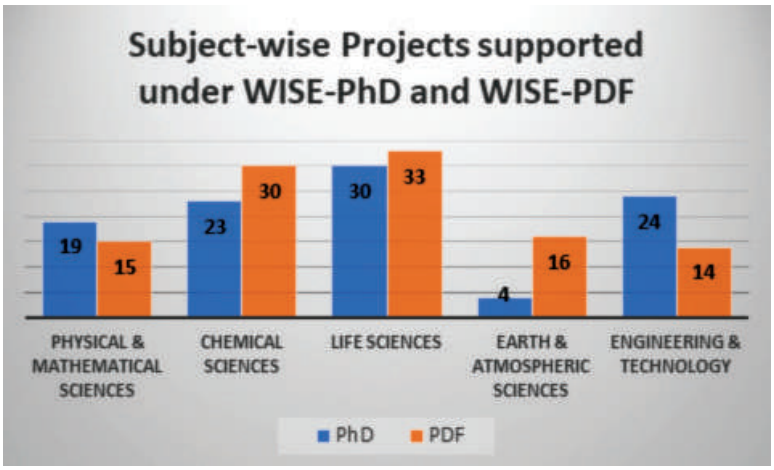
New Initiatives

During 2023-24, following five (5) new programmes have been launched to promote women in different sectors.

- **WISE Internship in Intellectual Property Rights (WISE-IPR):** This programme was launched in 2023 to train women aged 25-45 years in the field of Intellectual Property Rights (IPRs). The programme has 5 coordination centres in North (Delhi), South (Bengaluru), East (Kharagpur), West (Pune) and North-East Regions (Guwahati) for proper management of programme. Out of 2741 applicants, 100 women scientists were selected through a screening, national exam and interview process for an internship. After a one-month orientation, they were placed in various organizations handling Intellectual Property Rights.

Fig: Valedictory ceremony of orientation programme under WISE-IPR

- **WISE Fellowship for Ph.D. (WISE-PhD):** The WISE-PhD Programme aims to provide the opportunity to pursue Ph.D. in Basic and Applied Sciences to women of the age group of 27-45 years. In 2023, the division received 909 proposals across five subjects. After evaluating 562 proposals in five Subject Expert Committee meetings, 100 projects were recommended for financial support (19 in Physical & Mathematical Sciences, 23 in Chemical Sciences, 30 in Life Sciences, 4 in Earth & Atmospheric Sciences, and 24 in Engineering & Technology).
- **WISE Post-Doctoral Fellowship (WISE-PDF):** The WISE-PDF programme provides support to carry out research in five (5) subject areas of Basic and Applied Sciences. A total of 1011 proposals have been received under WISE-PDF and 751 proposals have been evaluated by the Subject Expert Committees. Finally, 108 projects (15 in Physical & Mathematical Sciences, 30 in Chemical Sciences, 33 in Life Sciences, 16 in Earth & Atmospheric Sciences and 14 in Engineering & Technology) have been recommended for budgetary support.



- **WIDUSHI (Women's Instinct for Developing and Ushering Scientific Heights and Innovation):** This new initiative of DST is for senior women scientists who have the potential to conduct cutting-edge research and have a flair to nurture budding researchers. The programme supports two (2) categories of senior women scientists viz. retired women scientists (Category-A) and senior women scientists who are not in regular employment (Category-B). A total of 70 proposals were received during the year and 47 were screened in for presentation before the Programme Advisory Committee.
- **WISE-SCOPE:** This unique initiative provides an opportunity to women to address societal challenges through their S&T expertise. The programme has identified five (5) thematic areas including Agriculture and Allied Sciences, Health Food & Nutrition, Engineering & Technology, Climate Change and Environment, and Waste and Water Management. A total of 109 proposals have been received under the programme.

Ongoing Programmes

- **Vigyan Jyoti:** The Vigyan Jyoti Programme aims to encourage girls to pursue career in Science Technology Engineering and Mathematics (STEM) fields where participation of women is low. During 2023, the programme is extended in Phase-IV to 250 districts of 34 states/UTs of the country. Vigyan Jyoti is providing various interventions to 21600 meritorious girls of Class IX-XII from JNVs, KVs, Army and other Government Schools in Phase-IV.

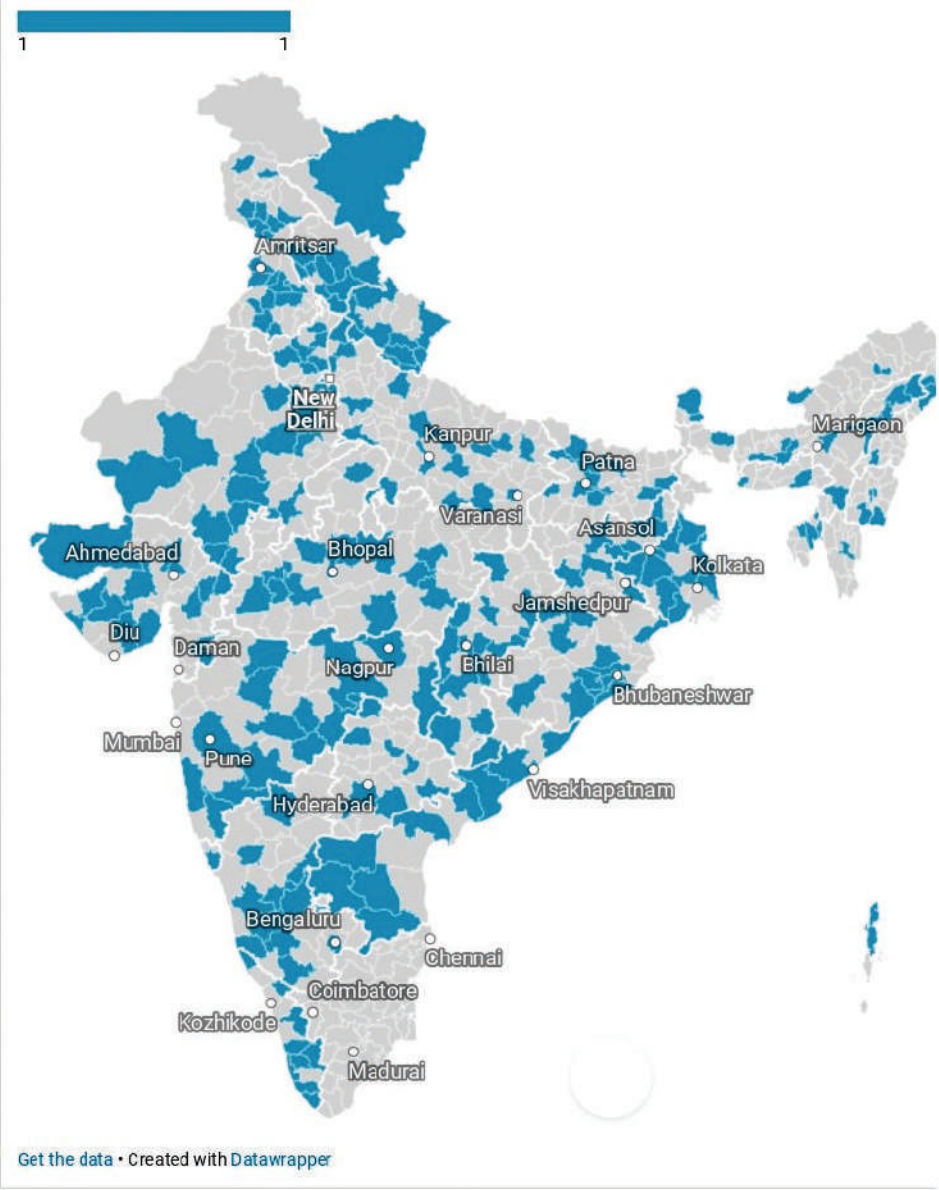


Fig.: Spread of Vigyan Jyoti Programme

Girls enrolled under Vigyan Jyoti Programme have benefitted through a diverse range of activities, including science camps, specialised lectures, additional academic support, student-parent counselling sessions, interactions with role models, tinkering activities, Coding Sessions, C-STEM Sessions, Sparkle Series, workshops, Career Counselling Sessions, STEMPORIUM: Vigyan Jyoti E-Newsletter, capacity building workshops for Teachers, visits to KPs, research labs, industries, and NGOs, etc.

Fig.: Glimpses of various activities under Vigyan Jyoti

A three-day Conclave was organized under Vigyan Jyoti to create awareness about space research and the latest achievements of ISRO in space science among children. Students also interacted with scientists from ISRO & other institutes of National Repute.

- **Women Scientists Scheme:** The Women Scientists Scheme provides opportunities to women scientists who had a break in their careers to pursue research. This year 128 women have been supported under WOS-A and financial support has also been extended for 143 ongoing projects under WOS-A and 25 ongoing projects under WOS-B.
- **CURIE (Consolidation of University Research for Innovation & Excellence):** In 2023, two (2) Women Universities and 18 Women PG Colleges in the country have been supported under CURIE Programme for improving R&D infrastructure and establishing State-of-the-art laboratories to create excellence in the S&T domain.





Review of CURIE Projects at Women Universities

- **Gender Advancement for Transforming Institutions (GATI):** The Pilot Phase of the GATI programme has been completed in 2023. The institutions have submitted self-assessment reports to DST which have been evaluated by the Expert Committees. Based on the evaluation reports and final assessment by the Programme Advisory Committee, 12 Institutions have been identified as GATI Achievers.

Further, a brainstorming meeting on **"Key Challenges of Women Researchers and Faculties in STEM and Solutions"** was organized to discuss existing challenges in the S&T career path of women under the Chairmanship of the Secretary, DST.

Brainstorming Meeting on Key Challenges of Women Researchers

Other Activities

- **Workshop on Brain Science:** A five (5) day training workshop on '**Brain Science and Artificial Intelligence'** has been organized at the Indian Institute of Technology Delhi for budding women neuroscientists in which about 100 young female scientists and engineers have participated.
- **Capacity Building Programme under WISE-SCOPE:** A two-day capacity building workshop at BAIF, Pune to enhance awareness for the WISE-SCOPE Programme. The workshop covered diverse thematic areas like agriculture, engineering, health and

nutrition, Natural Resource Management, green and clean energy applications, and Climate actions which are directly related to society

Capacity Building Programme for Women Scientists

- **Women Scientists and Entrepreneurs Conclave:** WISE-KIRAN Division is one of the organizer partners of **'Women Scientists and Entrepreneurs Conclave'** at India International Science Festival during January 18-19, 2024. Secretary, DST and Director General, CSIR inaugurated the conclave. More than 100 women scientists and entrepreneurs from different parts of the country have participated.

- **International Women's Day:** The Department of Science and Technology celebrated International Women's Day on March 08, 2024. Two technical sessions on Physical and Mental Well-being of Women: Maintaining Work-life Balance' and 'Role of Women in Start-ups' have been conducted. More than 200 DST Officials participated in this event physically. The programme was streamed on DST's YouTube channel. Further, an Oral Health Camp was also organized at Technology Bhawan by the residents of Maulana Azad Institution of Dental Sciences, New Delhi. Besides this, a video on Nari Shakti @DST was also unveiled on this occasion and success stories of girls and women benefitted under different programmes of DST's Women in Science and Engineering-KIRAN (WISE-KIRAN) Scheme have also been shared.

International Women's Day @Technology Bhawan

1.7 Cognitive Science Research Initiative (CSRI)

The Cognitive Science Research Initiative (CSRI) encourages research in highly interdisciplinary areas of c ognitive science to address various questions by combining ideas, principles and methods of psychology, computer science, linguistics, philosophy, neuroscience etc.

During 2023-24, the Division has supported 27 new projects and 28 ongoing projects. Further, financial support has also been extended for 19 ongoing projects of the SATYAM (Science and Technology of Yoga and Meditation) programme. Task Force Meeting was conducted to review the progress of 54 projects under CSRI, 49 projects under SATYAM and 12 projects under CSRI-PDF. The division has supported 10th Annual Conference of the Association of Cognitive Science at the Indian Institute of Technology, Kanpur.

1.7.1 Highlights of CSRI projects:

- **Construction of Brain Template Specific to Indian Population**

  Differences in brain structure among different population groups require the development of population-specific Magnetic Resonance Imaging (MRI) brain templates for the analysis of neuroimaging data. PI from the National Brain Research Centre, Manesar supported under CSRI to create a population-specific brain template for the Indian subcontinent which is very crucial because of variations in neuroanatomy within a genetically diverse population.

  A dataset of high-resolution 3D T1, T2-weighted, and FLAIR images acquired from a group of 113 volunteers (M/F - 56/57, mean age-28.96 ± 7.80 years) are used to construct T1, T2-weighted, and FLAIR templates, collectively referred to as Indian Brain Template, "**BRAHMA**". A processing pipeline is developed and implemented in a MATLAB

based toolbox for template construction and generation of tissue probability maps and segmentation atlases, with additional labels for deep brain regions. The pipeline, shown in Figure, consists of a series of steps for image pre-processing, template construction, and generation of associated segmentation atlases.

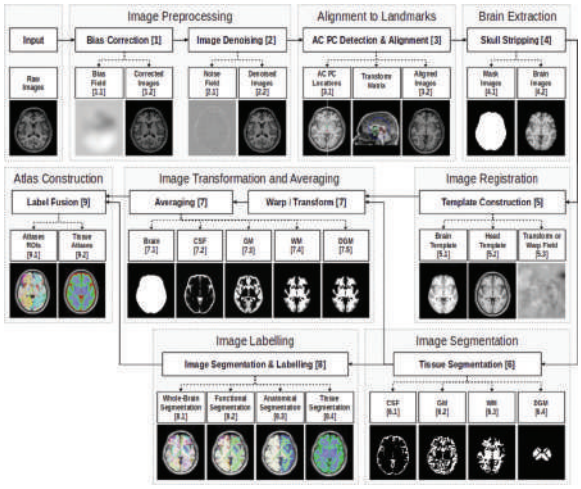


Fig.:The MRI brain template construction pipeline with intermediate results.

The constructed brain template is utilized for segmentation of AC-PC aligned images into different tissue regions, namely cerebrospinal fluid (CSF), grey matter (GM), and white matter. The image labels obtained from the segmented AC-PC aligned images are transferred to the constructed template image using label fusion. The constructed template and generate segmentation atlases and maps can be utilized for analysis of neuroimaging data obtained from different individuals.

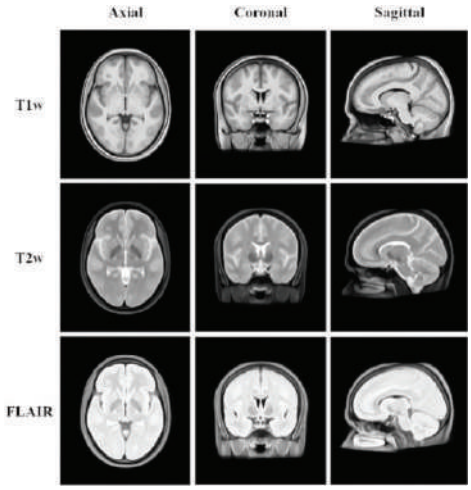


Fig.:The T1, T2, and FLAIR brain templates constructed for the Indian population from 113 individual scans. The axial slice (80th of 160), coronal slice (120th of 240), and sagittal slice (125th of 240) of the template images are shown.

The use of BRAHMA template for analysis of structural and functional neuroimaging data obtained from Indian participants provides improved accuracy with statistically significant results over that obtained using the ICBM-152 (International Consortium for Brain Mapping) template. This is the first Indian brain template where participants are taken from various states and the template is validated using state-of-the-art task-based functional MRI experiments. This work contributes significantly in helping to develop an Indian brain template for Alzheimer's disease and Parkinson's disease using the same MRI protocol and image processing platform used for BRAHMA template.

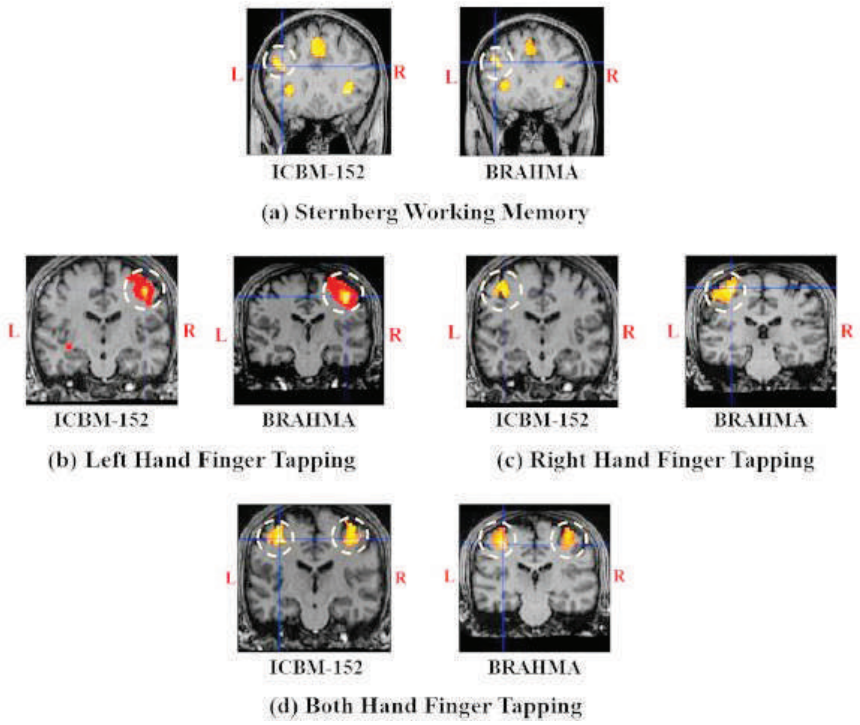


Fig.: A representation of comparative analysis of fMRI activations for the Sternberg Working Memory and Finger Tapping paradigms processed with the help of SPM12 program using ICBM-152 and BRAHMA templates.

- **Examine the effects of AIIMS Manual Cognitive Training kit (MCTT) and computer based cognitive training kit (PSS Cog Rehab) in improving the neuro-psychophysiological functioning in children aged 6-11 years diagnosed with ADHD**

AIIMS has developed a Manualized Cognitive Training Toolkit (MCTT) which is a comprehensive, structured, manually administered, sensory integration-focused, activity-based toolkit with 36 coCgnitive tasks spread over 9 cognitive domains: planning (P), sustained attention (A), simultaneous processing (SiP), successive processing (SuP), working memory (WM), language skills (LS), visual-spatial processing (VSP), mind-

motor coordination (MMC). All India Institute of Medical Sciences, New Delhi assessed the impact of MCTT and PSS Cog Rehab tool in 120 children diagnosed with ADHD.

Fig.: showing children performing various cognitive training activities of AIIMS-MCTT.

After eight (8) sessions of cognitive training program, results of the study showed an overall improvement on neuro-psycho-physiological functioning for the experimental groups namely MCCT manualized cognitive training program, PSS Cog Rehab and Cogmed computerized based cognitive training program compared with the Treatment as usual (TAU) as control group. Significant changes had also been observed in Children's 'Colour trails time taken and error committed', 'porteus maze time taken and error committed' and 'Stroop test naming colour & naming word time taken and error committed'. The results also revealed an overall improvement for the experimental group compared with the TAU group, the improvement were noticed in the attention problem, rule breaking behavior and aggressive behaviors after conduction of cognitive training program.

This study is the first step towards gaining a better understanding of manualized cognitive and computerized intervention on children with ADHD, furnishing useful content, and administration guidelines. Further, MCTT manual can be used by clinical/rehabilitation psychologists and psychiatrists. This manualized cognitive training toolkit with 36 activities with 8 levels of graded difficulty can also be converted to a computerized training programme.

1.8 Innovation in Science Pursuit for Inspired Research (INSPIRE)

Innovation in Science Pursuit for Inspired Research (INSPIRE) is a flagship scheme of Department of Science and Technology (DST) which aims to attract meritorious youth to study basic and natural sciences at the college and university level and to pursue research careers in both basic and applied science areas including engineering, medicine, agriculture and veterinary sciences. The ultimate aim is to expand the 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. INSPIRE scholarship(s)/ fellowship(s) are released adhering to the revised fund flow mechanism.

INSPIRE Internship component of INSPIRE Scheme was reinstated after post pandemic stabilisation of the academic institutions. Internship Science Camp Guidelines were revised. Internship Science Camps Selection Committee for consideration of INSPIRE Internship proposals was reconstituted with the approval of Competent authority. During the period, 03 Internship Science Camp Selection Committee meetings were held, in which out of 22 Internship Science camp proposals, 07 proposals were recommended by Committee for support. Also, 02 camps were organized during the period.

Fig.: INSPIRE Internship Science Camp organized for Class XI and XII level School students

Scholarship for Higher Education (SHE) component under INSPIRE scheme 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 2022 for INSPIRE-SHE was completed and in response, 16,522 applications were received. 10,045 INSPIRE scholarships have been offered. Also, 440 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, 54% are Female.

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. Program 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

program. 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 2022 was completed and out of 2,038 received applications, 1811 applications were cleared for level-2 evaluation for award of INSPIRE fellowships. After Level-2 evaluation of applications for which requisite documents were received, 1282 INSPIRE Fellowship applicants were offered INSPIRE Fellowship. Out of the awarded/offered INSPIRE Fellows 67% are female and 33% are male. Of the total awarded/offered INSPIRE Fellows, about 32% are SHE Scholars who have joined doctoral degree program in science and technology after availing 5 years INSPIRE Scholarship. Six Hundred and Thirteen INSPIRE Fellows were promoted from Junior Research Fellowship (JRF) to Senior Research Fellowship (SRF) after evaluation of the research work carried out by them. Nine INSPIRE Fellows each year are selected and participated in the 14th and 15th JSPS-HOPE meetings held in Japan during February-March 2023 and 2024 respectively.

Two research exposure cum training programs, one each at CSIR-North East Institute of Science and Technology (NEIST), Assam & Sree Chitra Tirunal Institute for Medical Sciences and Technology (SCTIMST), Kerala in subject areas of i) Artificial Intelligence & Machine Learning in Natural Sciences and ii) Biomedical Sciences were organised for the students from North-Eastern States and UTs of Jammu & Kashmir and Ladakh and trained twenty-six Masters degree holders in S&T areas from these states/UTs to excite them to opt for research as a career.

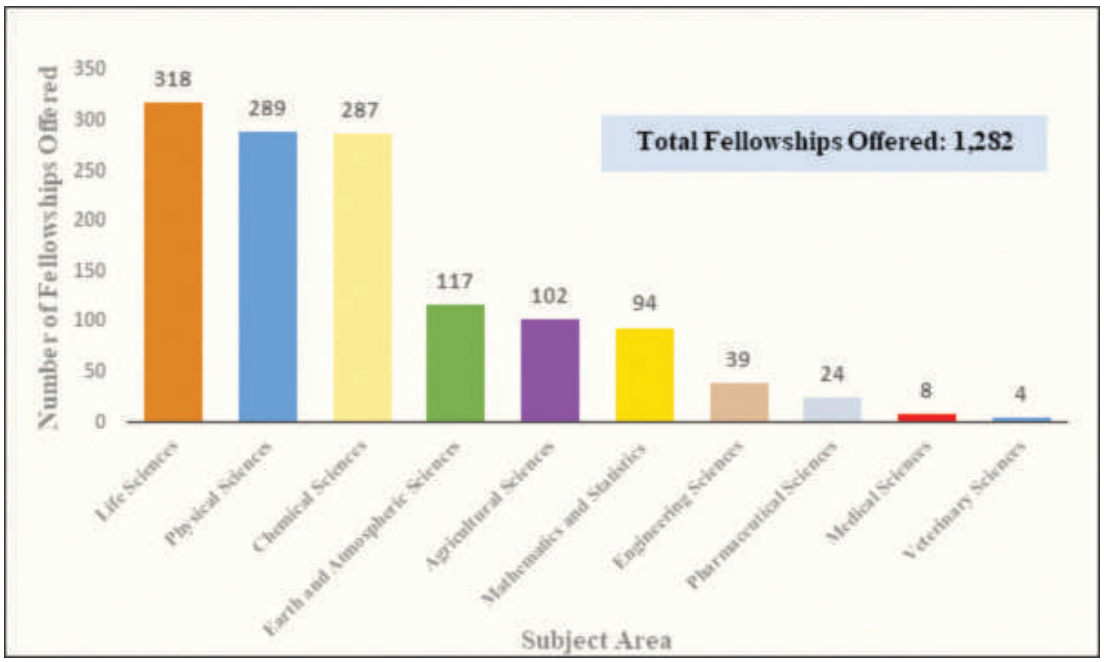


Fig.: Subject area-wise Distribution of Fellowships offered under INSPIRE-Fellowship during 01.01.2023 to 31.03.2024

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 Rs. 35 lakh (at the rate of Rs 7.0 lakh per year) of Research Grant 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.
- While the vertical migration among students in different INSPIRE components is encouraged, the scheme also provides an opportunity to students for lateral entry into this component.

During the period, 342 INSPIRE Faculty Fellows received their fellowship (both new and ongoing) and are pursuing the post- doctoral research in both basic and applied science areas including engineering, agriculture, veterinary and medicine. During the period of report, 122 INSPIRE Faculty Fellows joined various academic and research institutions. Out of these awarded/offered INSPIRE Faculty Fellows, 42% were female and 58% were male. Research progress of 227 INSPIRE Faculty Fellows of years 2016 to 2018 batches and 143 Faculty Fellows of 2019 to 2020 batches was reviewed with the help of subject-wise Performance Review Committees in the areas of Chemical Sciences, Earth and Atmospheric Sciences, Engineering Sciences, Life Sciences, Material Science, Mathematical Sciences and Physical Sciences. Out of 2121 applications received against the 2023 call of INSPIRE Faculty Fellowship, 116 applicants were offered fellowship.

1.9 INSPIRE-MANAK

The Department of Science and Technology (DST) in collaboration with the National Innovation Foundation – India (NIF), continued the annual implementation of the INSPIRE–MANAK (Million Minds Augmenting National Aspiration and Knowledge) program throughout India. INSPIRE–MANAK aims to cultivate scientific curiosity and nurture innovation among students aged 10-15 years, studying in classes 6 to 10.

Following are some key achievements under INSPIRE-MANAK during the period:

- Nomination Process: Between 1st June 2023 to 30th September 2023, 8,54,553 nominations were received from schools of various states, union territories, Kendriya

Vidyalaya Sangathan, Jawahar Navodaya Vidyalaya Samiti, and Sainik Schools. Notably, 53.25% of the nominations were from girls, while 46.75% were from boys. Rajasthan led with 1,59,885 nominations. The nomination process was augmented by 122 online workshops attended by teachers and school representatives, along with Block, District, and State Nodal Officers meetings held in Delhi to strategize the program's future.

- District Level Exhibition and Project Competition (DLEPC): Out of the total nominations, 45,626 students were shortlisted to participate in State/National Level competitions. A rigorous review process, involving around 300 experts from across the country and leveraging Information Technology, was conducted to shortlist the innovative ideas. To facilitate the nomination process, the "INSPIRE–MANAK App" was introduced, available for download from the Google Play Store and E-MIAS web portal.
- 10th National Level Exhibition and Project Competition (NLEPC): The 10th NLEPC was successfully organized from 9th to 11th October 2023 in New Delhi. Prof. Abhay Karandikar, Secretary DST inaugurated the event, and Hon'ble Minister of S&T Dr. Jitendra Singh felicitated the top 60 winners, including Navya Sharma, Daksh Kalia, and Shreyansh Nayak, who secured the first, second, and third prizes respectively. The exhibition attracted over 12,000 students from Delhi-NCR.
- Mentorship Workshops: 33 mentoring workshops were conducted for state/UT winners at prestigious technical institutes like IITs, BITS, and NITs. These workshops aimed to expose students to new developments in Science, Technology, and Innovation (STI) and guide them in refining their innovative projects.
- International Recognition: In the SAKURA Science High School Program 2023 (SSHP 2023), 55 students selected from the National winners of the 7th, 8th and 9th National Level Exhibition and Project Competition along with 6 supervisors visited Japan during November 05-11, 2023. In Japan, high school students and supervisors visited Japanese universities, research institutions and science museums. They also got opportunity to attend lectures from distinguished professors, and experience Japanese culture. INSPIRE-MANAK winners also showcased their projects at the ASEAN-India Grassroots Innovation Forums, with notable achievements by Aanchal Aggarwal, who won the 3rd prize for her project "Parkinson Lathi" at the 4th ASEAN India Grassroots Innovation Forum.
- Participation in National Platforms: INSPIRE-MANAK winners actively participated in national events like the India International Science Festival (IISF) 2023 and the National Technology Week, where they interacted with leaders and gained insights into entrepreneurial opportunities in niche sectors.
- Recognition and Awards: Winners of the NLEPC received prestigious awards, with Shreyanash from Odisha earning the Vivo Innovation Award for his project "Automatic Straw Processing and Packaging Machine for Oyster Mushrooms." Additionally, efforts

were made to protect the Intellectual Property Rights (IPR) of all NLEPC winners, resulting in 37 patents filed and 12 granted during the reporting period.

The INSPIRE-MANAK program continues to foster a culture of innovation among school students, providing them with opportunities for recognition, mentorship, and international exposure. The DST remains committed for nurturing and promoting a spirit of innovation nationwide in India's future youth generation.

CHAPTER 2

RESEARCH AND DEVELOPMENT

2.1 International Cooperation (IC)

The International Cooperation programme of the department is mandated with: (i) negotiating, finalizing and executing Science & Technology agreements between India and collaborating nations; (ii) fostering scientific research and development initiatives through diverse regional and multilateral platforms; (iii) delivering insights on Science and Technology matters in international forums. 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 towards fostering international cooperation and partnerships during the period are as under:

2.1.1 VAIBHAV Research Programme

- **VAIBHAV Fellowships**

  Government of India had organized **Vaishvik Bharatiya Vaigyanik (**VAIBHAV) Summit to connect Indian STEMM diaspora with Indian Institutions. The Summit was inaugurated on 2nd October 2020 by Hon'ble PM and was concluded on 31 October 2020. The Government has taken a step further to shape and implement the VAIBHAV Fellowship Programme in 2023.

  The first cycle of 1st call of VAIBHAV Fellowships in 18 thematic research areas was announced on 15 June 2023 and was open till 31 July 2023. A total of 302 applications were received under this call which were evaluated by Expert Review Committees in concerned research domains. The recommendations of ERCs were reviewed by Apex Committee and 22 proposals were recommended for support.

  The 2nd cycle of 1st call of VAIBHAV Fellowships in 18 thematic research areas was announced on 23 January 2024 and was open till 31 March 2024. A total of 216 applications received under this call which are under process of screening by Internal Screening Committee of DST.

- **Distinguished VAIBHAV Fellowships**

  In discussions, while preparing for the VAIBHAV Fellowship it was observed that

very distinguished Scientists of Indian Diaspora may not be available for month long Fellowship and also, may not like to apply for fellowships which may not fit their status. In order to provide a channel for these senior scientists and to make it possible to learn from their experience it was thought of creating **Distinguished VAIBHAV Fellows**, to be operated only by invitation by apex committee based on nominations (not applications) received. Members NITI Aayog, Principal Scientific Adviser to the Government of India and Secretaries to the Government of India, besides Noble laureates can make the nominations, which would be considered by VAIBHAV Apex Committee.

The nominations were called for the Distinguished VAIBHAV fellows and 07 nominations were received. The Apex Committee recommended 2 nominations to support out of the 07 nominations.

2.1.2 Bilateral Cooperation

Canada: The Department of Science and Technology (DST), Government of India and India-Canada Centre for Innovative Multidisciplinary Partnership to Accelerate Community Transformation (IC-IMPACTS) Canada has announced a new joint call for proposals on 15 July 2022 in the areas of **Carbon Reduction in Our Built Environment, Water.** In total, 113 proposals were received by DST against the joint call for which last date (extended) was 14 September 2022. Based on scientific merit, complementarities of the project objectives, scientific strengths of the project coordinators, national priorities and availability of budget, The Department of Science and Technology (DST), Government of India and and India-Canada Centre for Innovative Multidisciplinary Partnership to Accelerate Community Transformation (IC-IMPACTS) Canada have jointly decided to support 14 project proposals.

Russia: The 12th meeting of the Working Group on Science and Technology of the Intergovernmental Russia-India Commission for trade, economic, scientific and technical and cultural cooperation was held on January 11, 2023 via a videoconference. The Russian delegation was headed by Aleksandr A. Tolparov, Director, Department of International Cooperation, Ministry of Science and Higher Education, Russia. The Indian delegation was headed by Sanjeev Kumar Varshney, Advisor and Head, International Cooperation, Department of Science and Technology, Ministry of Science and Technology, Government of the Republic of India. Under the DST- RSF call 2023, 23 proposals are supported for Joint Research Project 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.

Four proposals were jointly supported under the Indo Russia Joint call 2022 with the Department of Science & Technology , Government of India and Ministry of Science and Higher Education (MSHE) of the Russian Federation in the following areas of i) Glycoscience & Technology: Exploration of structures and functions of sugars for diverse application in medicine, energy generation and materials science, ii) New Materials & Additive manufacturing, including

Development of new materials and technologies for their producing (both conventional and additive), iii) Precision Agriculture, including Development of equipment and machinery for agriculture and food production, and Digital and distance technologies in agriculture and iv) Aerospace technologies.

Japan: Under the Japan Society for the Promotion of Science (JSPS), 14th HOPE meeting of Nobel Laureates in Tsukuba, Japan was held from 27th February till 3rd March 2023 where 108 doctoral students were participated from Asia-Pacific and Africa region. Among them, Department of Science and Technology, Govt. of India sent 8 nominated doctoral students from different institutions across the country working in the field of physics, chemistry, medicine and engineering. The 15th HOPE meeting with the Nobel Laureates held in Kyoto-city, Japan from 26 February to 1 March, 2024.

17 proposals under the recent DST-JSPS exchange visit call 2022 were supported for grants. Under the DST-JSPS Call 2023 out of 158 joint proposals/workshops, 17 proposals and 3 works are finally selected and are being supported for grants.

Germany: Participation in the 72nd Lindau Nobel Laureate Meeting dedicated to Physiology/ Medicine at Lindau, Germany from 25th–30th June, 2023. Department of Science and Technology, Government of India has sent 17 students from different research and academic institutions from India for the participation of the 72nd Lindau Nobel Laureate Meeting. There are open talks and discussion on various topics of medicine and physiology such as genetics, neurobiology, vaccine, chemistry in life, drug, nutritional science, cell biology, structural biology, cancer, climate change and global health, emerging technology and next generation science, Artificial Intelligence and Data Science on health care system, etc. The Nobel laureates not only have delivered their presentation but also listened the students of their shot presentations and interacted.

For the participation of Indian students in the 73rd Meeting of Nobel Laureates, Lindau, Germany during 30 June to 5 July 2024 dedicated to Physics, selection committee meeting was conducted on 16th October for the evaluation of the 138 applications. Nomination of 41 students from DST for the participation of the 73rd Meeting of Nobel Laureates, Lindau, Germany during 30 June to 5 July 2024 dedicated to Physics, was informed to the Lindau organizing committee, Germany. The selected students were communicated in email for their initial nomination by DST and the rest students were regretted of not being nominated.

Ten women researchers from India and Two from Germany were awarded under ‘Women Involvement in Science and Engineering Research’ (WISER) programme to promote women researchers in India/Germany on the occasion of 13 Foundation day of IGSTC (Indo-German Science and Technology Centre). Industrial Fellowships-2023 Awards were given to 20 young Indian researchers from leading academic and research institutions spread across India. Dr. S.K. Varshney, Head (ICD) said Research efforts should be directed towards contributing to society and making a positive impact on people's lives. Stephan Grabherr, Charge d'Affaires

of the German Embassy in Delhi, highlighted the significance of collaborations between industries and universities and stressed the need for fostering strong partnerships and knowledge-sharing between these two spheres.

Israel: Organized 11th Governing Board (GB) meeting of India Israel R&D Technological Innovation Fund (I4F). During the meeting, the GB recommended 05 project proposals including projects for developing Indigenous Development of an Autonomous Subsea Wave Glider, design & development of next generation 3.6V / 2Ah cylindrical cell employing V-free cathode and hybrid hard-carbon anode and pilot Project for Production of Low-Sodium Salt. Support was extended to 11 ongoing industrial R & D projects under I4F.

An Indo-Israeli Joint call for Proposals was announced by the DST with Ministry of Science and Technology, Israel under the Indian-Israeli Joint Research Cooperation Programme (IIJRC) 2023 for inviting joint research projects carried out by Indian and Israeli researchers in the area of AI applications in climate change & Agriculture for food security. It was agreed to support 10 new projects from the 49 projects received against the Call. Support was extended to 16 ongoing/under closure joint research Projects

Norway: Support was extended to ongoing/under closure 20 joint R&D Projects.

Sweden:

- Three projects under academic R&D has been mutually awarded
- Industrial R&D call is launched through the new implementing agency

Spain: The Industrial R&D call is launched in Sep. 2023 with CDTI, Spain. The deadline is extended to attract more proposals till march 2024. The evaluation of the proposals are under process.

Egypt: Support was extended to ongoing 25 joint projects.

Philippines: Support was extended to all 3 ongoing projects.

Singapore: Under India Singapore MoU in S & T cooperation, an Indian-Singapore Call for joint Industrial R & D projects was launched in September 2024 with Technology Development Board (TDB) as implementing agency. 24 applications were received against the Call which are under review. It is also planned to organize India Singapore virtual workshops in the area of Green economy (Hydrogen) and digital health & Med tech.

Thailand: Support was extended to 10 ongoing joint R & D projects.

South Africa: Supported was extended to ongoing 10 projects.

United Kingdom: India UK Science and Innovation Council Meeting was held at London on 26th April 2023 and chaired by Hon'ble Minister of S & T and ES from Indian side and Science

and Technology Minister George Freeman from UK side. During the meeting, an MoU was signed between the Department of Science and Technology, Government of India and the Department of Science, Innovation and Technology, Government of United Kingdom and Northern Ireland in the fields of Research and Innovation at the minister level to facilitate India UK cooperation in various areas of Science, technology and Innovation. The MoU was submitted to cabinet for information.

An India UK call for Industrial R & D projects was announced in the area of Advanced Manufacturing and Power Electronics through TDB as implementation partner. 5 projects have been shortlisted for physical verification from 37 projects received against the Call.

Announced India UK Call for transforming Systems through Partnerships with Royal Academy of Engineering wherein DST as knowledge partner. About 12 projects were shortlisted for implementation.

2.1.3 Multilateral Cooperation

ISRF: As a part of India's initiatives to engage with our neighboring countries to develop S&T partnerships, Department of Science and Technology (DST), Govt. of India has launched India Science and Research Fellowship (ISRF) Programme for the Afghanistan, Bangladesh, Bhutan, Maldives, Myanmar, Nepal, Sri Lanka, Thailand researchers to work in Indian Universities and Research Institutions. It has been implemented since 2015.

Under ISRF Call 2022-23, a total of 55 applications were received from researchers of Afghanistan, Thailand, Bangladesh, Bhutan, Maldives, Myanmar, Nepal and Sri Lanka, which

were reviewed by a Panel of Experts. Based on research proposal, experience, academic merit and publication record, 50 candidates have been recommended for the award of India Science and Research Fellowship (ISRF) this year. Applications are supported in various areas such as Life Sciences, Veterinary Science, Fisheries, Medicine, Agriculture, Geology, Chemistry, Mathematics, Computer Science, and Engineering etc.

The new ISRF Call 2024-25 is announced in March 2024 for researchers of Afghanistan, Thailand, Bangladesh, Bhutan, Maldives, Myanmar, Nepal and Sri Lanka, in various areas such as Life Sciences, Veterinary Science, Fisheries, Medicine, Agriculture, Geology, Chemistry, Mathematics, Computer Science, and Engineering etc.

BRICS:

- Participated in the Seering committee Meetings of BRICS and for the calendar of working groups be organized in BRICS countries across the year.
- Attended the BRICS HPC work group meeting in China. Division's HPC work group proposed to create the digital earth as the BRICS project in the upcoming years. It was widely appreciated and agreed by the member nations.
- Evaluation of the BRICs call 2023 on Climate Change Adaptation and Mitigation.

Africa: Department of Science and Technology (DST) and Ministry of External Affairs (MEA), Government of India (GoI), through the Federation of Indian Chambers of Commerce & Industry (FICCI), launched the next Call for the C.V. Raman Fellowship for African Researchers programme to promote human capacity building through scientific and technological cooperation between Africa and India. About 100 fellows from 25 countries has been awarded CV Raman applications and 74 has availed/availing during the period FY 2023-24.

All the visit requests request received are approved and sanction issued under Bilateral and Multilateral programs of the division.

ASEAN:

- Collaborative R&D call areas has been identified and proposed to launch in April 2024 in the areas of HPC & AI, Marine science and technology and Materials science.
- Research Training Fellowship is launched in the reporting period and 67 proposals has been submitted by the ASEAN researchers to work in the Indian labs. Currently the evaluation of the proposal are under process
- 29 projects are supported in this period under CRD 2022
- Organized Gross-root Innovation Forum event in Malaysia during Nov 2023. A total of 200 participants attended the event. Indian participants won the third prize under gross root innovation competition and students innovation competition.

National facility: Inaugurated International Liquid Mirror Telescope (ILMT) in Aries Nainital on 21st March 2023 during the reporting period.

2.2 National Programme on Nano Science and Technology (NPNST)

The Department of Science and Technology has launched the 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) in the Phase I, and followed by a thorough evaluation subsequently total project cost of Rs.650 crores for next 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. Outcomes of various projects/programme successfully implemented under Nano Mission/NPNST are given below:

- A project was supported to **IIT Kanpur** on **"Nano Devices with Correlated Quantum Materials":** Fabrication of nano-scale devices based on correlated quantum and topological materials with enhanced functionality was reported in this project. High-quality single crystals of topological materials $MnBi_2Te_4$, EuAuSb and CeGaSi were grown and investigated using magnetic measurements, electrical resistivity, magnetoresistance, hall effect and electronic structure calculation in this project.

Fig.: The experimental Facility at IIT, Kanpur

- The project **"Emergent Phases in 2D Quantum Materials & Heterostructures"** was supported to **IIT Kharagpur;** Outcomes of this project include the **e**merging artificial two-dimensional (2D) van der Waals (vdW) heterostructures have shown unprecedented possibilities in atomic scale engineering in materials for tailoring material properties and novel device applications.

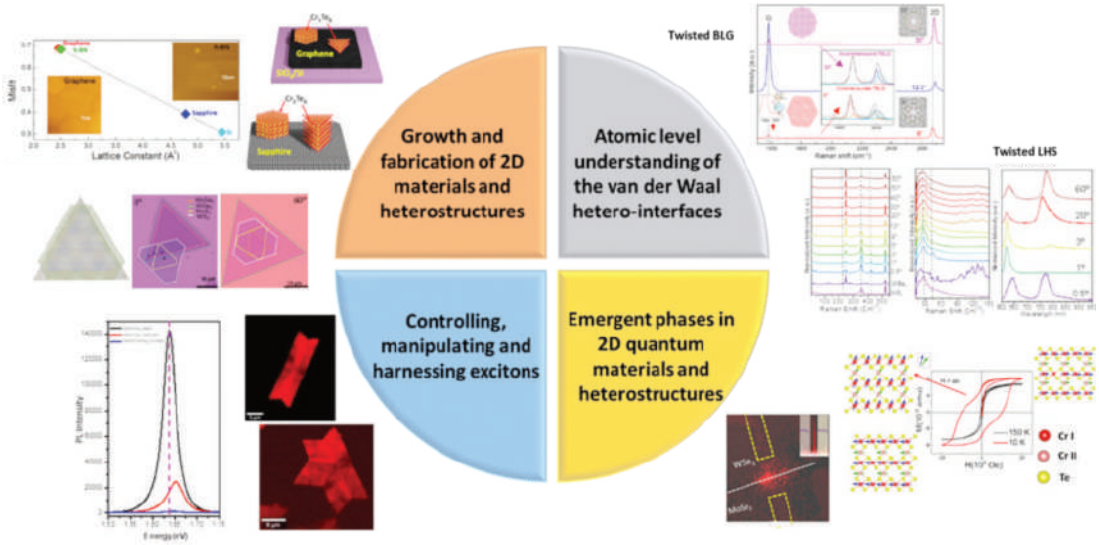


Fig.: Research outcomes at IIT Kharagpur

- Project on **"Hot Carrier Extraction in Lead Halide Perovskite Nanocrystals: Unveiling the Potential of Cu-Doped CsPbI3 NCs"** was supported to **IISER, Bhopal:** Lead halide perovskite nanocrystals have emerged as promising candidates for photovoltaic and light-emitting applications, largely due to their unique structural and optical properties. A

critical challenge, however, lies in the rapid extraction of hot carriers, which necessitates a longer thermalization time to enhance energy conversion efficiency. This project reported that the hot carrier extraction as a cornerstone for advancing the efficiency of solar energy harvesting technologies examining on the (1) enhanced structural and optical characteristics, (2) investigation on hot carrier dynamics and (3) dominant bandgap renormalization.

- A project **"Hyderabad on exploration of topological superconductivity and majorana fermions in hetero structured epitaxial thin films of topological materials, superconductors and magnetic insulators"** was supported to **TIFR, Hyderabad:** the challenge to indigenously develop a molecular beam epitaxy system for the high-quality growth of topological insulators and other quantum materials was investigated in this project. They have developed the indigenous capability to assemble a variable temperature insert cryostat attaining a base temperature of 1.5 K. The designs and assembly process are optimized and tested which is also available for technology transfer and commercialization. A patent has been filed with the interest to develop in-house cryogenic engineering expertise contributing to scalable quantum architectures in the future.

Fig.: In-house assembled Molecular Beam Epitaxy, VTI Cryostat, and RHEED output.

- Under a Project entitled "Design and Fabrication of wide-band rejection shields using multilayers of periodic resonator arrays and carbon based nanocomposites" it is reported that modified carbon black ink was used to print resonator arrays on the cellulose sheets. Spray printing or screen printing both were employed. They developed thin, flexible and transparent multi-layered film for wide band rejection of electromagnetic radiations in X-Band which will be used as coating material on class of objects like aircraft model. In field test use radar testing for estimation of RCS from the radar echo of modelled targets was done to prove the efficacy of the synthesized shielding materials.

International Collaboration for Indian Beamline

- Indian Beamline at Photon Factory KEK, Japan supported during Phase-II: During Phase II of Nano Mission, all the developed facilities in the Indian beamline at Photon Factory (provides four quantum beams: photons, neutrons, muons and positrons), which is a synchrotron source facility at the High Energy Accelerator Research Organization (KEK), Japan, were commissioned for utilization of the Indian scientist as well as international scientific community. The development work of the Indian Beamline has been completed, wherein, 8 Post-Doctoral Fellows obtained required training for such advanced experiments and engaged in providing users support in this beamline. During this period, one high resolution big area detector was purchased which significantly reduced the data collection time. Scientists from **47 Indian research institutes, universities, IITs and IISERs** have utilized this facility for their research works during Phase II which resulted in **160+ research publications**.

- 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. In 2011, ISIS started the construction of four more instruments listed below at TS2, which became operational sequentially from 2014 onwards:

  - ❖ LARMOR - spin manipulation techniques to enhance capabilities in diffraction and SANS
  - ❖ IMAT - combined imaging and residual stress capabilities
  - ❖ ChipIr - testing electronic components and systems for the effects of high energy cosmic rays
  - ❖ ZOOM - focussing small-angle scattering

Of these instruments at TS2, Zoom was co-funded with the under Nano Mission- JNCASR-STFC agreement. Zoom is a state-of-the-art SANS beamline that can provide information regarding the shape, size, size distribution and correlation, etc. of density fluctuations in materials.

Fig.: Small Angle Neutron Scattering at RAL, UK co-funded under Nano Mission, DST

India-RAL Neutron and Muon Science Meeting Workshop & User's Meeting was organised on June 12-16, 2023 at JNCASR Bangalore: Participants obtained hands on experience on handling evaluating and analysing the data from Neutron and Muon beamline under the guidance of the Experts from RAL UK. It was real time exercise where the students could analyse their beamline data and discuss the interpretation with the global experts in the area of neutron and muon beamline data analysis.

Workshop on Neutron Scattering (Elastic and Inelastic) and Muon Spectroscopy was organised on February 16-17, 2024 at IIT Guwahati: The workshop was scheduled was part of this project providing lectures on fundamental aspects of neutron scattering (elastic and inelastic) and muon spectroscopy. More than 180 researchers including Ph.D. students and Post-Docs applied for attending this workshop, out of which 110 were selected based on their topic being relevant to the theme of the conference. Another 100 participants attended the event including students from the host Institution and from other North East based institutions/ universities. Participants learned how to submit the neutron beamline proposals to both Indian and abroad beamlines including BARC and RAL (UK). Students learned to interpret neutron and beamline data on various single crystalline and polycrystalline samples. Interaction with the eminent speakers at the workshop really helped the students to implement the neutron and muon spectroscopy in their research work and appropriate travel support from the DST NPNST supported India-RAL project. This workshop enabled the northeast part of the universities/ institutes in India to link rest of the academic and research institutes both from India and abroad especially neutron beamline facility at ISIS-RAL (UK) and Dhruva reactor at BARC Mumbai (India).

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.


Fig.: Group photos during June 12-16, 2023 at JNCASR Bangalore, and February 16-17, 2024 at IIT Guwahati

- Indian Beamline for Nano Science and Technology at PETRA III at DESY Hamburg, Germany: The synchrotron source facilities PETRA III at DESY are essential tools for exploration in materials and nano science research. Access to such facilities, which are not available in India, is extremely important for the Indian materials science community. During Phase II, about 2280 shifts (8 hour each) have been completed and about 375 distinct users have attended the beamline experiments, resulting in 200 publications from phase II, leading to a total 340 publications combined with phase I till Feb 2024. Since 2019 the mean number of publications per year is about 45. In all, about 563 proposals were submitted and after the review, about 226 proposals all over India were selected for the beamtime allocation for the most used techniques of EXAFS (P64/P65), HAXPES (P22), Powder/high P/high res. Diffraction (P02.1, P02.2, P08), Crystallography (P23/P24), Nuclear Resonant Scattering (P01) during 2019-2023. The number of proposals increased gradually over the years: 122 (2019), 228 (2020), 616 (2021), 557 (2022) and 756 (2023), which sums up to 2279 well matching the required 2275 shifts for phase II. Nearly 60 Institutions/Universities all over the country have participated in the experiments during Phase II. From 2012 to 2023 the number of user visits is more than 1300 for a total of 451 beamtimes. 5% of the total PETRA III users came from India in 2023.

New initiative: In March 2024 a test phase for rolling access to 5 selected beamlines namely P08, P11, P22, P23, P24 started at PETRA III. Proposals for these 5 beamlines can be submitted at any time without any special deadline. In the proposal handling software DOOR at DESY the option of multiple access proposals has been deactivated for proposals of type India@DESY to make sure that only single access is granted for each Indian proposal. This restriction can be removed on short notice at any time if desired.

India@DESY Bi-lateral Steering Committee meeting with India@DESY Workshop was **held during 12-14 March 2024 at JNCASR, Bengaluru** coordinated by Prof. Kanishka

Biswas to discuss the progress of the project and to discuss on new research results on novel quantum materials or energy materials. Dr. Brock of DESY brought out the experience of DESY in involving industry in its endeavour, informing about the growing interest in carrying out Synchrotron experiments by the leading industries.

Fig. Group photos during 12-14 March 2024 at JNCASR, Bengaluru

2.3 Mega Facilities for Basic Research

Mega science projects are long-term projects which involve state-of-the-art technologies and complex issues. Such projects require large amount of resources both in terms of funds and expertise. Because of these reasons, such projects are manifestly multi-agency, multi-institutional and, most often, international in character. Mega Facilities for Basic Research Scheme is aimed to enable participation of Indian researchers in such state-of-the-art research facilities abroad, especially from academic and scientific sectors, and to create such facilities in and out of the country. In many of these projects, Department of Science and Technology (DST) is partnering with Department of Atomic Energy. 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 a 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.

2.3.1 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

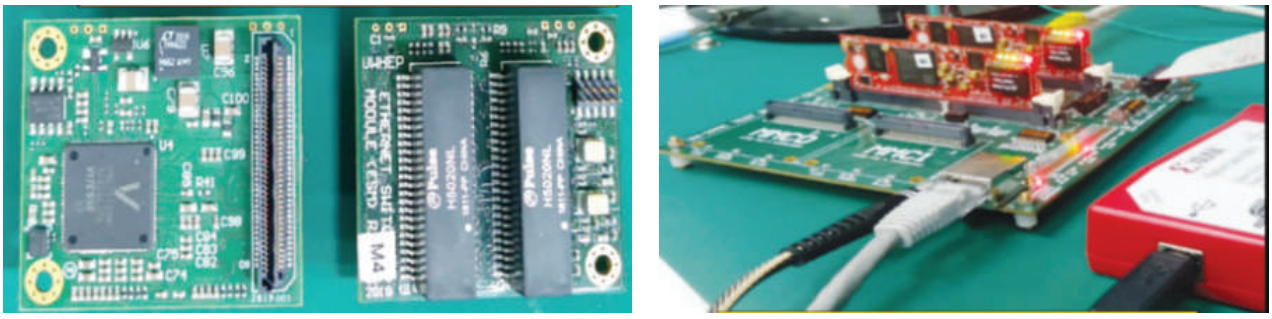
and ALICE experiments. India is also an Associate Member State of CERN. The important achievements from these initiatives are as under.

Indian Participation in CMS Experiment at LHC, CERN

Indian researchers are participating in CMS experiment at CERN which is designed to understand the physics of laws of nature as very fundamental length scale (the kind of particle interactions and their dynamics at 10^{-17}cm or so). Indian participation in the experiment involves 32 Indian faculty members/scientists and about 70 PhD students/ post-docs from 13 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 several Indian industries which include Micropack, HiQ, Peninsula, PCB Powermarket, Metatronics, CU-W industry. 7 Detector Labs established earlier continued contributing for experimental activities at CERN.

Fig.: Outer Tracker silicon module and mechanical components.

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 Micropack. Trigger boards were fabricated by Peninsula and Micropack and HGCAL readout boards were fabricated by Peninsula and HiQ.



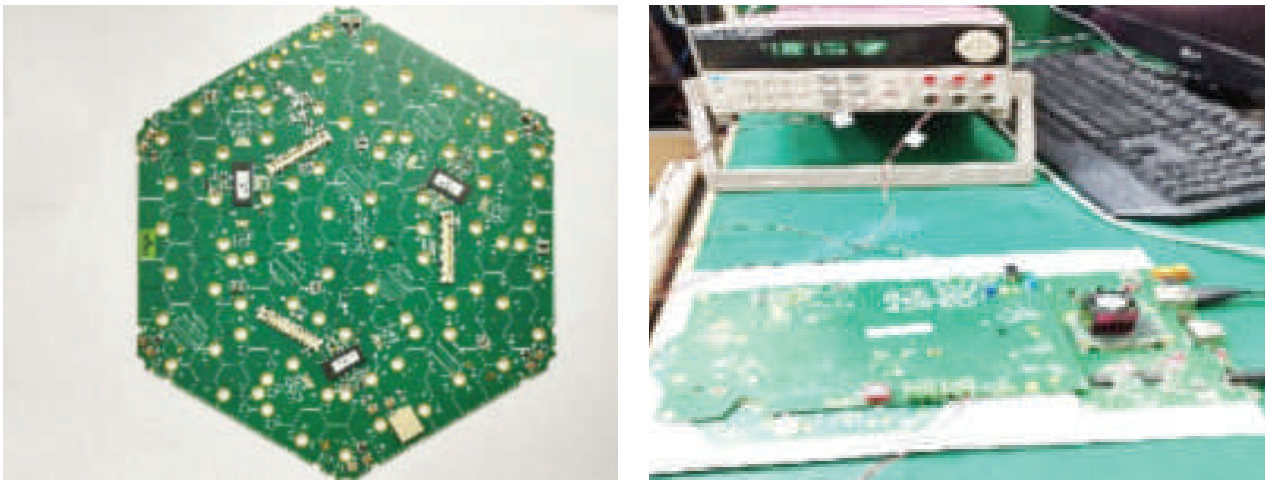


Fig.: Trigger boards and HGCAL Readout Boards

For silicon outer tracker project, different module components including stifners, cooling plates and baseplates, made of carbon fiber material were produced. 4 outer tracker modules were also assembled by India-CMS groups and more than 100 silicon sensors were tested during the period.

India-CMS has successfully contributed towards the trigger boards prepared by India industries, HiQ/Peninsula at Bengaluru. The HGCAL activities continued towards front-end and back-end readout boards.

During the year, 15 research publications were produced with Indian faculties, students as the lead authors. Output from the project also includes several conference publications and 15 PhDs. 1 Faculty got Outstanding Faculty Award. 1 PhD student got best thesis award while another got CMS 2022 Award. One previous Master's student from India-CMS also received best thesis award for the year 2023.

Indian Participation in ALICE/STAR Experiment at CERN/BNL

15 Indian research groups involving 30 scientists/engineers and 60 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 and n-type silicon detectors continued. The developed n-type silicon detector was tested at CERN. Indian ALICE group has indigenously designed, developed and fabricated p-type Silicon detector array of dimensions 8X9 on 6-inch wafer with 1 cm^2 array element. This is first of its kind in India. During the year, Indian researchers were joint authors in 12 collaborative research publications from ALICE and STAR experiments. Output from the project also included 8 PhDs.

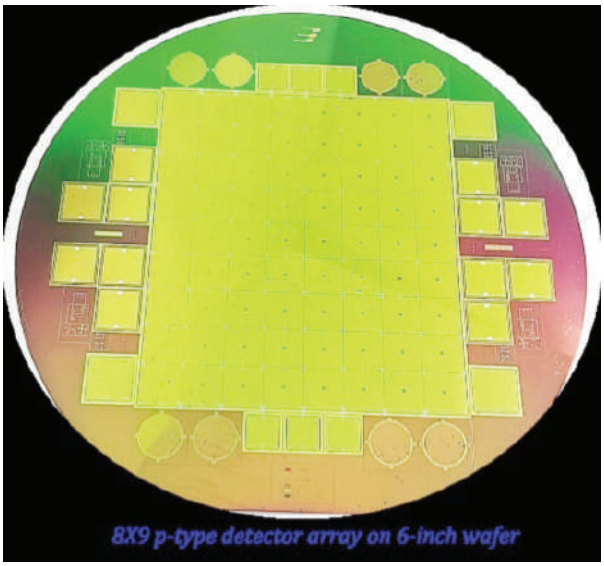


Fig.: p-type detector array on 6-inch wafer with 1 cm^2 array element

Utilization of Regional WLCG

During the year, two Tier-2 Centers at Mumbai and Kolkata continued processing voluminous data obtained from CMS and ALICE experiments, thereby supporting the researchers from 29 Indian research groups. Both Tier-2 Centers continued running 24x7 during the year with high-level of availability and reliability. Financial appraisal of the project proposal advanced further.

2.3.2 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.

2.3.3 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. At present, 9 PhD students are stationed at Fermilab for experiments. The NOvA (to better understand one of nature's most elusive particles: neutrinos) experiment shifts continue to be operated by Indian participants at Fermilab and remotely from India too, using Remote Operations Centre at Chandigarh. The progress of the project was reviewed during the year. Output from the project included 15 collaborative research publications, 15 other research publications, 30 talks/posters, 3 PhDs and, training of more than 10 human resources.

2.3.4 Utilization of Indian beamlines, XRD2 and Xpress, at Elettra Sincrotrone, Italy

During the year, utilization of Indian beamlines, XRD2, and Xpress beamlines at Elettra continued. Major achievements from these beamlines are as follows.

XRD2: The beamline continued to be utilized for high-end research in the areas of 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 4 institutions were carried out. 57 PhD students continued utilization of the beamline for their research work. The output also included 10 research publications, 3 PhDs, and the deposition of several protein structures in the Protein Data Bank. 15 of the 69 protein structures deposited so far in the Protein Data Bank were released during the year.

Xpress: The beamline continued to be utilized for advanced research in the areas of condensed matter physics, chemistry, and material science under extreme pressures and temperatures. During the year, 33 experiments involving 16 institutions were carried out. Out of these, 27 proposals were performed in the presence of 53 participants in total who received onsite hands-on training to carry out high-pressure or high-pressure high/low-temperature experiments. 36 PhDs students continued utilization of the beamline for their research work. Output also included 21 research publications and 3 PhDs. The beamline hosted two Indian PhD students fully funded by Elettra through the International Centre for Theoretical Physics-Training and Research in Italian Laboratories program during the period.

2.3.5 Low-Energy Accelerator-based Research Facility at Kurukshetra University

Support for the facility continued during the year. During the year, more than 50 experiments were performed with gaseous and solid ions on varying thin films and bulk targets at ion energy of 30 keV with different ion fluences and at varying oblique incidences of 15-80^0. Research output from the project includes 10 research publications, 14 conference papers, 4 M.Sc. projects, 8 invited lectures and 1 PhD submitted.

2.3.6 Indian Participation in FAIR project at Darmstadt, Germany

India is participating in construction of FAIR as a Founder-Member partner. Civil construction of the project almost completed, and installation of accelerator components has been scheduled. At Indian end, support towards the facility continued during the year and ongoing project activities in the country gained further momentum. During the year, tripartite in-kind contracts were signed between Bose Institute, FAIR GmbH and Siechem Technologies Pvt. Ltd. for development and fabrication of Power Cables, IT and Diagnostic Cables. During the year, 82 Power Converters and 7 types of IT Cable (Pre-series) each 200 m were supplied to FAIR as Indian in-kind contribution. India received credit for 58 Ultra High Vacuum Chambers supplied earlier to FAIR as Indian in-kind contribution. FAIR Industry Meet was organized

with participation of 16 Indian industries. Indian delegates participated in important meetings at the project site and took note of the progress made towards its civil construction and associated works. Besides developmental work, output from the project included 3 research publications, 14 conference papers, 6 PhDs and training of 6 project students. 1 post-doc received 'One of the Best Thesis Presentation' Award. 3 PhD students from the project joined Indiana University, University of Massachusetts, Amherst, and Jefferson Laboratory, Ohio University as post-doc respectively.

2.3.7 India's Participation in Thirty Meter Telescope (TMT) project

India is participating in the construction of TMT as a Founder-Member partner with continued support from DST and DAE. The project is facing a delay of about 12 years and a cost escalation of about USD 2 B.

During the year, the 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 received NSF funding of USD 6.5 M for the Preliminary Design Phase. Final Design Review is expected to be completed shortly with funding of USD 10 M. In parallel, India-TMT continued design, development and prototyping activities towards its in-kind commitments to the project involving 28 Indian industries.

M1 Segment Polishing: Installation of India-TMT Optics Fabrication Facility (ITOFF) completed with all tests and calibrations. Stress Mirror Polishing (SMP) of first segment at ITOFF is underway.

Segment Support Assembly (SSA): India will provide 574 SSAs. During the year, first 5 sets of SSA Module Assembly and testing completed successfully and Indian industry became production-ready.

Central Diaphragm: 4 Central Diaphragms were fabricated successfully.

Warping Harness Cables (WHC): 2 sets of WHC were sent to the TMT Project Office which was reviewed successfully and passed all cable qualifications.

Actuators: Technical and commercial evaluation of vendors for P3 actuator manufacturing phase completed. Two vendors were selected for production of 20 actuators. Parts of 20 actuators were fabricated. Assembly and functional testing of actuator parts also started. Testing of 5 actuators completed while assembly of 6 actuators were completed successfully.

Edge Sensors: Machining of edge sensor coupons and gold coating processes continued. Chromium coating on edge sensor blocks was completed and 10 Gold coated blocks were developed.

Observatory Software (OSW): Executive Software (ESW) Development for phase-1

completed. Infra-red guide star catalogue (IRGSC) Phase-3 work package completed in-house, and a prototype user interface was developed for the same. OSW operation and maintenance work package continued in progress.

Wide Field Optical Spectrograph (WFOS): India-TMT continued work prototyping complete Grating Rotation and eXchange (GRX) system, mechanical, electronics controls and electrical and software. Work on developing Instrument Control Software, opto-mechanical design of the calibration system, and finite element analysis of the structure of WFOS also continued.

High Resolution Optical Spectrograph (HROS) Opto-Mechanical Design: India-TMT team concluded the optimization of optical design of HROS, like, Atmospheric Dispersion Corrector and K-mirror which are part of HROS pre-slit optics, beam compression using Prisms, multiple collimator and combination design to reduce optical aberrations as in-house activity. Mechanical layout and space envelope were also worked out. India-TMT team is exploring various possibilities of feeding light from M3 to HROS.

In addition to developmental activities, the project also resulted in 1 scientific and technical publication, 5 PhDs were ongoing, 6 India-TMT team members undertook outreach activities. Executive Council for the project was reconstituted during the year.

2.3.8 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, Government of India granted approval for Indian participation in the project.

2.3.9 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, Government of India granted approval for the project.

2.4 Climate Change Programme

The Climate Change Programme (CCP) is implementing two national missions launched 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). Both these missions aim at building S&T capacity in the area of CC and adaptation strategies.

2.4.1 Major Achievements and Progress

- During the period, many new initiatives were taken up under both the missions including establishing 11 State Climate Change Cells (SCCCs) Phase-II in the states-

Telangana, Tamil Nadu, Kerala, Puduchchery, Karnataka and Chhattisgarh and West Bengal, Arunachal Pradesh, Nagaland, J&K and Meghalaya 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/NMSKCC priorities of action.

- A new Centre of Excellence (CoE) on "Climate Change Research" (DST-CoE-CCR) was established in area of Variability and Predictability of Indian Monsoon in a Changing Climate at University of Allahabad which aims to study Indian summer monsoon rainfall (ISMR) and its associated circulation pattern which are sensitive to the global warming and are undergoing significant spatio-temporal variability in a warming environment. The research is focussed on modelling work including regionalization (downscaling) and evaluation (correction/calibration) over the Indian subcontinent for investigating sub-seasonal to decadal scale variability and predictability of the ISMR. Project on Hydro Climate Extremes (CE-HCE) such as extreme rainfall events, floods, droughts, heat waves, and compound hot and dry extremes is supported under Major R&D Programme at Indian Institute of Technology Gandhinagar, Gujarat. The study is aimed to understand the gap in translating knowledge of climate change risk, climate adaptation and building climate resilience in the three crucial sectors -water, agriculture, and infrastructure.

- Capacity Building Program in Glaciology was launched with the objective to empower program participants to unravel the complexities of glaciology, glacial-hydrology, and climate change influences and was focused on theoretical aspects of glaciology, advanced research methodologies, utilisation of state-of-the-art facilities and instruments, glacier field training, and engagement with a highly skilled team of field glaciologists

- A project was supported on Human Capacity Building Programme at Indian Institute of Public Administration, New Delhi which aims to improve the capacity of key stakeholders to respond effectively to climate change, issues, its impacts adaptation needs, and options.

- CCP, co-organized “The International Climate Research Conclave 2023 (ICRC-2023)” at IIT Bombay and the report “India’s Climate Research Agenda: 2030 and Beyond” was released by Secretaries of DST and MoES.

- DST hosted and participated in technical sessions in Conference of the Parties (COP-28) of the United Nations Framework Convention on Climate Change (UNFCCC) at Expo City, Dubai, United Arab Emirates from 1st-5th December 2023 (Fig). DST participated in the conference. DST coordinated a special technical side event focusing on two pivotal themes: "Climate Change Vulnerability in the Himalayan Region: Impacts and Implications" and "Climate Resilient Development Strategy for Indian Himalayan Region (IHR)-Green Resilient Mountain Communities" at the India Pavilion which saw high number of participation from experts. DST officials participated in the panel discussion in other

event and also engaged in insightful sessions covering climate-resilient development, sustainable investments, and India's strides in sustainable cooling, contributing globally to initiatives like One Sun, One World, One Grid, and "Save the Soil."

Fig.: A side event organized by DST on 'Climate Resilient Development in Indian Himalayan Region' hosted at the India pavilion at the UN Climate Conference COP 28 held on December 3, 2023 at Dubai.

2.5 National Supercomputing Mission (NSM)

NSM has created the first indigenous server called Rudra 1.0 using Intel Cascade Lake processor platform. During the reporting period a lot of technical challenges has been addressed. Similarly, the Rudra server have gone through rigorous validation process before moving it to production line. After its successful validation as par with the industrial standards, this technology has been transferred to couple of Indian manufacturers for mass production. Also, the 1st batch of Rudra servers have been arrived, and couple of systems have been commissioned at Inter University Accelerator Centre, Delhi and CDAC Delhi. The machines commissioned using Rudra servers at IUAC, Delhi and CDAC Delhi is shown below.

Fig.: 3.1 PetaFlop system commissioned at IUAC, Delhi

Fig.: 200 TeraFlop system commissioned at CDAC Delhi.

- Around 20,000 manpower has been trained under NSM through various level of training programs. So far, ~90,00,000 computing jobs has been carried out and 7500 users from more than 100 institutes across the nation are using the NSM infrastructure for their High-Performance Computing needs.

- Alongwith Rudra the high-speed interconnect Trinetra-B has also undergone rigorous testingwhich is expected to be used in the future installations.

Fig.: Rudra server installed in the rack

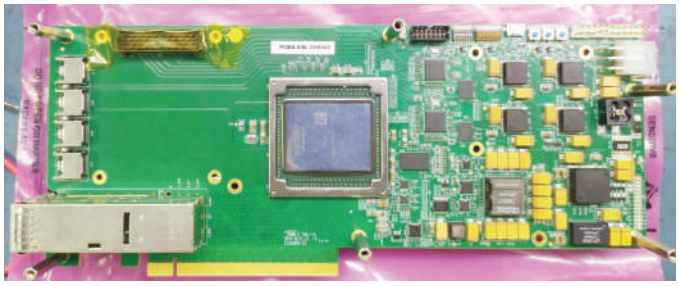


Fig.: Trinetra interconnect board

CHAPTER 3

INNOVATION TECHNOLOGY DEVELOPMENT AND DEPLOYMENT

The umbrella scheme 'Innovation, Technology Development and Deployment' mainly focuses on strengthening the Innovation, technology development ecosystem tech-led entrepreneurship in the country. This umbrella scheme with its sub- schemes contribute broadly on capacity building for research and innovation, creating an ecosystem for technology development and adaptation of need-based technologies to address the identified societal challenges; research and technology- based solutions for India-centric challenges related to Water and Clean Energy etc.; nurturing and scaling up of innovative technology-based start-ups through institutional support and incubation; scientific awareness, communication, popularization and scientific temper for all; development of geo-spatial solutions for sustainable socio-economic growth; translation of research into products and processes for greater economic and societal benefits.

3.1 Technology Development Programme (TDP)

Technology Development Programme (TDP) is mainly aimed to promote and support activities related to indigenous development of innovative technologies in identified areas at various R&D laboratories/ institutions across the country.

During the period, a new joint call for proposal was launched in **4 thematic areas such as** (i) Advanced Materials and Processing; (ii) Agro Tech & Food Processing;

(iii) Construction/ Infrastructure & Low-cost Building Materials; and 4) Spectroscopy/Sensors /Devices/ Environmental Technology Solutions, along with creation of Centre of Excellence (CoE) for validation of Agro related Technologies. Overall, 462 proposals were received, out of which 40 proposals have been recommended by the PAC for the grant support. Also, one CoE for validation of Agro- Technologies has been recommended.

Apart from this, programme ,two brainstorming workshops on agriculture-related technologies were organized.

Some of the technologies developed based on the societal need under the TDP programme are as below.

- **Low-Cost All-in-One Millet Processing Machine**: This invention developed at NIT Rourkela mainly focuses on the primary processing of all the minor millets in a low-cost

integrated all-in-one machine. The machinery for the processing of minor Millet was developed by modifying the existing machinery available for wheat and rice. There is no single machine available that can be used for all the minor millet. The developed machine consumes less electrical power, requires no skilled manpower or extensive maintenance, and occupies a small floor space when compared with existing machinery. For achieving the maximum possible separation, a millet separator with baffles was designed along with variable frequency drive to attain different speeds for different millets. t. The widespread impact of low-cost, all-in-one primary processing machinery for minor millets can benefit various stakeholders, including smallholder farmers, rural communities, women, and the broader agricultural and food sectors. The technology possesses the capability to enhance livelihoods, nutrition, and food security, all the while advocating for sustainable agricultural practices.

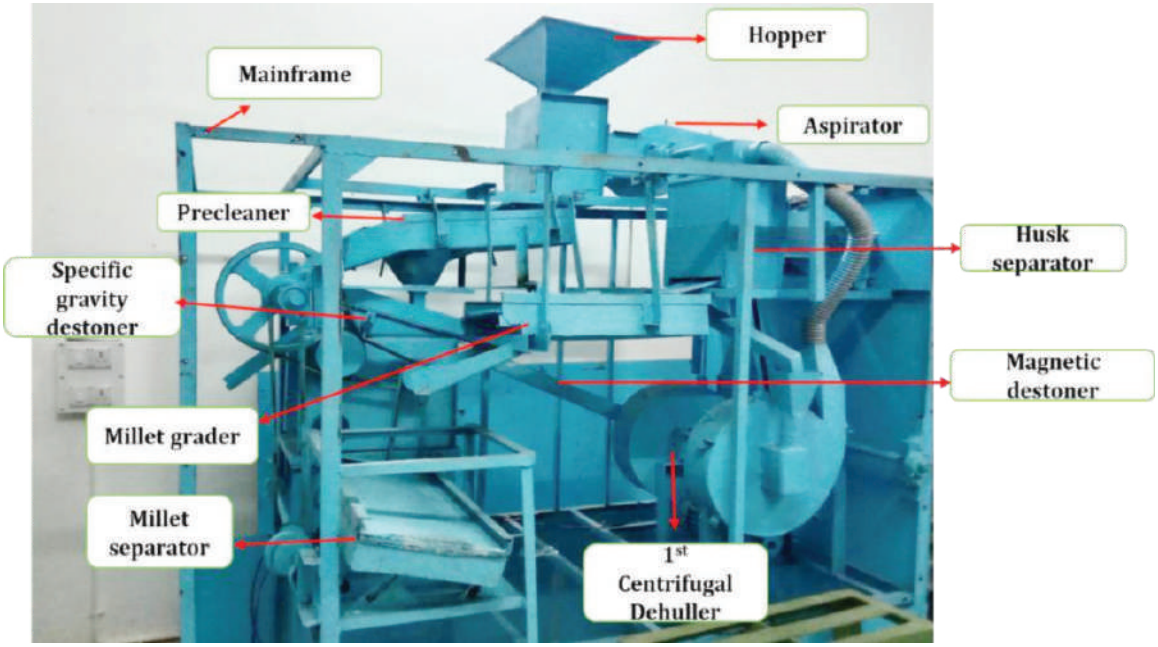


Fig.: All-in-One millet processing machine components

- **Process Development of Potato Peel Bio-Refinery:** This technology developed by NIT Nagpur is useful for the potato processing units. The novelty of the process is to use waste potatoes in bio refinery way to make value products with ZERO discharge. Waste of potato processing using is separated into peel and starch rich effluent. The effluent is used for biogas production using anaerobic digester while the peels are used to extract poly phenols and dietary fibres. The selective extraction of polyphenols from a dilute aqueous solution is the engineering science challenge. For every one ton of potato processed 300- 400 kg of potato waste is generated. This organic waste can fetch revenue by the technology. Existing potato processing units can make use of this technology.

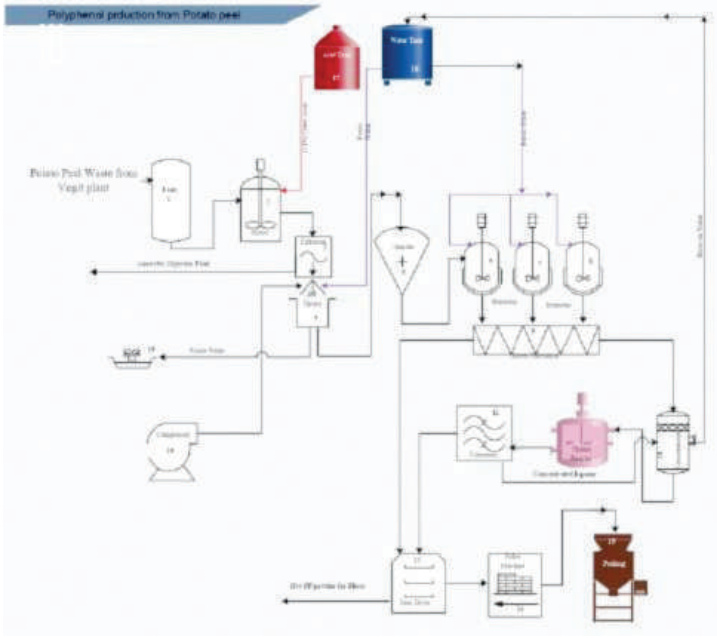
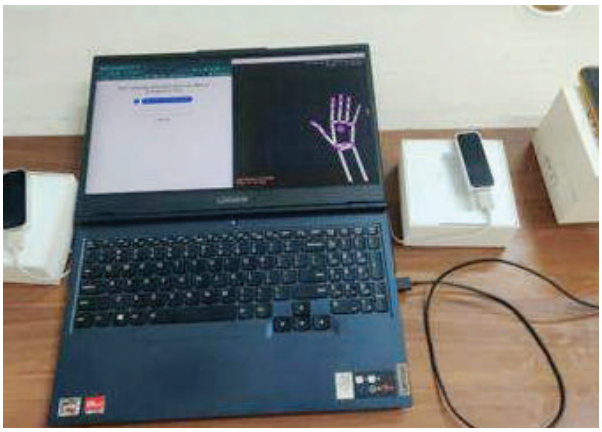


Fig.: Process Development of Potato Peel Bio-Refinery

- **Communicating Device as Teaching Aid for Hard Hearing Community:** This new device helps to interpret the signs shown by the deaf and convey the message to the hearing community and reciprocally the voice reply messages are converted into sign messages and shown to deaf people. This communicating device can very well be a teaching aid for hard hearing. Hence with the help of the device developed the hard hearing community can also compete with all other people and make the social equity. The developed device will have the functionalities of sign to speech and speech to sign conversion. The impact likely to be created by the Technology to the Hard Hearing People / Normal People / Businesses / Charities / Educational Institutions etc.



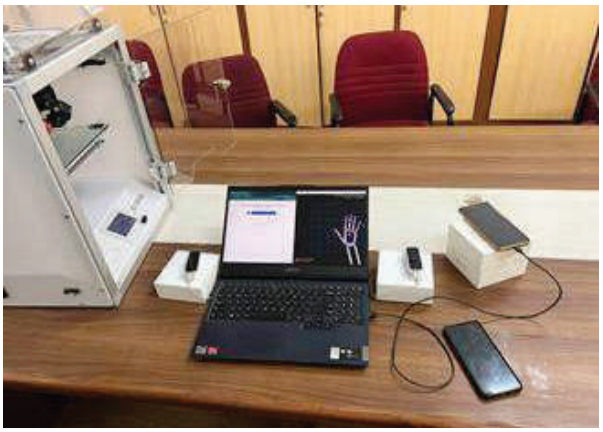


Fig.: Establishing Communication Between Normal and Hard Hearing Community People

- **Sensor-based precision seeding retrofit module for cultivators:** The PUSA- ESMM developed at IARI PUSA, New Delhi is a low-cost retrofit with the cultivator. It can work as a multi-crop precision planting machine. It can be retrofitted and removed very easily with a developed mechanism for the varying sizes of strands of cultivators. The retrofitting with a lock ensures firm integration with cultivator tyne, sustaining the jerks, vibrations and obstacles encountered on the field without affecting the performance. The split hopper and metering system facilitates easy carrying and storage. There is no need for an additional power source as a tractor battery powers it. This module is going to impact the farming community and Farm machinery sector.

Fig.: Sensor-based precision seeding retrofit module for cultivators

- **Development of cryogenic micromachining for fabrication of soft and stretchable polymer based artificial skin with multi-modal sensing capability by Indian Institute of Technology Patna:** The micromachining on viscoelastic polymer under the cryogenic environment has been performed to develop microchannels of required shape and sizes on its surface. For the machining of the soft polymer, a cryogenic cooling chamber equipped with an automatic cryogen supply has been designed which maintains the desired temperature. This technology can machine soft polymer within controlled glass transition temperature region. With the help of a developed cryogenic machining setup liquid metal-embedded microchannel sensor has been fabricated. For the axial detection (x and y) strain gauge, the design has been replicated whereas for normal direction (z-axis) a circular channel design opted with channel sizes nearly 200 x 200 μm_2. Strain sensor has been tested on finger for bendability whereas pressure sensor has been tested with industrial manipulator to pick different objects. In the future, we are looking forward to develop a prototype of the wearable sensory system using cryogenic machining which need to be tested in real time. Further design and aesthetic improvement will be required, following the product and medical regulatory standards.

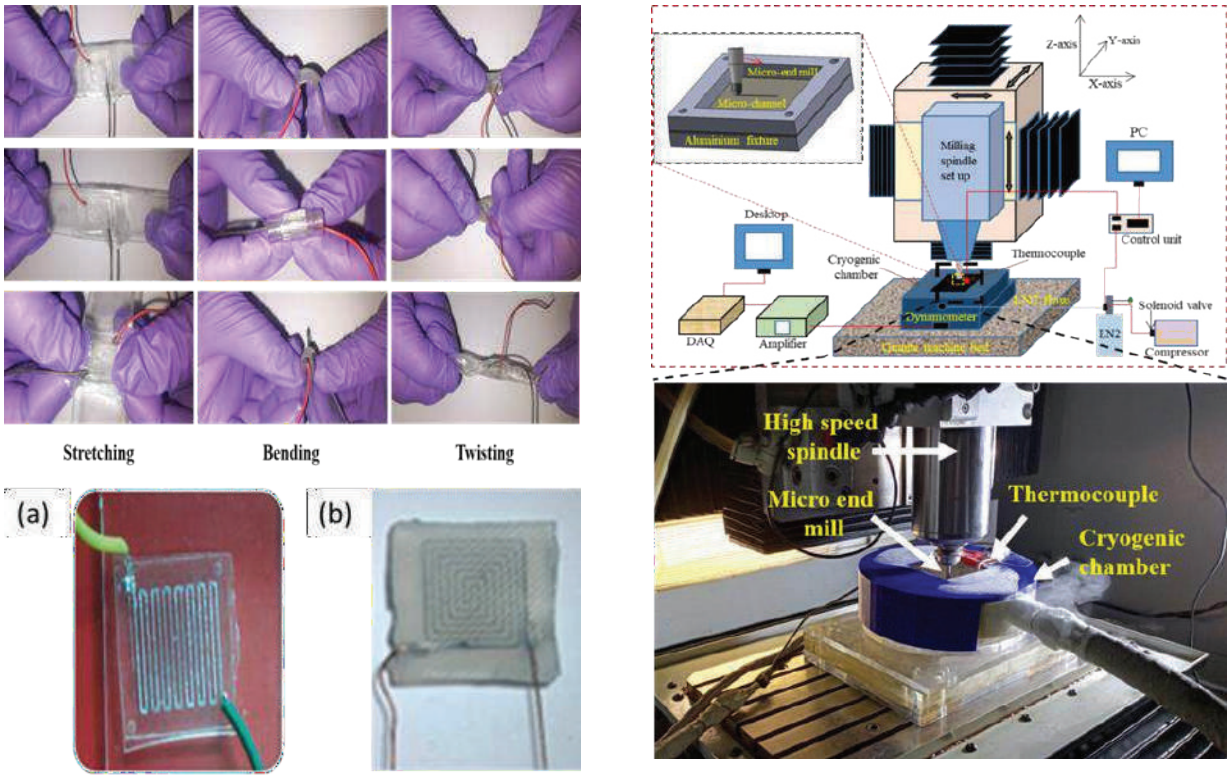
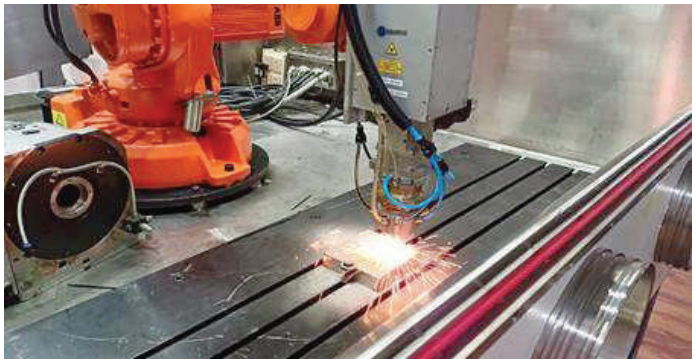


Fig.: Cryogenic micromachining for fabrication of soft and stretchable polymer based artificial skin

- **Design and Fabrication of Indigenous Powder Fed Metal Additive Manufacturing Machine by IIT Jodhpur and PSG College of Engineering, Coimbatore:** Metal additive manufacturing, commonly referred to as metal 3D printing, involves fabricating metal components layer by layer through a range of techniques. This innovative process enables the production of intricate and sophisticated designs that would pose challenges or be unattainable with conventional manufacturing methods like machining or casting. The Directed Energy Deposition Metal Additive Manufacturing Machine boasts a distinctive capability in fabricating intricate geometries. Employing a Six degrees of freedom industrial robot as its primary motion source, it integrates two additional axes in the form of a tilt and rotary table for enhanced printing convenience. The entire system operates within an inert atmosphere, ensuring optimal processing through gas purification and recirculation. Facilitating metal powder delivery to the build chamber via a coaxial nozzle, a twin hooper metal powder feeder with preheating capability is utilized. Its primary power source is a 3 kW diode laser, offering high-power applications with precision. Additionally, the system incorporates a Smart Optical Monitoring System, providing continuous monitoring of printing parameters and delivering insights such as material composition and printing imperfections.

Printed samples



Cladding head

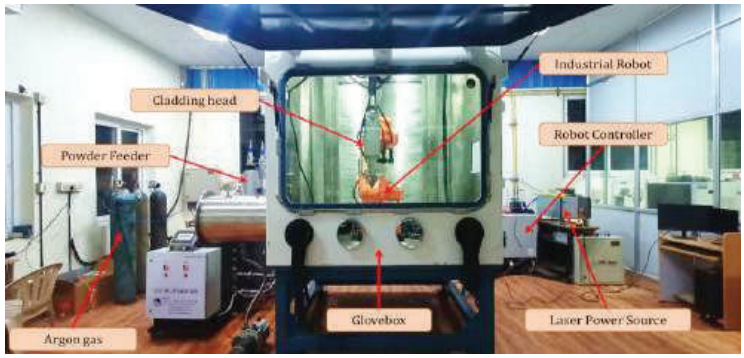


Fig.: Indigenous Powder Fed Metal Additive Manufacturing Machine

The tensile test results of the newly developed machine were subjected to comparison with those of commercially available machines, revealing superior performance. Through rigorous evaluation and analysis, it was determined that the developed machine outperformed its commercially available counterparts in terms of various metrics and criteria.

- **Development of a versatile casting unit for light weighting: metal foams and composites by IIT-Bombay:** A fully indigenous melting-stirring-directionally cooled unit for foams and composites including sandwiched parts. The facility is capable of heating to 1000 ºC, and cooling at variety of pulling speeds ranging from 100 µm/s to 10 mm/s. The bottom part is also cooled to get desired temperature gradients. We have demonstrated

(i) aluminium alloy foams (ii) aluminium alloy composites and (iii) a sandwich product of both al foams and composites. Three in situ composites (of Al_3Zr, Al_3Ti and the hybrid (Al_3Zr + Al_3Ti), and corresponding composite foams have been fabricated in a lab-scale prototype.

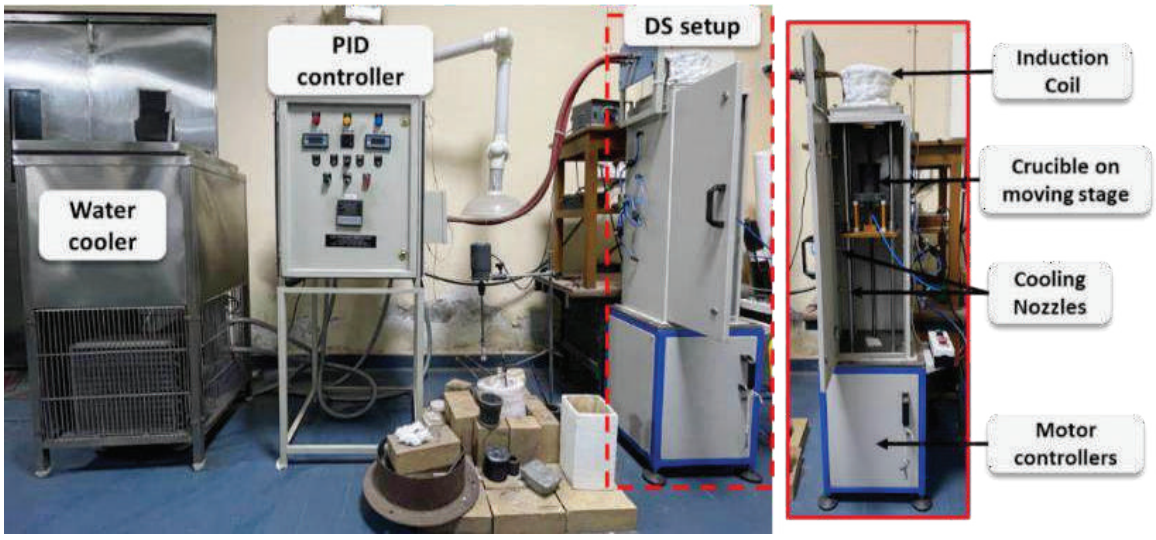


Fig.: Facility showing key parts of the furnace and foaming units

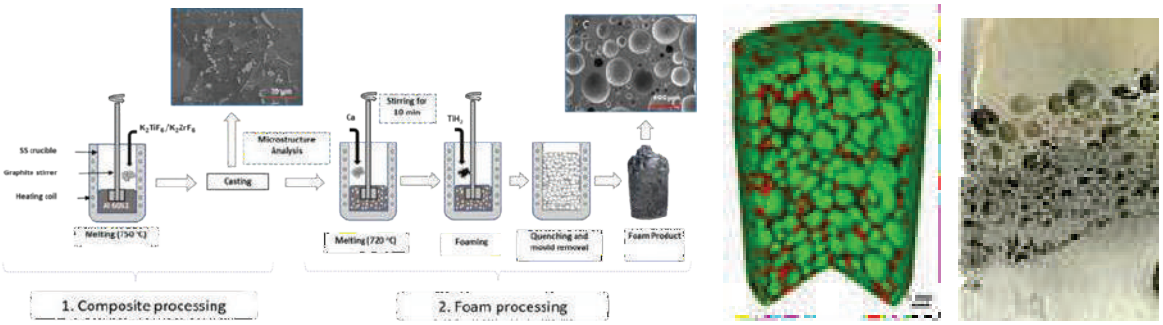


Fig.: Process development map for composites and foams, pictures of sandwiched parts

- **Modification and operation of stationary and automotive engines in VIT Vellore with decentralized biogas produced from food waste and STP sludge**

  Stationary biogas engine: A Kirloskar (KGB-20WS) SI engine, naturally aspirated with a power output of 12.5 kVA (10 kW) at 1500 RPM was identified and purchased. The naturally aspirated engine is modified as a turbocharged engine to enhance engine power output. Further, an electronic control unit (ECU) was developed to operate the engine in a closed loop mode to maintain stoichiometric air-fuel ratio to improve brake thermal efficiency.

Fig.: Biogas engine test beds with subsystems

The stationary engine has been installed in the biogas plant and a baseline reading using LPG has been recorded. The engine is further optimized using an ECU and the readings using biogas has to be carried out.

Automotive HCNG engine: A naturally aspirated TATA Ace CNG engine (BS VI regulation) with a power output of 19.4 kW at 4000 rpm was purchased as the automotive engine. The automotive engine was mounted on the engine test bed and ECU was developed. Baseline readings have been generated using LPG and CNG. The engine post optimization has been mounted on a TATA Ace truck to test the performance using CNG. Further, addition of hydrogen along with CNG has to be tested on the engine test bed and in the vehicle using flow controllers. The sparkplug based direct injection (SPDI) system has been developed as a prototype for the automotive engine. The SPDI prototype has to be tested on the test bed and the vehicle.

Fig.: CNG vehicle, ECU, and flow controllers

3.2 Technology Missions (Energy, Water and others)

Under Technology missions, the main focus is on two programmes, i.e. Clean Energy Research Initiative and the Water Technology Initiative. Additionally, emphasis is placed on Carbon Capture Utilization and Storage Technologies (CCUS), with the establishment of three National Centres of Excellence and participation in the Clean Energy Transition Partnership. Further, three draft white papers on electric mobility: (a) tropical EV Battery; (b) Motors and Power Electronics; and (c) EV Charging Infrastructure have been developed through an extensive process of consultation with stakeholders.

3.2.1 Clean Energy Research Initiative

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:

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

During the year 2023-24, several new dimensions were added to the CERI programme to accelerate the pace of clean innovations to meet national needs, which are as follows:

Mission Innovation (MI):

Mission Innovation (MI) is a global initiative that includes 23 countries and the European Commission (representing the European Union). MI is committed to 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 solutions for all. The initiative focuses on maximizing the impact of research, development, and demonstration (RD&D) investments through collaborative efforts and partnerships with stakeholders worldwide.

The ongoing mission focuses on Zero-Emission Shipping, Clean Hydrogen, Green Powered Future, Carbon Dioxide Removal, Urban Transitions, Net-Zero Industries, and Integrated Bio-refineries.

India hosted the joint Ministerial Event of the 8th Mission Innovation (MI-8) and 14th Clean Energy Ministerial (CEM-14) alongside the G20 Energy Transition Ministerial Meeting (ETMM) from July 19-22, 2023, in Goa, witnessing 3,000 participants to address global clean energy challenges, with inaugural and plenary sessions chaired by the Hon'ble Ministers of Power and Science and Technology.

Fig.: Energy Ministers of MI countries during CEM14/MI-8 Ministerial at Goa, India (19-22 July, 2023)

Ministers and Heads of Delegation from approximately 40 member countries and 10 international organizations, along with CEOs of leading energy companies, policymakers, and academicians, participated in various meetings, including plenaries, roundtables, side

events, and high-level dialogues. Over 80 side events were organized, focusing on various Missions, Platforms, and Work streams of MI and CEM. Additionally, a technology showcase on the theme "Zero Emission Vehicles and Advancing Clean Energy @DST" was inaugurated by the Hon'ble Chief Minister of Goa. During the event, a compendium on the RD&D projects under the Clean Energy Research Initiative (CERI), funded by DST, was released. Key outcomes include featuring 146 technologies, filing of 91 patents and grant of 36 patents

DST organized an MI Stakeholder Workshop on March 21, 2024, at The Energy and Resources Institute (TERI), New Delhi to establish a framework for collecting RD&D data in Clean Energy. Representatives from multiple ministries and departments engaged in the clean energy sector actively participated in the workshop.

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. One of the successful project is highlighted below:

- **Fight Against Pollution: Flow Battery an 'Efficient Replacement' to Diesel Generators**

  Developed by SERL at IIT Delhi and supported by DST's MES programme, Vanadium Redox Batteries (VRFBs) provide a non-polluting, scalable, and durable energy storage solution. They can efficiently store energy from kWh to MWh at a lower cost than conventional batteries. SERL's research has resulted in five patents and numerous publications. VRFBs are ideal for renewable energy storage, rural electrification, e-vehicle charging stations, and power backup, contributing to a zero-carbon footprint.

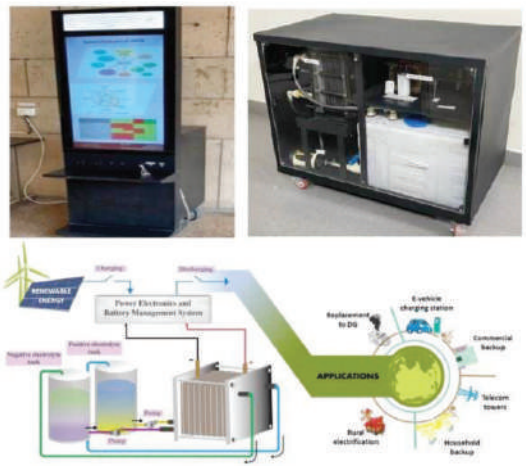


Fig.: Vanadium-based Flow Battery for Large Scale Renewable Energy Storage System.

Electric Vehicles- Electric Vehicles represent a significant advancement toward greener transportation.

- **Release of White Paper on Catalysing Technology-led ecosystem for eMobility:** On National Science Day, February 28, 2024, Dr. Jitendra Singh released a White Paper titled "Catalysing Technology-led Ecosystem for eMobility." This paper, informed by interactions with over 100 industries and stakeholders, identifies barriers to electric vehicle (EV) adoption in India and addresses critical technology gaps. It proposes R&D solutions for tropical EV batteries, power electronics, and charging infrastructure. Additionally, a dedicated eMobility workshop held the same day brought together experts from industry, R&D labs, and academia to discuss funding for advancing R&D infrastructure and facilities, aimed at accelerating India's transition to the EV sector.

Fig.: Release of White Paper on National Science Day

Carbon Capture Utilisation and Storage CCUS: CCUS involves the capture of CO_2, 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 CO_2 emissions from power plants and carbon intensive industries.

- **Establishment of India's First Three CCUS National Centres of Excellence (CoE):** The Department of Science and Technology (DST) has set up three National Centres of Excellence in Carbon Capture and Utilization (CCU) at IIT Bombay, JNCASR Bengaluru, and NEERI Nagpur. These centers focus on advancing R&D, innovation, and fostering industry collaboration in CCUS technologies. Key achievements include the development of methanol-based catalysts and CO_2 to CO conversion technology, with startups like Breathe India Pvt Ltd and UrjanovaC emerging from these initiatives. IIT Bombay has also designed a CO_2 mineralization unit capable of removing 40 kg of carbon per day using industrial waste. NEERI Nagpur's centre emphasizes advanced CO_2 capture techniques with nanotechnology and algae-based sequestration. These efforts aim to

develop a synergistic CCUS ecosystem, addressing the needs of industries such as steel, chemicals, and oil & natural gas, while contributing to a circular carbon economy.

Fig.: a) National Centre of Excellence in Carbon Capture and Utilization (NCoE-CCU) at IIT Bombay, Mumbai site visit. b) National Centre in Carbon Capture and Utilization (NCCCU) at JNCASR, Bengaluru.

- **Launch of two Pilots for the deployment of Carbon Capture and Utilisation (CCU) Technologies in an Industrial Coal Gasification facility (Power Sector):** India's "Panchamrit" climate action plan integrates Carbon Capture and Utilization (CCU) to achieve net-zero emission targets, particularly in sectors like cement, steel, aluminum, power, and chemicals. CCU captures CO_2 from industrial processes for uses such as enhanced oil recovery, chemical production, and construction materials. Two pilot projects have been approved in Pune and Hyderabad. The IIT Delhi-Thermax consortium will develop CCU technology for a coal-to-methanol plant in Pune, producing 1.4 TPD methanol. The CSIR-IICT-BHEL consortium will demonstrate CO2 capture and conversion to 0.18 TPD dimethyl ether (DME) in Hyderabad, aiming to support commercial scaling and India's net-zero targets.

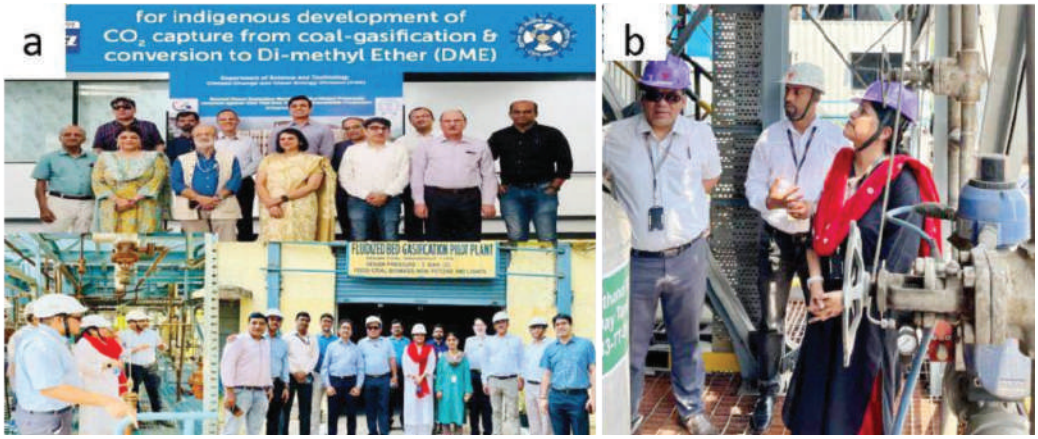


Fig.: a) Site Visit at CSIR-IICT-BHEL Consortium Setup in Hyderabad, b) Site Visit at IIT Delhi-Thermax Pilot Plant in Pune.

Major National and Transnational Calls in 2023 for Accelerating CCUS Technologies

- **Advancing CCUS technologies through the Clean Energy Transition Partnership (CETP):** DST has joined the Joint CETP 2023 Call Module-04 CCUS, with a focus on cleaner technological solutions for CCU (Carbon Capture and Utilization) and CCS (Carbon Capture and Storage), through transnational project funding. The focus remained on accelerating and maturing CCUS technologies via targeted financing of innovative research endeavours.
- **CCUS RD&D with Mission Innovation Partnership:**. Significant progress in mobilizing CCUS Research, Development, and Deployment (RD&D) through a global partnership has resulted in 156 proposals, with 45 shortlisted for advancing CCUS technologies to higher Technology Readiness Levels, emphasizing their techno-economic and environmental viability and safety.
- **National-level Brainstorming Meeting:** DST conducted a Brainstorming exercise with strong and active participation by Experts and representatives from Research Groups and relevant Industries like Cement, Oil & Natural Gas, Steel, and Power, to delineate and prioritize DST's roadmap towards India's Net Zero targets through CCUS during November 2023. As forward lead of this activity, DST has constituted a High Task Force with representation of eminent Experts and relevant Industries for evolving the contours of DST's CCUS roadmap.

Solar Fuels: A solar fuel is a synthetic chemical fuel produced from solar energy. Solar fuels can be produced through photochemical, photobiological, thermochemical and electrochemical reactions

- **CO_2 conversion to rtificial (synthetic) liquid fuels by solid oxide electrochemical approach: Photo Voltaic to Fuels:** Prof. Chinmoy's team at IISc, funded by DST, has developed a cutting-edge operando cell capable of analyzing reactions within solid oxide cells operating at high temperatures. Using Raman and mass spectroscopy, they discovered that NiOx is the active catalyst in pure CO_2 electrolysis on Ni-YSZ. This breakthrough cell has global significance, revealing that Cu doping improves the stability of Ni-based electrodes during CO_2 electrolysis by reinforcing Ni-O-Ni bonds, preventing catalyst deactivation. These findings mark a significant stride in understanding solid oxide cell reactions, promising impactful future applications.

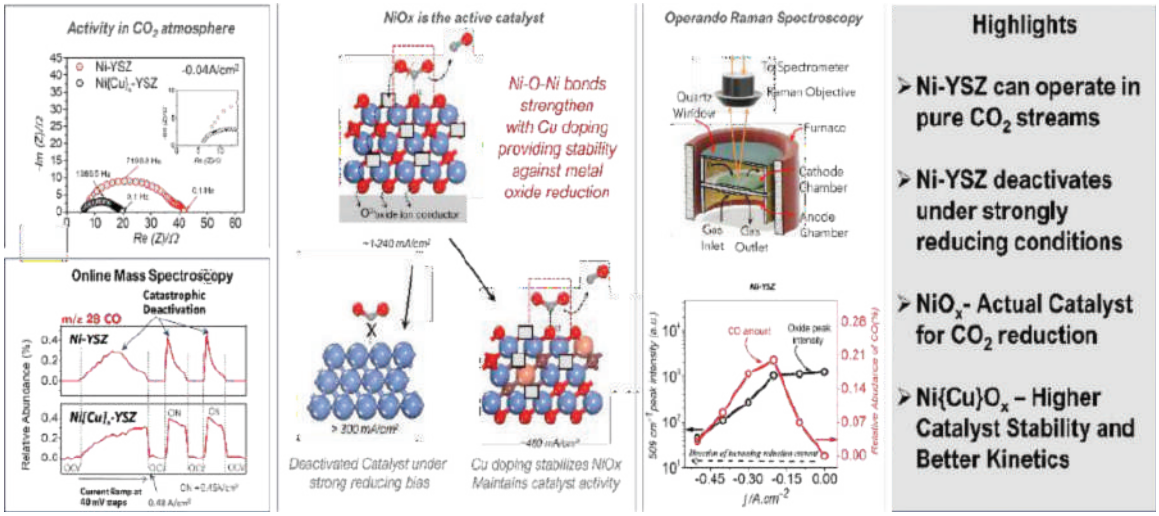


Fig.: Operando studies reveal Cu doping to stabilize CO_2 on Ni-YSZ.

- **Development of solar to chemical fuel generation device/process based on earth abundant materials:** CSIR-IMMT and IACS Kolkata have synthesized the layered photocatalysts using Earth-abundant elements like MXenes (Ti_3C_2) and nitrogen-deficient C_3N_4, achieving impressive selectivity in CO2 conversion to ethanol and CO with 7.7% and 11% Apparent Quantum Efficiency (APCE), respectively. These photocatalysts, MXene-Ceria and MoS_2-C_3N_3 nanocrystals, fine-tune over-potential requirements and selectivity. The project is funded by DST and these findings mark significant progress in sustainable CO_2 conversion technologies.

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.

- **Development of an Electronically Controlled High Performance Hot Surface Ignition Engine Running on Methanol for Automotive Applications:** As part of the Clean Fuel Mission – Methanol project, IIT Madras, in collaboration with M/s Ashok Leyland Limited and supported by DST, developed a methanol-fueled Hot Surface Ignition common rail engine with full electronic controls.

  Optimized on a test bed, the engine demonstrated effective operation in a light commercial truck. Innovative strategies addressed methanol's low Cetane number challenges, resulting in valuable patents and publications. The engine's thermal efficiency matched or exceeded that of diesel engines, with HC and CO emissions meeting standards. The Diesel Oxidation Catalyst (DOC) effectively reduced unregulated emissions, and while engine-out NOx levels were lower, consideration for SCR implementation is acknowledged for the future.

Fig.: Neat Methanol Hot Surface Ignition Common Rail Engine Demonstration Vehicle.

Sunlight to X Tiny carbon flowers turn light to heat for smoke-free heating of water & air: India's abundant sunshine, highlighted by Prime Minister Modi's One-world-One-sun-One-grid initiative, emphasizes solar energy's role in energy security. Prof. C. Subramaniam's team at IIT Bombay has developed nanocarbon florets (NCF) with 87% efficiency in converting sunlight to heat. These "blacker than black" coatings are used to heat rooms, water, and shelters in high-altitude, low-temperature regions, benefiting the Indian army and residential sectors. Supported by the Swarna Jayanti Fellowship and DST's CEST Division, this technology has the potential to significantly reduce carbon footprints and advance sustainable energy use.

Fig: USHMA-light based space heater

Blending of Agro-Residue with Coal: DST initiative for Blending of Agro- Residue with Coal in Thermal Power plant:. IICT-Hyderabad is developing a pilot cavi-leaching process to remove chlorine and alkalis from agro residues, creating modified biomass briquettes. Additionally, Chennai Institute of Technology is advancing technology for cement-based

materials using biomass fly ash from agricultural residues. Supported by the Sustainable Agrarian Mission (SAMARTH), this initiative addresses challenges in utilizing agri-residue in thermal power plants.

Green Hydrogen - Green hydrogen is defined as hydrogen produced by splitting water into hydrogen and oxygen using renewable electricity.

- **Selection of Hydrogen valley Innovation Cluster (HVIC) to be established in four different regions of India:** The DST is leading Mission Innovation (MI) 2.0 in India, focusing on the Clean Hydrogen mission to reduce hydrogen costs to $2/kg by 2030. DST has established Hydrogen Valley Innovation Clusters (HVIC) to demonstrate hydrogen technologies across the value chain, targeting 2 tonnes of green hydrogen production per day. Supported with INR 30 to 50 crore over 5 years, each HVIC involves leading academic institutions, industries, and startups. The green hydrogen will be used in mobility, steel, and chemical industries. DST collaborates with MNRE on standards, quality control, and R&D under the National Green Hydrogen Mission.
- **Cutting-edge quantum-technology backed green hydrogen production unveiled to power a green future:** The Green Keplerate Team at Banaras Hindu University has introduced a high-throughput Quantum-powered Green Hydrogen Production Technology, developed by Dr. Somenath Garai, Prof. S. Srikrishna, Mr. Shankab J. Phukan, and Mr. Suraj Goswami. Inaugurated by Dr. Anita Gupta, Dr. Ranjith Krishna Pai, and Prof. R. R. Sonde, this eco-friendly innovation features a quantum-powered photo-catalyst with a charge transfer system and high proton availability. It achieves over 1 liter/min per 10 g of Quantum Photocatalysts, enhancing cost-effectiveness. Funded by DST, the technology has diverse applications in energy, transportation, and agriculture, and supports storage-free direct hydrogen internal combustion engines for various automobiles.

Solar Energy: The Solar Energy Research Initiative has made significant strides in various streams including equipment and consumables, technology demonstration, affordable innovation, convergent solutions, and applied research, promoting R&D and field-oriented solar solutions. Here are the key milestones achieved:

- **Multi-Crystalline Silicon Ingot-Production to Wafer Facility:** A pilot scale facility for producing 800 kg multi-crystalline silicon (mc-Si) ingots to wafers has been established at SSN College of Engineering, Chennai. This setup uses advanced solidification furnace coupled with state-of-the-art brick making and slicing machines to produce commercial-size mc-Si wafers, showcasing India's capability to develop cost-effective, indigenous silicon wafer manufacturing technology. Optimization of silicon ingots parameters is in progress.

Fig.: 800kg multi-crystalline silicon solidification furnace and slicing machines.

- **Indoor Light Harvesting Using Dye-Sensitized Solar Cells:** Scientists at CSIR-NIIST achieved a record 35.6% efficiency in indoor light harvesting with dye-sensitized solar cells (DSCs), offering a sustainable alternative to primary batteries and reducing environmental pollution. This breakthrough, published in the Journal of Materials Chemistry, features semi-transparent DSCs in various colours and designs, enabling innovative applications in glass facades, greenhouses, and indoor installations. This achievement is part of the Champion Solar Cell Challenge initiative.
- **Silicon Heterojunction Solar Cells with Carrier Selective Contact (CSC):** IIT Delhi has established a lab facility to fabricate silicon solar cells, mastering silicon surface conditioning to achieve an optimized thickness (2 nm + 8 nm) and demonstrating a power conversion efficiency of ~19.06%. This advancement showcases India's expertise in enhancing solar cell technology, pushing the boundaries of performance and reliability for indigenous champion silicon solar cells.
- **PV Panel Cleaning Robot:** PSG College of Technology, Coimbatore, developed an autonomous solar PV panel cleaning robot featuring a robust chassis, motor, tire/belt, brush, and sensor, shown in Fig. Using line detection with a camera module for navigation, the robot's motor drives control the crawler speed and cleaning mechanism. Special protection features ensure stability in various climatic conditions. Field testing of the prototype is ongoing, addressing the challenge of maintaining and maximizing energy output in solar farms.

Fig.: Autonomous Solar PV Panel Cleaning Robot.

- **Saur Stambh**: Smart Solar High Mast Light with Long Range, Low Power, Wireless Wide Area Network for Agri-IOT Applications has been developed by Aartech Solonics, R&D unit in Bhopal. The solar energy is harvested using PV Panels and stored in Li-Ion batteries using Maximum Power Point Tracking (MPPT) Charge controllers. The LORAWAN gateway and sensor network are configured to provide customized agriculture services such as Environment Monitoring / Detection / Warning Systems (eg. Forest Fire / Floods) / Soil Condition Monitoring / Remote Pump Operations for farmers community.

Fig.: Saur Stambh –for agri-iot applications.

- **Prototype of Plug and Play IV Curve Tester for Photovoltaic Modules:** Mahindra Ecole Centrale, Mahindra University, Hyderabad, developed two handheld IV curve testers (80V/10A and 450V/20A) for photovoltaic modules. These testers are equipped with external irradiance and temperature sensors to enhance functionality.

- **Field deployment and scale-up of the volumetrically controlled Wankel steam expander for use with low-pressure solar and process steam (IIT madras) :** IIT Madras developed a volumetrically controlled Wankel steam expander for low-pressure solar and process steam, becoming a finalist (8/163) in the MIT Climate and Energy Prize. Although they did not win, the recognition highlighted their technical strengths and market strategy, opening global market opportunities. The team is now fundraising to initiate commercial operations for this solar thermal technology.

Fig.: Volumetrically Controlled Wankel Steam Expander for use with Low-pressure Solar and Process Steam.

- **Development of Concentrated Solar Power with Carbon Dioxide-Based Power Cycles:** Feasibility report to establish Concentrated solar power plant with Trans critical Carbon dioxide power cycles for power generation of MW scale for Ladakh region. Finalization of Road map for R&D development of high temperature (700°C & above) concentrated Solar power with supercritical carbon dioxide power cycle.

  Compact Heat Exchangers for supercritical CO_2 power cycles, designed for extreme temperatures and pressures, have been developed. The necessary tools for flow path optimization, chemical etching, micromachining, and bonding force analysis were successfully created. Lab-established process parameters for diffusion bonding, a critical milestone, have been achieved. Scale-up activities for the full-scale heat exchanger are in progress, undergoing pressure- temperature test cycles to demonstrate the indigenous technology.

Smart Grids Research Initiative: As a part of the joint collaborative project between India and USA, led by IIT Kanpur, two rural pilots, integrating solar PV, biomass, biogas & battery; a semi-urban pilot, with solar, battery & thermal storage, EV Charging with Advanced Distribution Management System; and three urban pilots integrating multiple energy vectors and utilities for an effective demand response mechanism including peak load shifting and enhancing the performance and life span of the transformer have been commissioned.

Building Energy Research Initiative: The team lead by IIT Roorkee has developed localized building simulation weather files at 25Km grid resolution covering 4790 locations pan India. The weather files that offer current & future typical & extreme scenarios will improve building energy demand predictions and energy efficiency assessments which are currently done using typical weather files of about 65 locations. The team lead by IIIT Hyderabad has developed an IoT enabled cost-effective smart home energy management system capable of real-time logging and feedback. The system can assist users in effective demand side management and control.

The compendium of technologies has been published on building energy efficiency, highlighting the R&D outcomes and impact from 40 projects supported by DST. This compendium covers four thematic areas namely – innovative low- carbon building materials, low-energy heating and cooling technologies, information and communications technology (ICT) & building controls and integrated energy demand reduction.

DST organized a side event along with the UK and EU on “The transition towards low-carbon affordable heating and cooling solutions - The way ahead” as a part of the ministerial meeting of the 14th Clean Energy Ministerial and 8th Mission Innovation (CEM14/MI-8) held on July 19, 2023 at Goa. The event focused on exploring pathways and disruptive technologies for sustainable heating and cooling of buildings, identifying synergies with other missions, and fostering international collaboration for the potential programs.

DST convened an industry-oriented stakeholder consultation and interaction workshop on Smart Grids and Sustainable Heating & Cooling of Buildings during 8th – 9th May 2023 at Jaipur which brought together experts from over 100 industries & industry bodies and 60 R&D institutions across India. Outcomes of the clean energy research initiative and potential for upscaling & mainstreaming the technologies developed through this initiative were deliberated in the workshop.

3.2.2 Water Technology Initiative

The Water Technology Initiative (WTI) 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 2023-24.

DST and the Dutch Research Council (NWO) of the Netherlands have announced a joint call for proposals on “Water Disaster Management.” This partnership aims to develop scientific and technical solutions for managing floods and droughts in both countries. They will support three consortium proposals focusing on low-cost disaster emergency services, "hydrotwin" solutions, and transformative strategies for water disaster management in India and the Netherlands.

A call has been announced to support innovative, cost-effective technologies for water-related issues, including availability, distribution, quality analysis/treatment, and industrial wastewater management. The call encompasses Proof-of-Concept (applied research), lab-scale demonstrations (technology development), pilot-scale field demonstrations (technology assessment), and customized solutions for water challenges in selected clusters (convergent solutions).

WTI supported 20 proposals under the “Desalination Technologies Call,” focusing on R&D in membrane-based desalination, thermal desalination, and emerging technologies for reliable

water availability. Additionally, a Centre of Excellence (CoE) on Membrane Technologies for desalination and brine management was established at IIT Bombay and inaugurated in July 2023.

Under a WTI supported project, UPES Dehradun developed a sustainable solution integrating sewage water reclamation, microalgae cultivation, biofuel and biogas production, and manure by-products. The team has filed three patents and published five papers on the technology.

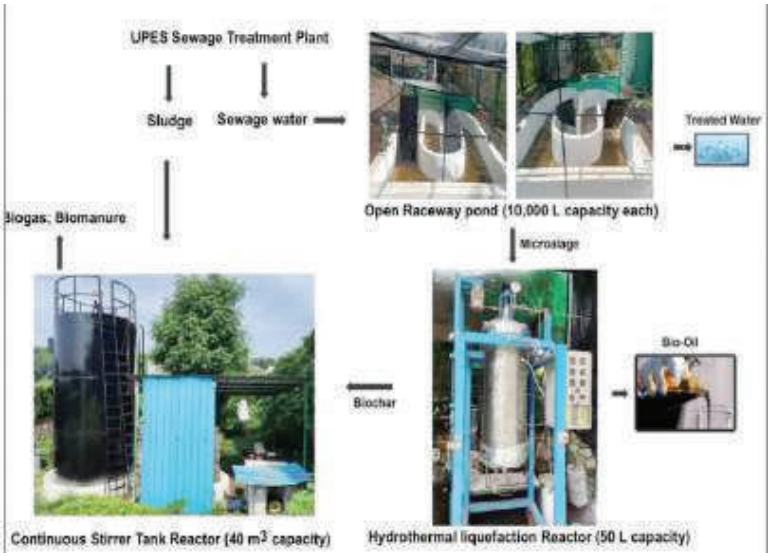


Fig.: Flow diagram of Integrated Pilot Scale Unit for Sewage water treatment with Bio-oil, Biogas and Bio-manure production.

IIT Roorkee under a DST-WTI supported project has developed electrocogulation based sustainable Arsenic and Fluoride containing groundwater treatment technology. The team has also demonstrated the pilot scale plant at Netaji Subash Chandra Bosh School Hostel, Kunja Bhadur, Roorkee.

Fig.: (a) 550 L electrocoagulation treatment plant installed at IIT Roorkee (b) 1000 litre Pilot scale at Netaji Subash Chandra Bosh School Hostel, Kunja Bhadur Roorkee.

Under a WTI supported project, Manav Rachna University, has successfully developed "Co solving water logging and ground water depletion issue in Faridabad smart city using underground taming of flood (UTF) water for aquifer storage and recovery (ASR)", two innovative ground water recharge structure developed at sector 15A and 16A for resolving water logging and ground water depletion problem simultaneously.

Fig.: Actual pictures of site at Sector 16 Faridabad, before and during construction of ARS System, Digital Water Level Recorder (DWLR) installation and ASR Structure after completion.

The structures have been constructed in the land of PWD and handed over to PWD after completion of the project for further maintenance. Faridabad Smart City Limited (FSCL) has helped to obtain NOC for the construction of structures in PWD premises. The FMDA (Faridabad Metropolitan Development Authority) has also shown its keen interest to replicate these systems in Faridabad.

- **Community water supply scheme based on Integrated Rainwater harvesting and Solar PV water pumping system:** The intervention aims to use solar PV power for sustainable sanitation and drinking water in Paruldanga village, Birbhum, West Bengal, by hybridizing rainwater and groundwater. Supported by DST, Visva-Bharati and NBIRT constructed a rainwater filtration system with a 25,000L storage and a 5000L upper reservoir, and installed two solar-powered water hydrants, providing 300L of drinking water daily.

Inaugurated by Dr. Anita Gupta, the project includes Water User Groups led by local tribal women, ensuring long-term sustainability. The community water supply scheme was inaugurated on February 23, 2024, highlighting the commitment to clean water access.

Fig.: Inauguration of water dispensing points in Paruldanga village, Birbhum, West Bengal

3.3 National Geospatial Programme (NGP)

The **National Geospatial Programme (NGP)** 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.

Vision: Catalyzing the National Geospatial Ecosystem.

Mission: Promoting Geospatial Science and Technology, Policy, Solution, capacity building, entrepreneurship and International cooperation for sustainable socio- economic development at all levels of Governance.

The progress made under various sub-programmes of NGP along with details of the various new initiatives are as under:

3.3.1 Geospatial Science Programme

National Programme on Geodesy

- The National Centre for Geodesy (NCG) at the IIT Kanpur campus was set up with the support of the Department of Science and Technology (DST), mainly with the objectives of (i) capacity building in the area of Geodesy through various outreach activities, (ii) development and dissemination of related educational resources, and (iii) conducting cutting edge R&D in Geodesy while acting as a national resource Centre to provide extensive support to the students and researchers from academia and state/central government departments in the country

- NCG and RCGs has been pro-active in organizing short-term courses and other training programs. In 2023-24 , NCG and RCGs have organised more than 10 capacity building activities in form of short-term courses and workshops (for government, industry and academia) and various outreach activities, which have been attended by more than 200 participants. NCG has also organized an open house on 4th November 2023 to communicate the importance of Geospatial Science and Technology for Nation Building to over 500 students from nearby schools and colleges of Kanpur.
- NCG has been selected as the host institute for the next DORIS station, which is also the first DORIS station in India. The selection was made after competing with 7 other international proposals submitted under Call for Proposal by International DORIS Service. An initial reconnaissance survey has been done by a representative from IDS. It is proposed to establish a functional DORIS station by November 2024.
- The CORS station established at NCG is now the part of APREF and IGS network and will be used in the next ITRF realisation. Further, NCG-RCG have collaboratively established a network of CORS stations mainly for academic and research activities. These are planned to include in the national CORS network also.
- NCG members have gained visibility in the international geodesy community and have been invited to be members of various working and study groups. Further, staff of NCG are members of the governing board of Global Geodetic Observing System (GGOS) and chairing new study group collaborating with 15 geodesists from 10 different countries. India has also been nominated as an associated analysis centre for International Height Reference Frame (IHRF), with NCG staff as the national representative for the same.
- NCG and RCGs have been involved in developing project proposals of National importance and also R&D project proposals focusing on geospatial science and technology.
- NCG has supported over 15 PhD students and Research staff for various training in geodesy and allied areas. Presently, NCG is also supporting 11 MS(R) and 3 DIIT students. Internships have been provided to nine students from seven different educational institutes.

R&D in Geospatial Science

With the aim of strengthening the country's geospatial science, project proposals were invited in various themes. Out of the 161 proposals received online, 14 R&D projects have been considered for support in domains such as geo-kinematics, generalization of spatial data, ubiquitous mapping, big geospatial data cube development etc.

3.3.2 Geospatial Analytics.

In order to strengthen the area specific geospatial analytics capabilities of the country during the pandemic as the outbreak will not have only short-term impact but also many

long-term socio-economic effects as well, out of total 140 R&D proposals received online, eleven proposals were supported in the areas of; Geospatial Analytics for Rural Livelihoods in Post-Pandemic Era; Inter-dependency modelling of Healthcare; Socio-economic Impact of Migration during Pandemic; Social Vulnerability Mapping Impact Assessment; and Modelling Geographically varying Relationships of COVID-19 outcomes. Few highlights of the work supported are as follows:

- **Dependency Assessment of Healthcare Infrastructure of Aizawl District, Mizoram (Mizoram University, Aizwal):** The study examined COVID-19 healthcare facilities in Aizawl, Mizoram, highlighting uneven distribution of health centres and categorizing them into dedicated COVID hospitals, health centres, care centres, and community care centres. It compiled data on recovery and case fatality rates, availability of medical staff and equipment, and vaccination details. Nearest Neighbour Analysis (NNA) and Weighted Linear Combined Model identified infrastructure weak zones and areas of interest, while shortest path analysis determined optimal routes to health centres. Hot spot analysis identified key COVID- 19 hotspots, and the SEIR model predicted the spread over three pandemic waves with a 45-day short-term forecast. The study validated its model using the ROC curve and developed a District Healthcare Information Portal on a Web-GIS platform, recommending improvements in healthcare availability and infrastructure. The portal can be accessed at https://arcg.is/115Gyv.

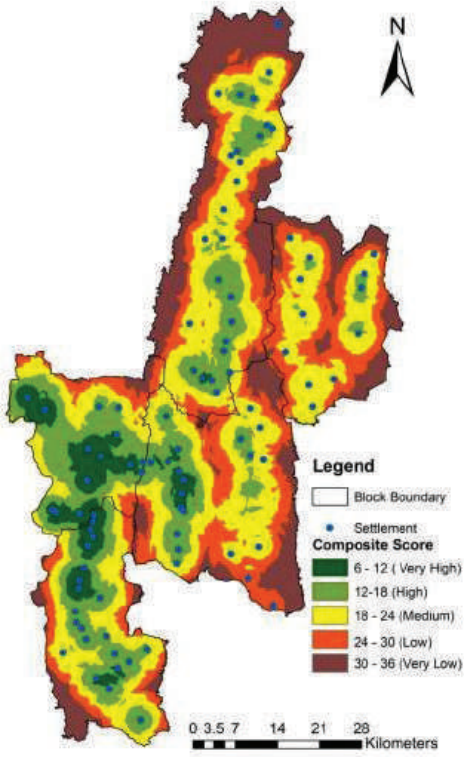


Fig: Healthcare service zone undertaking and it's prediction during Covid-19 in Aizawl district.

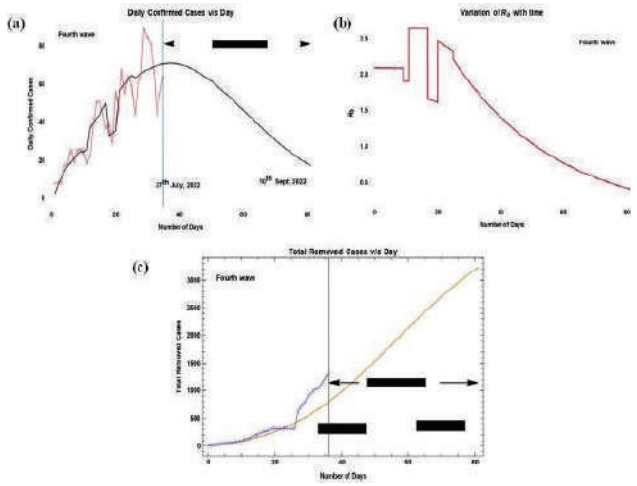


Fig. : Nature of COVID-19 and it's prediction during 4th wave, (a) Daily Confirmed cases (b) Basic Reproduction rate, (c) Total removed cases.

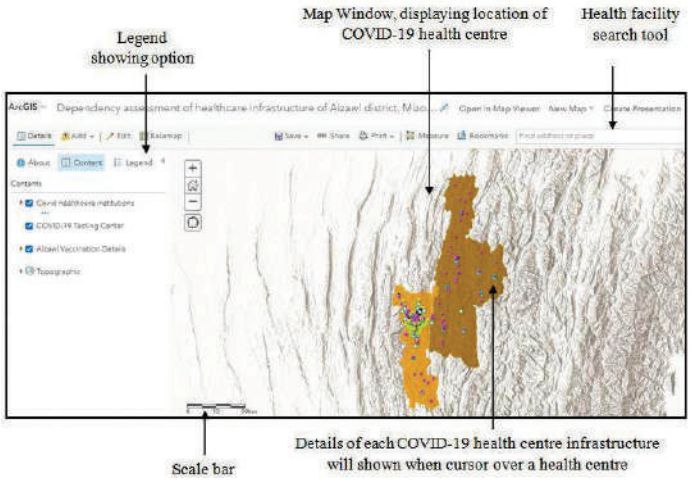


Fig. : Main window of WebGIS for the COVID-19 health facilities.

3.3.3 Geospatial Technology Programme

The programme aims at catalyzing the development of indigenous geospatial/ location specific technologies in the country with the main objectives of; improving the economic value of the existing Geospatial Technologies in practice along with promotion of demand based futuristic Geospatial Technology development.

GISE HUB Activities: Under this initiative, Geospatial Information Science and Engineering (GISE) hub has been established at IIT Bombay, which has emerged as a center of excellence in geospatial data management and applications since its inception in April 2022. The hub has fostered extensive collaborations with local and international organizations across government, industry, and academia. Key initiatives include

developing GIS-based case studies for village planning, contributing to international geospatial standards, and conducting capacity-building programs such as winter schools and workshops. The hub supports multidisciplinary research across various domains, including agriculture, disaster management, education, and health, funding 28 research projects and fellowships for Master's students. One OGC Stack Winter School was carried out in the area of emerging standards and designing interoperable solutions in addition to a 03 days on 'Practical aspects of Conceptual Modelling of Geospatial data'. Additionally, partnerships with leading institutions and incubation centers, such as SINE IIT Bombay, enhance entrepreneurship and innovation in geospatial technologies.

Research and Development activities: Further, under this initiative, in order to Strengthen Nation's Technology and Innovation Ecosystem, currently **total 09 project proposals** are being supported out of total 217 proposals received online. The projects proposals are supported in the areas of: Geospatially Enabled Learning approaches for Intelligent IoT based applications; Movable Monostatic Radar Mapping System for soil moisture retrieval; Hyperspectral Imaging System Development for Precision Remote Sensing Applications; Automatic Guided Weeding-tool based on Plant Geo-positions; Low-cost GNSS RTK Base for Precise Geo-location and Handheld Precise Geolocation Enabled Multi-Sensor Rover System; UAV-based near Real-time Surface Fire Detection andDelineation System; Geospatial Framework for Precision Agriculture – Leveraging the Synergy of Satellite and Drone imagery, Artificial Intelligence, Big data and Cloud Computing etc. Highlights from the research projects being supported include:

- **Development of Low-cost GNSS RTK Base for Precise Geolocation and Handheld Precise Geolocation Enabled Multi-Sensor Rover System (University of Burdwan):** The project objective is to develop a cost- and power-efficient, compact, GNSS Real Time Kinematic (RTK) GNSS Base station for mass-market applications. As the primary step of the work, multiple combinations of compact GNSS modules with multiple commercial patch antennas have been tested to find out the best combination in GNSS RTK performance. The cost-performance benefit analysis has also been performed. The GNSS Base station transmits Real Time Correction Messages (RTCM) over the internet using Network Transportation of RTCM using Internet Protocol (NTRIP) service and over Radio. Cost-efficient, LoRa modules together with other low-cost control electronics have been successfully tested for bidirectional GNSS data communication over 2.5 km baseline length within city urban environment for reducing the dependance on GSM network for RTCM message transfer. Together with open-source RTKLib software, commercial Alberding RTK software is studied, which will be used for performance analysis of the final products. As the RTK processor, Windows based (Lattepanda) and Linus based (Raspberry Pi) Single Board Computers (SBC) are analysed.

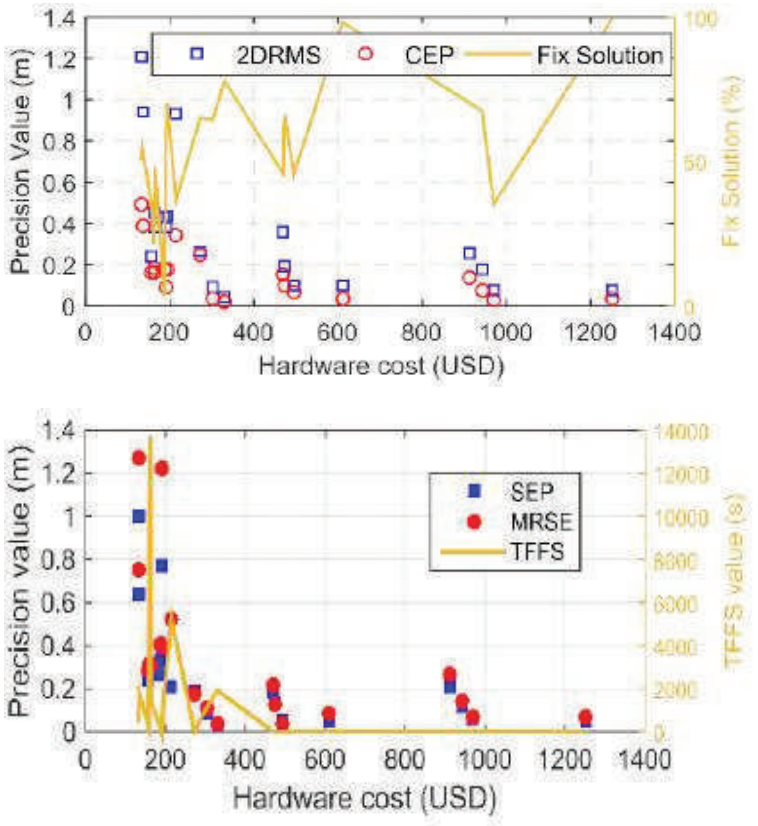


Fig.: Cost-performance analysis of different GNSS compact module - antenna combinations for medium baseline, GPS-only RTK (a) 2D solution quality together with RTK FIX solution volume, (b) 3D solution quality together with Time to First FIX Solution (TFFS).

- **Drone/UAV based Multi Sensor High Quality Precision Photogrammetry Laser Mapping and Data Capture, Processing for Geo Spatial Platforms (Vasavi College of Engineering, Hyderabad):** The project focuses on the assembly and integration of UAVs with specialized payloads for advanced data collection. It includes integrating LiDAR technology, specifically the Velodyne VLP-16 model. Studies and experiments have been conducted to achieve time synchronization and visualization of data from both LiDAR and flight controllers. This involves generating simulations for 2534 sample images with timestamps at a 10 Hz rate and visualizing IMU data from the flight controller. The aim is to improve UAV capabilities in synchronized data collection and visualization for precise scientific and technical applications.

3.3.4 Geospatial Solutions Addressing National Priorities and Sustainable Development Goals

Geospatial Solutions for Urban Governance: Under this, projects proposals are supported in the areas of city governance applications as well as in the core R&D areas focusing on

emerging technologies related to city development using Geo- ICT. The various R&D projects are supported focusing on Smart Parking Management System using sensors; IoT and GIS Technologies; Framework for Flood Mapping and Early Warning System in the occurrence of Flood; City GML based 3D models for smart cities; Industrial Indoor Assets Positioning and Navigation System using Geospatial Analysis; Geomagnetism based Indoor Navigation system etc.

3.3.5 National Programme on Spatial Disaster Risk Reduction (SDRR)

Landslide Hazard Mitigation (LHM): A set of 11 R&D projects has been supported for the development of an early warning system covering areas (States) like Sikkim, Nilgiris (Tamil Nadu), Manikaran, Kotropi, Mandi and Darmashala (Himachal Pradesh), and Uttarakhand. The main outcome of few supported projects are as follows:

- **Development of Landslide Early Warning System and Real Time Monitoring for Combined Hazard in Uttarakhand (IIT Indore)**: This project aimed to develop an early warning system and real-time monitoring for landslides in Uttarakhand. The work involved collecting and preprocessing geological, hydrometeorological, seismological, geotechnical, and landslide inventory data for the study area. The project sought to understand landslide spatial distribution and the factors conditioning slope failures, defining the relationship between rainfall and seismic landslides through data analytics and machine learning algorithms. Geotechnical and geophysical field surveys, including borelogs, soil sampling, MASW, and 2D resistivity tests, were conducted at critical slope sections. Drone surveys were used to map the slip surface. Efficient wireless sensor networks were designed for landslide monitoring, with performance investigated through analytical results and Monte-Carlo simulations. Real-time monitoring of active slopes was achieved by installing Micro Electromechanical (MEMS) based sensors at critical sections, leading to the development of a regional Early Warning System.

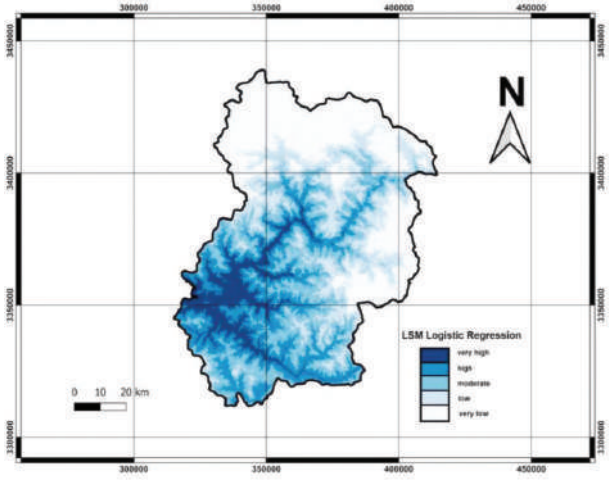


Fig. Landslide susceptibility map obtained using Logistic Regression Algorithm.

- **Geotechnical and Geological Study of an Active Landslide in Himachal Pradesh (HP) for Vulnerability Mapping and Risk Assessment (Lovely Professional University, Punjab)**: The project employed various methods to assess and mitigate landslide risks. The quantitative method of assessing landslide susceptibility yielded better results than the semi-quantitative method, with potential for further enhancement using advanced machine learning tools. Second-order depth-averaged shallow water equations were used to simulate slope-parallel and flow velocities of the landslide, successfully achieved using the RAMMS tool. The Spatial Approach to Vulnerability Assessment (SAVE) model, focusing on population as the primary parameter, was applied over the study area, revealing that only one out of 18 spatial units fell into the low landslide vulnerability zone.

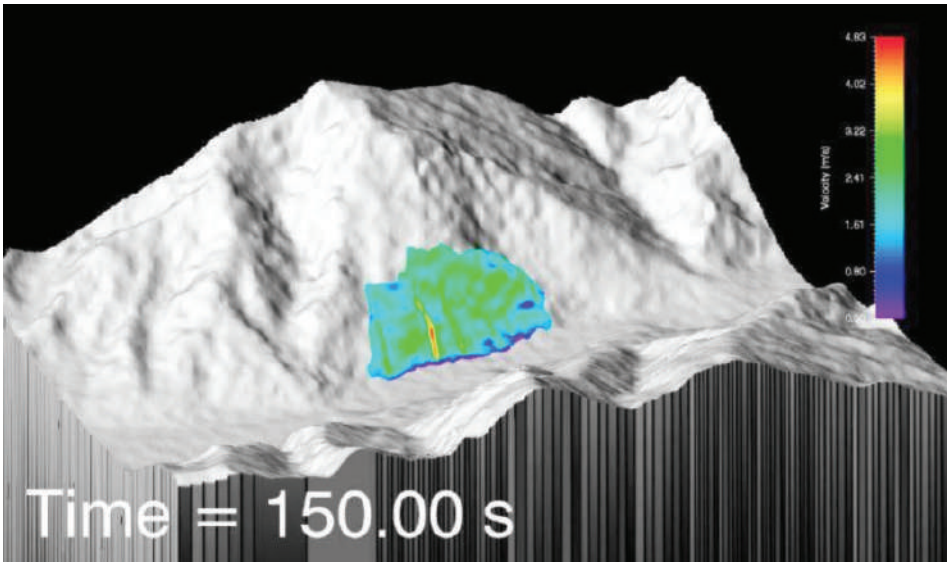


Fig.: Landslide flow velocity simulation.

3.3.6 Geospatial Capacity Building Programme

Summer/ Winter Schools in Geospatial Science and Technology: The Geospatial Capacity Building Program, a cornerstone in fortifying India's geospatial ecosystem under the NGP-DST (formerly NRDMS) banner, has successfully conducted 208 comprehensive three-week sessions since its inception until 2023. These sessions, which incorporate classroom, lab, and field activities as well as mini projects, have impacted over 5500 participants from academia, government, and research institutions across India. This program not only builds capacity but also enhances existing capabilities through a two-pronged approach that strengthens both individuals and institutions. The emphasis is on identifying pivotal institutions across India to create a unified network providing comprehensive geospatial capacity-building coverage.

Aligned closely with the UNGGIM IGIF Framework, the program has adopted a multifaceted approach to drive geospatial awareness and competence among various stakeholders,

including school teachers, students, and grassroots organizations. It offers Level 1 (basic) and Level 2 (advanced) courses, each spanning three weeks and encompassing lectures, hands-on sessions, group work, and fieldwork. The Level 1 curriculum remains standardized and regularly updated to stay current with industry advancements. To harness the potential of India's youth, a three-day Geo Innovation Challenge Program was launched in 2021, aimed at identifying sectoral challenges and applying geospatial technologies to address them.

In 2023, a specialized Level 1 course on Spatial Thinking was introduced to build awareness and skills in recognizing the role of location data in addressing societal issues. Thirty programs, including 11 Level 1 (Standard), 4 Level 1 (Spatial Thinking), 8 Level 2, and 7 Geo Innovation Challenge Programs, are being conducted in the current cycly. A two-day orientation workshop for the principal investigators (PIs) conducting these programs was held, attended by 30 PIs, setting the tone for robust implementation in the coming year.

The NGP-DST Geospatial Capacity Building Program is a dynamic force transforming the nation's geospatial landscape through continuous innovation. It imparts knowledge and skills while fostering innovation, entrepreneurship, and inclusivity. As it evolves and adapts, it remains committed to strengthening the adoption of geospatial technology at all levels.

Fig. Coordinators meet of the Geospatial capacity building programme.

3.3.7 International Collaboration

Activities under this Initiative aim at developing the national capacity for Geospatial Technology development, acquisition and transfer through international partnerships/ collaborations involving bodies/ agencies like the United Nations Global Geospatial Information Management (UNGGIM), Open Geospatial Consortium (OGC), Brazil Russia India China South Africa

(BRICS) Cooperation, Indo-Africa collaborations etc. The following activities through **UNGGIM collaborations** have been carried out during the year:

- Participation in the Thirteenth Session of UN-GGIM which was held at the United Nations Headquarters in New York from August 2 to 4, 2023. Several side events and meetings relating to the substantive work of the Committee of Experts were held on the 31st of July and 1st of August 2023, as part of the Thirteenth Session. This annual meeting of designated national representatives and senior executives from Member States' national geospatial information authorities, as well as geospatial information experts from international organizations, the UN system, and relevant stakeholders, will continue to improve global geospatial information management collaboration, coordination, and coherence. UN-GGIM, led by Member States, addresses global concerns in geospatial information creation, availability, and application, notably in development agendas and policymaking. UN-GGIM is the United Nations' apex intergovernmental mechanism for making joint decisions and directing national, regional, and global policy frameworks and development objectives toward nationally integrated geospatial information management.
- Additionally, under a project for UNGGIM Activities to achieve Sustainable Development, a comprehensive evaluation was undertaken for technology and people pillars of the Geospatial Ecosystem (focused on IGIF framework) to ensure accuracy and relevance, the assessment utilized customized questionnaires aligned with the World Bank's Diagnostic Tool.

3.3.8 New Initiatives and Major Achievements

- The National Geospatial Policy puts a core focus on innovation, as it aims to create a robust innovation ecosystem in the country; to achieve this vision of the policy, many activities like Need Assessment Surveys and Stakeholder Consultations were held. In order to concretize the role and scope of work of the envisaged innovation hub, a brainstorming workshop “Manthan” was organized on 28th-29th August 2023, at Hyderabad, with a distinct objective of bringing together a diverse spectrum of stakeholders from both the Innovation and Geospatial technology sectors onto a shared platform. It was intended to solidify the articulation of the innovation hub's role and scope of operations. Based on the above activities, it was concluded that there is a need for a Geospatial Innovation Hub in the country, which shall provide exclusivity to the domain; for the same a Tripartite MoU has been signed between DST, NIGST (SOI) & TiH IIT Tirupati for establishment of the hub (CoE) (Pilot). This hub shall cater to various aspects of innovation like, Technology Development, Capacity Building, R&D, & support to start-ups, entrepreneurs & innovators.
- A Capacity Building Workshop for Teachers and Educators from the Hyderabad area was organized on 20th December, at NIGST, Hyderabad, in accordance with the conversation about the Geospatial Innovation Hub’s activities as Pilot. This session served as a means

of raising knowledge of geographic technologies and their applications and it was one of the first activities of the hub. The Workshop had a component for creation of awareness around Geospatial technologies and its applications amongst the School-teachers who can be nodes for inculcating the spatial thinking in the young minds. It was one of the first steps in the direction of realizing the vision of the hub. More than 40 teachers from various districts of Telangana attended the workshop.

3.4. National Initiative for Developing and Harnessing Innovations (NIDHI)

The National Initiative for Developing and Harnessing Innovations (NIDHI) Program focuses on nurturing start-ups and individual innovators. This program exemplifies DST's commitment to translating research into practical applications, fostering innovation and promoting entrepreneurship in technology.

Following are the key components of NIDHI umbrella programme:

3.4.1 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.

3.4.2 NIDHI TBI (Technology Business Incubator)

Technology-based new enterprises are high-risk and high-growth ventures and require an enabling environment like NIDHI-TBI to enhance the prospects of their success. The Technology Business Incubators are supported 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.

3.4.3 NIDHI – iTBI (Inclusive-Technology Business Incubator)

The aim of NIDHI Inclusive-TBI is to instil a spirit of innovation and entrepreneurship in students, inventors, and entrepreneurs, as well as to stimulate and support creative ideas and start-up creation through incubation. The i-TBI facilitates in conversion of ideas into

startups. The Host Institution (HI) and surrounding geographies benefit from an i-TBI culture of innovation and entrepreneurship. I-TBI provides grants-in-aid to innovators to help them turn their ideas into prototypes and prototypes into enterprises. DST has supported more than 30 iTBI across the country.

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

- **ThoraCare by Larkai Healthcare Pvt. Ltd - Incubated at NIDHI CoE at KIIT, Bhubaneswar**

  ThoraCare by has introduced a portable device designed to replace multiple components of a traditional ECG and stethoscope setup. It features a novel AI algorithm capable of diagnosing early-stage real-time heart impulse and valvular disease for futuristic predictive analysis. The device delivers a comprehensive screening report on heart and lung conditions, which can be easily interpreted by individuals with minimal training. The product has been deployed in various health centers, ambulances, healthcare companies, and pharmacies.

Fig.:: ThoraCare by Larkai Healthcare Pvt Ltd

- **Hydrovert Energy Pvt. Limited - Incubated at NIDHI CoE at Venture Center, Pune**

  Hydrovert is developing a safe, reliable, and durable hydrogen fuel cell-powered drivetrain that can be used in mobility applications and stationary power generation. The Startup has completed the development of a 5kW hydrogen fuel cell-powered motorcycle. It has also started the development of a hydrogen fuel cell-powered cargo three-wheeler and a hydrogen fuel cell-powered stationary power generator (as a replacement for diesel generators).

The company is supported by NIDHI PRAYAS and NIDHI Seed Support, along with CSR initiatives.

Fig.: Hydrogen fuel cell powered two-wheeler built by Hydrovert Energy

- **Maroon Oak Technologies Private Limited (Incubated at NIDHI TBI - PDEU Innovation and Incubation Centre, Gandhinagar)**

  Maroon Oak Technologies Private Limited has developed Sustainability as a Service (SaaS). The company aims to democratize sustainability adoption through technology. They provide end-to-end solutions for ESG compliance and communications, encompassing ESG reporting, capacity building, advisory, and assurance. Their software, Prism, helps organizations effortlessly drive and manage their sustainability strategy, optimize performance, and identify ESG risks and opportunities on the go. Prism collects, manages, and processes ESG data to create dashboards using a custom template or any of the global frameworks (GRI, TCFD, BRSR, CDP, SASB, etc.), and to communicate ESG performance to internal and external stakeholders. Maroon Oak has built an AI-based employee engagement platform. The platform uses AI to instill behavior-based skill development for the blue-collar workforce and provide real-time visibility of processes to the management team. Their aim is to reduce the skills gap and the communication gap, resulting in increased productivity and fewer workplace accidents.

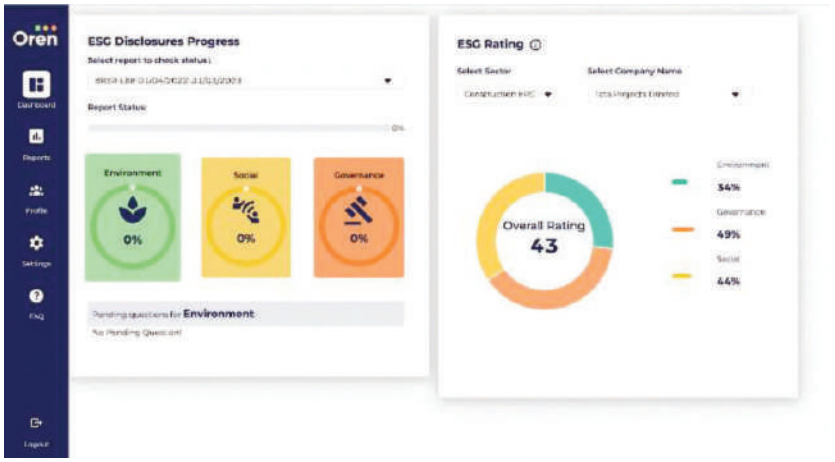


Fig.: Maroon Oak's AI based Employee Engagement Platform

- **Kashmir Organogreens Pvt Ltd (Incubated at SKAUST-Shalimar, Srinagar, Jammu and Kashmir)**

  The startup has innovated CarroDiet, a series of nutraceutical products derived from a unique variety of carrot, Daucus carota L. Recognizing the limitations and side effects of traditional allopathic medicines, the Startup aims to harness nature's potential to create a plant-based, affordable, and sugar-free solution rich in anti-obesity, antioxidant, anticancer, and antidiabetic properties. CarroDiet is being designed to cater to the health needs of diverse populations, including those with high cholesterol, obesity, diabetes, and weakened immune systems.

Fig.: CarroDiet by Kashmir Organogreens 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 NIDHI PRAYAS Program has generated a considerable impact, such as:

- 1800+ innovators supported across the country
- Successful development of 1200+ prototypes
- 700+ patents filed by the innovators
- Cumulative funding raised of more than ₹600 crores
- Revenue generated of more than ₹280 crores

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 Program are given below:

- **IntelliPole Smart Streetlight integrated with EV Charging – Supported by PRAYAS Centre at IIIT Hyderabad Foundation, Hyderabad**

IntelliPole – Smart Streetlight is capable of charging three EVs simultaneously, has a street light powered by a solar panel, and includes an air quality monitoring system.

Fig.: IntelliPole Smart Streetlight integrated with EV Charging

- **InfyU Labs Fruit Quality Assessment System – Supported by PRAYAS Centre at IIT Gandhinagar, Gujarat**

  InfyU Labs has developed a pocket device to assist with food quality management. The device uses spectroscopy to perform quality assessments of fruit consignments.

Fig.: InfyU Labs Fruit Quality Assessment System

3.4.5 NIDHI-EiR (Entrepreneurs-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.

NIDHI EIR Program has generated a considerable impact which include:

- 1074+ EIRs fellows supported across the country
- 537 IPs created - 287 Patents, 205 trademark and 45 copyrights by EIR fellows
- 3200+ New jobs created
- 60% EIRs have private limited companies / Limited Liability Partnerships
- More than Rs 226.35 crore of funding has been raised by EIRs as against the Rs 27.32 crore of fellowship support extended by DST under NIDHI EIR program, i.e. fund raised by NIDHI EIRs are 8 times of the funding support received from DST.

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 2023, 18 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 2023-2024, seed support has been provided to 14 new incubators and 12 incubators with ongoing support as subsequent releases under NIDHI-SSP to further extend financial assistance to deserving startups. During this period, 90+ startups got benefitted under SSP.

Few notable success stories of the NIDHI-Seed Support Program for this year are as under:

- **Farm Sathi by startup Dhi Sathi Robotics Pvt. Ltd. incubated at IIMK LIVE, Kozhikode, Kerala**

Product/Innovation: The startup is into developing fully Autonomous Weed and Pest Control Robots that are equipped with Artificial Intelligence, robotics actuators, etc. to control weed, pest and nutrition. It uses Convolutional Neural Networks to identify pests and weeds in the fields. Reinforcement learning to help the robot navigate in unpredictable terrains. Solar-cum-Grid auto docking features enables it to operate with almost zero operating costs. It can be operated both day and night and can cover up to 6 acres per day, making it much faster, cheaper and efficient than manual labour.

Achievements: The startup has raised Rs. 5 Crores of external investment.

Fig.: Farm Sathi Autonomous Weed and Pest Control Robot for Agricultural Application

- **Acquafront Infrastructure Pvt. Ltd. incubated at SIDBI Innovation and Incubation Centre (SIIC), IIT Kanpur, Kanpur, Uttar Pradesh**

Product/Innovation: Acquafront Infrastructure (P) Ltd., is an industrial manufacturer of modular floatation products used for maritime and inland waterways applications. In the last 5 years, they have completed major projects with Gail India Ltd., Spicejet, and Planer India

Pvt. Ltd. They have installed the world's first floating CNG filling station for eco-friendly boats at Khirkiya Ghat Varanasi (U.P), and the world's first floating CNG MRU (Mobile Refueling Unit) for eco-friendly boats at Ravidas Ghat Varanasi (U.P).

Achievements: The startup and its product was appreciated by Prime Minister Narendra Modi. They were awarded the National Meritorious Innovation Award 2018 by NRDC (A DST Enterprise) and the Dalmia Bharat CSRBOX CSR Impact Award 2023. They also successfully designed, manufactured, and installed 11 oxygen plants with capacities of 450 and 600 LPM across India during the critical period of the COVID-19 pandemic.

Fig.: World's first floating CNG filling station at Khirkiya Ghat Varanasi (U.P)

- **EyeROV by startup IROV Technologies Pvt. Ltd. incubated at Entrepreneurship Development Center (Venture Centre), Pune, Maharashtra**

Product/Innovation: EyeROV is one of the initial commercial Underwater Drone. The company is focused on underwater robotic systems developments both hardware and software. Its products for search and rescue, water management infrastructure, aquaculture, research and defence can be used to find and retrieve underwater objects.

Achievements: EyeROV has won numerous awards including India Fast pitch GITEX Award 2023, National Startup Award 2021 by TDB, Department of Science & Technology, Best Tech Design Award in 2020, KMA NASSCOM IT Award 2018.

Fig.: EyeROV Commercial Underwater Drone

3.4.8 Other Innovation & Entrepreneurship Initiatives

- **The National Technology Award for Technology Business Incubator** was presented to T-Hub Foundation, Telangana, during National Technology Week 2023, for outstanding contributions in techno-entrepreneurship development and the promotion of S&T-based startups. DST has established a NIDHI – CoE at T- Hub, which significantly contributes to India's pioneering innovation ecosystem.
- **The Director General of the World Intellectual Property Organization (WIPO), Dr. Daren Tang,** along with the WIPO delegation, visited the DST- established NIDHI CoE at IIT Delhi (FITT) and interacted with the startups. DST apprised the WIPO delegation of the diversity of India's innovation ecosystem and the critical role of intellectual property rights.

Fig.: Director General of World Intellectual Property Organization meeting with DST Officials

- **DST Geospatial Hackathon** was organized by DST, in consultation with the Survey of India, the Technology Business Incubator - CIE at IIIT Hyderabad, and Microsoft India. The objective was to encourage and support startups and researchers to identify problems in the geospatial domain and develop solutions useful for the community. Four winners were selected for further mentoring support (two each under the Startup Challenge and Research Challenge) through a finale event in May 2023.
- Organized **a Brainstorming Session on establishing a 'DST Supported Conducive Platform to Support Deep-Tech Startups'** at the NIDHI Centre of Excellence, FITT, IIT Delhi, with the participation of esteemed industry and academic leaders, CEOs of DST-supported TBIs, startup founders, and DST officials. The session was chaired by Prof. Abhay Karandikar, Secretary, Department of Science & Technology.

Fig.: DST delegation at the India ASEAN Startup Summit 2023, Kuala Lampur, Malaysia

- DST participated in the **India ASEAN Startup Summit 2023**, held in Kuala Lumpur, Malaysia, leading a delegation of eight DST-supported startups along with two NIDHI Centres of Excellence. Startups showcased innovations in MedTech, sustainability, and UAV sectors, attracting attention from accelerators, investors, and government stakeholders. The event facilitated collaboration between startup ecosystems, encouraging participants from ASEAN and India to learn how to build a vibrant startup ecosystem and expand their networks.
- DST supported the participation **of 12 women-led startups** in a combined startup event, **'Expand North Star, GITEX Global, FinTech Surge, Marketing Mania, and Future Blockchain Summit,**' held in Dubai during October 2023. Startups in the domains of drones, sustainability, SaaS platforms, electronics, etc., received a good response from entrepreneurs and investors visiting the Expo in Dubai.

Fig.: DST Supported Delegation at Expand North Star, GITEX Global, FinTech Surge, Marketing Mania, and Future Blockchain Summit,' held in Dubai

3.5 National Council for Science and Technology Communication (NCSTC)

The programmes of National Council for Science and Technology Communication (NCSTC) Division, Department of Science and Technology (DST), are largely aimed at communicating and popularizing science and technology (S&T) to masses and stimulate scientific temper as per article 51 A, as enshrined in the Constitution of India.

The initiatives of NCSTC were committed towards dissemination of knowledge in interesting, informative and innovative formats using multiple means to enable delivery of S&T in every nook and corner of India.

Highlights of various activities and achievements are summarized here under different areas:

- **Low Cost Teaching Aids:** 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. 100 training workshops were supported in the states of Haryana, Bihar, Andhra Pradesh, Gujarat, Nagaland, Telangana, Dadra & Nagar Haveli, J&K, Madhya Pradesh, Karnataka, Odisha, Tamil Nadu, Uttar Pradesh, West Bengal, Punjab, Rajasthan, Uttarakhand, etc., to motivate science teachers to perform hand on activities enabling school students to understand the basic principles of science. The participating teachers further encourage students and promote the concept of learning science by fun. The workshops created a pool of 3000 trained teachers having ability to organize hand on activities in schools and at district level.

Fig.: Hands-on activities by the participants

- **Science Communication through Folk Media:** Several projects were implemented in different parts of the country focusing S&T based Communication to reach to remote areas through folk media (puppetry, street play, nukkad natak, folk songs, dances, etc.), in vernacular. To promote S&T awareness, field programmes, 25 training workshops and 100 awareness programmes were supported in the state of Uttar Pradesh, Madhya Pradesh, Haryana, Orissa, Andhra Pradesh, Andaman & Nicobar, Assam, Gujarat etc. to develop resource persons as science communicators through folk media


Fig. Developing scientific temperament by using traditional folk media in school children through science theater (Vigyan Rangmanch)

The programmes were also held at several places across the country for demystification of S&T.


Fig. Developing scientific temperament by using traditional folk media in school children through science theater (Vigyan Rangmanch)

- **STEMM Demonstration:** 'Science, Technology, Engineering, Mathematics and Medicine (STEMM) Demonstration' activities comprise of science fairs, melas, expositions, mobile science exhibitions, lecture demonstrations, interactive media, visits to S&T establishments like labs and industry, hands on-STEMM activities, and so on. More than 180 static and mobile exhibitions were organized in different parts of the country.
- **Science Exhibition on Wheels:** Through 'Mobile Science Exhibition' students, especially having no or very little access to lab facilities, get an opportunity right at their school premises for hands-on engagement in science activities which will help them in understanding difficult curriculum-based concepts with fun and ease. The target group for these activities includes general public, school & college students, youths, women, teachers, gram panchayat members, voluntary organizations and policy makers, etc.

Several Mobile Science Exhibitions/Labs run in various states i.e. Assam, U.P, Haryana, M.P, Karnataka, Chhattisgarh and Andhra Pradesh for Science Popularization. More than 40 Lakh students, teachers, people attended these sciences on wheel activities.

Two Mobile Science Labs (MSL), equipped with all types of basic scientific equipment's of physics, chemistry, biology, electrical, electronics and mathematics in the state of Haryana and Gujarat respectively took the laboratory experience to underprivileged children right at their school premises.

More than 43 community awareness programs, including 3 sky-watch sessions and 18-day IGM, were conducted in Ambala by Society for Promotion of Science Technology and Innovation (SPSTI). Interactions were held with 71073 villagers on issues of scientific importance. SPSTI conducted six science stage shows at different locations with participation of 5800 students and teachers. 'Festival of Science ', a mega event was organized at DAV College Bathinda with participation of 4,500 students from schools and colleges. SPSTI further conducted 9 summer schools of 22 days duration in Science and Mathematics in June 2023, at Ambala, Dadawas (Gurugram district), Jind, Kurukshetra, Karnal, Kaithal, Palwal, Panchkula and Yamunanagar. Around 1378 Students attended these summer schools.

The MSL carried out workshops on Telescope making, Electricity, Magnetism, Pinhole Camera, Lens Camera, Kaleidoscope, Periscope, Mathematical Theorems and Sundial to enhance access to hands-on science education in schools that lacked proper laboratory facilities. Between April, 2023 and Dec. 2023, students made 70 Telescopes, 120 periscopes, 169 horizontal sundials, 67 Lens Cameras, 113 Pinhole Cameras, 202 Kaleidoscopes, 47 Communication Satellites and used 364 mathematics formulas using sheets under the supervision of communicators in MSL. During India International Science Festival-2023, more than 4000 people, including teachers, students, and college students visited the mobile science lab.

- **Science Exhibitions:** More than 100 Science fair/Science exhibitions/campaigns on identified themes Environment Awareness, Astronomy, Biodiversity etc. were conducted for people at grassroots in several states.

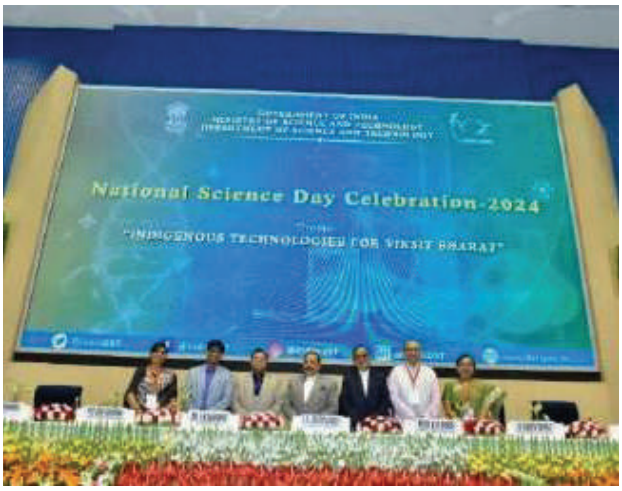


- **Visit to Industries:** The industrial tours were organized at several places in India like, research organizations, factories, steel plants, power stations, milk plant, dams, petroleum refineries, automatic bakeries, automobile repair workshop, modern agriculture and poultry farms etc. to expose young minds and develop their curiosity and creativity. More than 70 visits to Industrial establishments were held in several states.


- **Motivational Talks for Students:** To encourage bright students to select careers in science it is imperative to sensitize them about science & technology related work going on various laboratories, universities and scientific institutions in the country. Famous science communicators, scientists, professors were invited to deliver talks on emerging fields of Science and Technology in more than 50 schools and institutes under this program. More than 5000 school children, teachers and parents attended this program.

- **National Science Day (NSD) Celebration 2024:** The theme of NSD 2024 was "**Indigenous Technologies for Viksit Bharat**" and NSD was celebrated at Vigyan Bhawan on 28th February 2024 in the gracious presence of Dr Jitendra Singh, Hon'ble Minister of Science & Technology, Principal Scientific Advisor to Government of India and Secretaries of DST, DBT and DSIR. The NSD lectures were delivered, Prof. Bhaskar Ramamurthi, IIT-Madras and Prof. Urvashi Sinha from Raman Research Institute, Bangalore. Two panel discussions were conducted on the topics: 'Bridging the Knowledge Gap: Effective Science Communication for Viksit Bharat by 2047' and 'Strengthening Research and Developing Indigenous Technologies for Viksit Bharat by 2047,' involving eminent scientists and science communicators. NCSTC also created a film on Decadal Achievements of DST and developed a Podcast Series, 'Vigyan ki

Aawaz' of eminent Indian Scientists. NSD was celebrated across the country through 22 State S&T Councils and various activities such as lectures, quizzes, radio and television broadcasts, open houses, debates, painting competitions, were conducted around the identified specific theme. Engaged 22 State S&T Councils in NSD festivities, reached out to 20,60,713 students, teachers, and the general public through multitude activities.



- **National Children's Science Congress:** The National Children's Science Congress (NCSC) stands as a flagship initiative of the NCSTC Division, DST, Government of India, with the primary goal of instilling inspiration, innovation, and practical application of scientific ideas among children. This initiative targets children aged 10-17 years,

nurturing their scientific curiosity through the utilization and understanding of the 'method of science,' which encompasses observation, data collection, experimentation, analysis, and drawing conclusions. The NCSC is executed with a unified theme across all states of the country, theme for last two years was “Understanding Ecosystem for Health and Well- Being,”. Over 585 projects have been selected from the state-level Children’s Science Congress for participation in the National Level event and students from all the states and UTs of the country benefited through this initiative. The program unfolded in three stages: scientists initially shared their findings at the district level, followed by state-level presentations, culminating in a national-level event expected to take place in August, 2024. The national-level event will bring together a diverse array of participants, including child scientists, distinguished scientists, academics, teacher resource persons, evaluators (both local and external), volunteers, and students.

Fig.: Photographs of State Level Activities in the Country

- **Initiative for Research and Innovation in STEM (IRIS):** The Initiative for Research and Innovation in STEM (IRIS) is a programme supported in PPP mode by NCSTC Division, Department of Science and Technology and Broadcom. The objective of IRIS is to promote and nurture science and scientific research among young Indian innovators,

from diverse and inclusive backgrounds, with the objective of recognizing and rewarding outstanding scientific research projects. It is implemented by EXSTEMPLAR Education Linkers Foundation. IRIS National Fair is conducted annually in India for school students of classes 5 to 12. Each year, IRIS reaches out to students, teachers and schools across the country and encourages them to come up with research-based science projects in 21 subject categories. The students submit their project entries online and subsequently; these projects are scrutinized by IRIS Scientific Review Committee (SRC) to select 20 best projects to represent India at Regeneron International Science and Engineering Fair (ISEF).

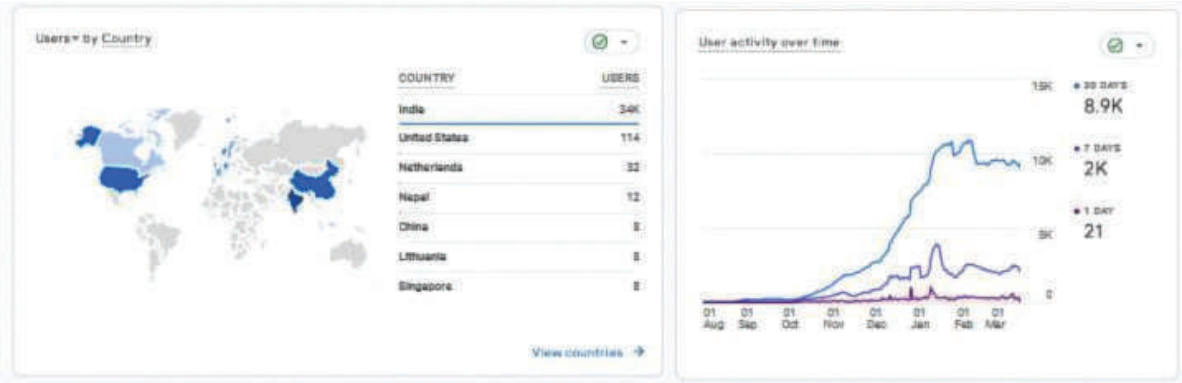
The IRIS National Fair 2023-24, was held in Dr Ambedkar International Center, New Delhi from 29-30 January 2024. A total of 140 students across the country showcased 100 innovative projects to get an opportunity to be in top 20 projects to represent India at the Regeneron International Science and Engineering Fair (ISEF) to be held during May 11-17, 2024, in Los Angeles, California, United States of America (USA). This year, 23 students for 20 STEM projects were selected for participation in Regeneron ISEF. Team India won total 10 awards (6 Special awards & 4 Grand awards) in ISEF-2024.

Fig.: Photographs showing IRIS National Fair and participation of Team India in ISEF-2024

- **Children Centric Outreach Programme:** In the project entitled, 'Teach in 10: Discovering Talents in Rural School Students' mentoring of rural school students were carried out by IIT Madras graduate students & PMRFs (as mentors) for about one academic calendar year, at the end of which a rural school student (mentee) recorded a '10 min' teaching/ demonstration video on what they learnt during their interaction with the mentors. This mentor-mentee interaction was completely in-person interaction at IIT Madras for about continuous 5-6 months. 22 students (mentees) from 13 schools mentored by 61 PMRF scholars resulted in 12 device engineering videos and 10 3D printed product videos. The details are available on the web portal: https://teachtolearn.co.in/teachin10.php and the YouTube Channel: https://youtube.com/@teachtolearniitm.

Under the project entitled, 'To create an awareness regarding the rational use of medicines and current drug resistant profile (antibiotic resistance) among school students, PGIMER, Chandigarh created awareness amongst 26,546 students in various schools across the country about the uses and misuses of medicinal products (antibiotic resistance) or antibiotics by different modules: Audio-Visual Aids, Group-Discussion, Diagrammatic-Representation, Post Assessment of awareness program and to assess the quality of medicines and effective drug therapy among senior secondary school's students.

- **Creation of Science and Technology Content for Indic Wikipedia:** A project entitled "Creation of Science and Technology Content for Indic Wikipedia," was supported to IIT Kanpur which involved utilizing various platforms for hosting articles and establishing two instances of MediaWiki. One instance was dedicated to testing purposes, while the other served as a platform for writers to create and refine articles. Under this project, the Vigyanwiki portal (https://www.vigyanwiki.in) was developed to host a comprehensive collection of science and technology articles. Additionally, the Vidyalayawiki portal (https://www.vidyalayawiki.in) was specifically designed for students in grades 9-12 to create Hindi articles covering Physics, Chemistry, Mathematics, and Biology. A total of 15,600 articles were generated on Vigyanwiki, while 1,820 articles were authored on Vidyalayawiki.



- **Showcasing Indian S&T Prowess for Outreach in Newly Constituted UTs of J&K and Ladakh:** Indian scientific and technological developments, focused on promoting locally adapted science and technology showcasing Purple Revolution, Biotechnology Parks, Heliborne Technology, and various schemes of S&T Ministry were highlighted in the newly formed UTs of J&K and Ladakh through 20 creatives for digital displays and print media. Airport the most prominent location was also used to create awareness among 3-5 lakh domestic and international visitors at the Srinagar and Jammu airports.

3.6 Science for Equity Empowerment & Development (SEED)

SEED program aims at Creation of Sustainable Livelihoods and Strengthening the Livelihood System of most vulnerable sections of the society through S&T Interventions whilst addressing socio-economic disparities, strengthening informal knowledge systems and innovations, gender equality etc. in the context of Equity & Inclusion. The programmatic support is provided for action-oriented and location- specific projects with a focus on the socio-economic development of disadvantaged sections of society through appropriate interventions of Science, Technology, and Innovation (STI) for improved quality of life and livelihood. For geographical inclusion, Science Technology and Innovation (STI) ecosystem at the State/UT level is also catalysed by leveraging the network Science & Technology Councils through systemic interventions.

Some of the important activities under SEED Division during the year 2023-24 are as under:

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

The SUNIL programme aims to support technology delivery and models of social enterprise creation for Economically Weaker Section (EWS) of society including need-based & action research projects to identify local and systemic solutions to implement S&T based projects at community level.. It also encourages improving their S&T knowledge, skill enhancement,

capacity building and socio-economic conditions. Some of the significant achievements areas follows:

- **On-field applications for water technologies in UP and Bihar region**

  Development Alternatives (DA) has developed an Arsenic-removal filter, which is a mineral-based filter, that uses an adsorption technique for the removal of Arsenic from drinking water. It also has a capacity of 500-1000 litres for its deployment at the community level. The water treated through this filter is arsenic- safe for drinking. The filter is ideal for rural areas and easy to install and use. Some of the major advantages are that it removes iron and bacterial contamination down till the permissible level. It is also robust, easy to operate and easy to maintain. Another solution on coagulation-based domestic defluoridation kit (25L capacity) has been developed to remove fluoride from drinking water, with collaboration of MNIT Jaipur and technology has been patented under Indian IPR. DA aims to target the development of 30 units of defluoridation kits and hand them over to families with 4-6 members to assess the wider field application in a highly fluoride-contaminated region.

Fig.: coagulation-based domestic defluoridation kit

Fig.: Arsenic-removal filter

- **Clean energy, Health, Nutrition and Enterprise development in HP**

  Himalayan Research Group (HRG) Shimla has tested medicinal plant Swertia cordata aqueous extract to control pathogenic bacteria isolates having high resistance to the existing antibiotics. Bacterial cultures were procured from MTCC Chandigarh. The powdered sample of Swertia cordata was used for the extraction (figure). The lowest concentration required to inhibit the growth of E. coli, S aureus, S. typhi, S. flexneri, P. aeruginosa and B. cereus was found to be 0.625 mg/100 µl, 0.625 mg/100 µl, 1.25 mg/100 µl, 0.3125 mg/100 µl, 0.0781 mg/100 µl and 0.1562 mg/100 µl conc. respectively. At the same time validate the ethnic medicinal use of Chirayita in fever developed with contaminated water, food or by other means of bacterial contaminations in human

beings. This study also helped to test the extract of this plant in control of snake bite wound treatment for the first time.

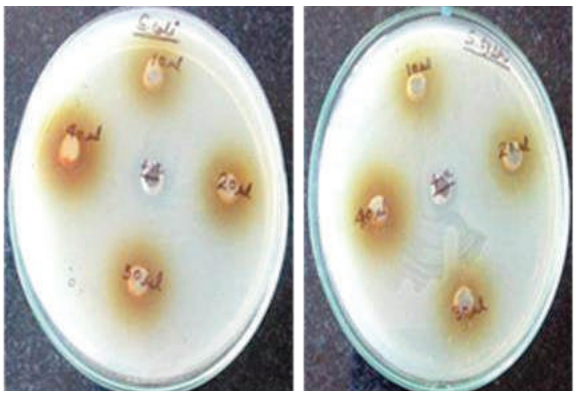


Fig.: Women member at herbal production unit

- **Food and Nutritional Security of marginal communities through 4C approach**

  M S Swaminathan Research Foundation, Wayanad, Kerala introduced and implemented 4C approach (conservation, cultivation, consumption and commercialization) in bioresource management and benefitted the community through 5 production units run by women groups (1 herbal unit, 1 ginger value addition unit, 3 bio input production units), 22 rice seed villages and 200 Household nutri-gardens. Promotion of medicinal plants and spices was achieved through establishment of women led herbal processing unit (supported with pulverizer, drier and production techniques of 17 products) and ginger value addition unit (with modified peeling and slicing equipment and knowhow of 9 innovative ginger products). Thirty rice seed villages established by MSSRF are involved in cultivation of various traditional medicinal and aromatic rice varieties across Wayanad.

Fig.: Seed germination and dormancy

- **Enhancing Farmers Livelihood Security in Arid Rajasthan through Value addition, Design and Development of Harvester of Kair, Moringa and Nagauri Methi**

  Agriculture Research Station Jalore, and CTAE, Agriculture University, Jodhpur introduced eight Moringa varieties and evaluated by establishing plantation at ARS Keshwana, Jalore for pod and leaves production. Total 55 ITK were documented from five district of Arid Rajasthan and found that there is a marked diversity with respect to plant types, canopy, flowering and fruiting were observed in natural Kair population. Under project, Battery operated mechanical Kair fruit harvester, Vaccume operated kair harvester, Nagauri methi leaves harvester and Moringa Leave harvester were developed and increased the efficiency of users & reduces drudgery for harvesting of kair, moringa and methi.

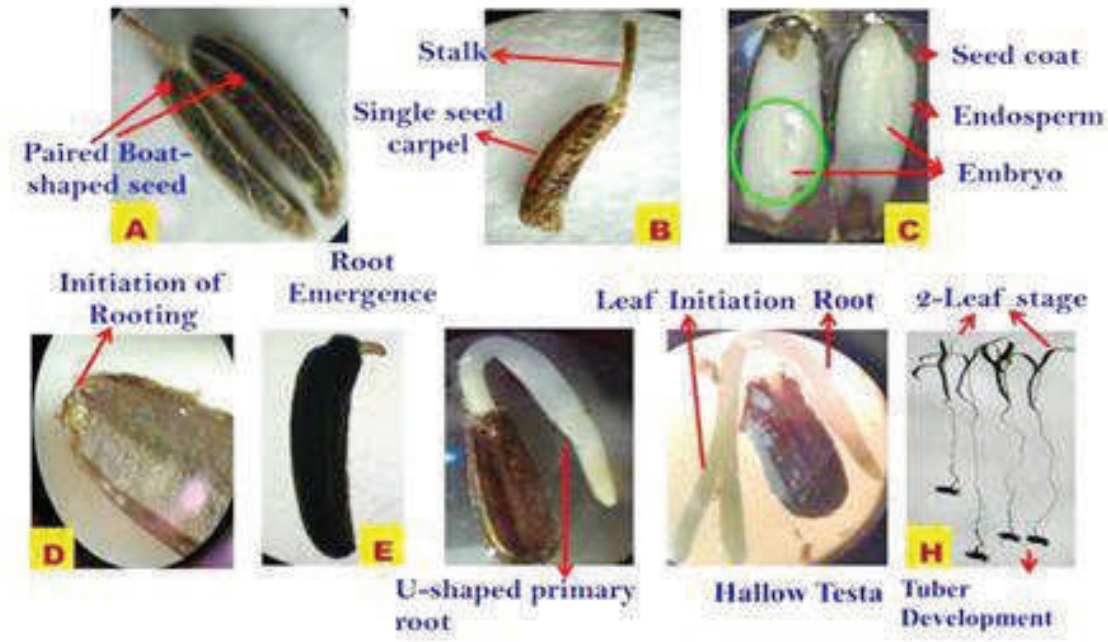
Fig.: Vacuum operated Kair harvester

Fig.: Nagauri methi harvester

Fig.: Moringa Leave harvester

- **Achieving sustainable livelihood in cold arid regions of Ladakh through skill development in tuber production of Kalazeera (Bunium persicum Boiss)**

  Saffron Research Station, Sher E Kashmir University of Agricultural Sciences and Technology of Kashmir, Jammu & Kashmir demonstrated trials for Kalazeera tuber and conducted seed production at 38 locations, including protected (polyhouses) and open field conditions. Germination percentage under protected conditions was 70-75 % whereas under open field conditions it was 50-55 %. Seedling length under protected conditions showed 20-25 % increase over the open field conditions, leading to increased tuber weight compared to open field conditions. An average of 150-160 flower bearing tubers /m2 were harvested from protected conditions while in current cropping season 120-130 flower bearing tubers/m2 were harvested from open field conditions in addition to 8-10 kgs of Kalazeera seed. The net income of farmers from one Kanal of land through tuber production of Kalazeera was approximately Rs. 1.3-1.4 lacs per annum as compared to Rs. 25000-30000 per annum from other field and vegetable crops.



3.6.2 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 center 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 with a goal of achieving local self- reliance for economic re-growth. During preceding calendar year, 10 WTPs have been supported and more than 9,00 women benefitted. Some of the notable achievements are as follows:

- **Promotion of Climate resilient native Poultry, setting up LED production Unit and processing of NTFP & Agri-Horti based Products for livelihood, Kanker district, Chhattisgarh**.

  Madhya Pradesh Vigyan Sabha (MPVS) through a WTP has established an LED bulb production unit in the WTP Centre and signed and MoU with NTMFP for marketing of the Bulbs and Tubes. Around 30 interested women beneficiaries have been trained on assembling and repairing of LED bulbs, Solar panels and Pumps etc. This has promoted a LED bulb brand “Vikalp’ and women beneficiaries have earned approx. Rs.12612/- from the sale of LED bulbs in nearby areas, Malls, and Grocery Shops etc. Promoted the processing of NTFPs & Agri-Horti produces such as Tamarind, Mango and Mahua

etc abundant in the area and standardized the processing of products such as Ghatagat (mouth freshner), Mahua Laddu, Imli Sauce, Imli brick, for gaining good income to around 150 women beneficiaries. Promoted rearing of Native Poultry and Hatchery management and 54 members have earned Rs.9134/- per month. Selected 90 beneficiaries from 07 villages through baseline survey and trained through 15 technical training programs on cultivation of nutri-vegetables and medicinal plant in backyard nursery.

Fig.: LED bulb production unit at WTP, kanker, CG

- **Capacity building and entrepreneurship development for women at Ranchi and East Singhbhum, Jharkhand**

  CSIR-National Metallurgical Laboratory (NML) in association with the National Institute of Advanced Manufacturing Technology (NIAMT), Ranchi has established a Women Technology Park (WTP) for capacity building of women participants on 3D printing technology to create prototypes of their products and test them before going into full production. Use of software like Tinkercad helped women to create innovative designs for making molds for key hangers and paper bricks. Paper rolling machines, waste paper collector, and paper shredder machine have been used for cost-effective and easy to design innovative models, products to reduce waste and promoting sustainability.

Fig.: A 3D-Printer in Common Facilitation Centre (CFC)

- **Multiplex real-time PCR based rapid detection of sexually transmitted pathogens in tribal women of district Anuppur, Madhya Pradesh**

  Indira Gandhi National Tribal University Amarkantak, Madhya Pradesh conducted a study for prevalence of most prevalent pathogens in Sexually Transmitted Infections (STIs) i.e. Chlamydia trachomatis, Neisseria gonorrhoeae, Trichomonas vaginalis, Mycoplasma genitalium, Mycoplasma hominis, Ureaplasma urealyticum, and Ureaplasma parvum and implemented precise diagnostic methods for detection and assessed the antibiotic sensitivity profile for effective management of STIs in district Anuppur, Madhya Pradesh. A total of 55 endocervical/swab samples were analysed using Multiplex-PCR, out of which 42 (76.36%) were PCR positive, and 13(23.63%) were PCR negative for eight STI pathogens. Organization has established networking with CHC Jaithari and CHC Kotma for collection of samples and dissemination of information about prevalent strains of microorganisms and AST results.

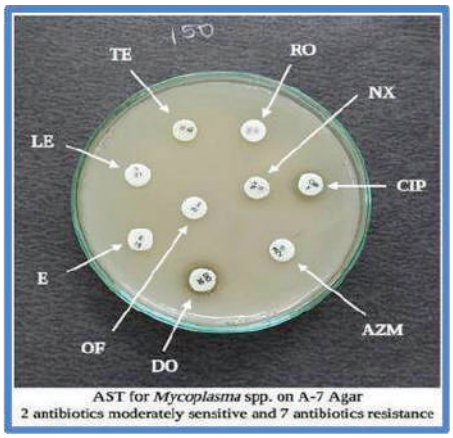


Fig.: Antibiotic Sensitivity Profiling

Fig.: Awareness Campaign

- **Modernization and design modification of machines for improving working conditions and empowerment of artisans, North-eastern region**

  NIT Silchar conducted a study in the area Baleswar, Ratanpur Pt I and Ratanpur Pt II villages of Nilambazar sub-division in Karimganj district to investigate the nature, economic gain, and viability of murta-based products of the artisans. Approx. 92% of people in these villages are associated with murta-based businesses predominantly and almost 87% of the manufacturing works, including splitting of strips by teeth, processing of strips and pati weaving by hand are executed by females only. To address the problem of strip extraction from cane, a prototype of the solar powered cane slicing machine has been developed to deliver power from the solar panel for some other purposes when the machine is idle. The organization has also upgraded basic structure of the semi-automatic looms to the plain loom with additional attachments of semi-automatic wrap stop and weft stop motion along with positive let off motions.

Fig.: Solar operated Cane slicing machine

Fig.: Gear for pulling and rolling of the designed machine

- **A Versatile Portable Framework for Economic & Skill Empowerment of Women's Sustainable Livelihoods through Digital Literacy**

  NIT Tiruchirappalli has established the Thirumathikart Application Development, Intelligence, and Computing Laboratory (TAIL) and implemented 'Thirumathikart App' with AI-based geo-location technology to facilitate connections between customers and Self-Help Groups (SHGs), empowering women with sustainable income-generation opportunities. The set up collaborated with Trichy Magalir Thittam, Holy cross College and WEAT Association to enhance the logistics framework. Around 200 Women entrepreneurs registered for Thirumathikart Seller app and trained 600+ self-help group women and entrepreneurs.

- **Development & evaluation of a women-centric comprehensive weight management module**

  AIIMS, New Delhi implemented a project to study the comprehensive lifestyle interventions for postpartum and perimenopausal women aimed to assess the effectiveness of developed guidelines through a Randomized Controlled Trial (RCT) and health camps conducted in residential societies. Key parameters such as weight loss, improvement in symptoms, and overall health were closely monitored and designed tailored lifestyle interventions encompassing dietary modifications, exercise routines, and stress management strategies. A pioneering book titled "Obesity in Women: Important Facts and Management Tips" has been published to serves as a comprehensive guide, offering a wealth of knowledge on the intricacies of obesity, its implications and management strategies for women's health.

3.6.3 Technology Interventions for Disabled and Elderly (TIDE)

The TIDE programme focuses 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. The programme provide grant- in-aid support for Research and Development (R&D) in Assistive Technology (AT), design and development of prototypes, processes and protocols, validation, testing, limited field trials, scaling up etc. Around 50 ongoing projects were successfully completed with technologies developed at various stages of field trials, validation, scale up and commercialization etc. In terms of new knowledge generation, 50 research papers and 5 patents were published. The few significant outcomes from the program are as follows:

- A **Video Laryngoscope** with Styletoscope Integrated with mobile phone to overcome difficulty in airway management for elderly has been designed and fabricated by Nitte Meenakshi Institute of Technology, Bangalore. The prototype was presented in ISACON-2019 (Indian Society of Anesthesiologist Conference) held in Bangalore on 25th to 29th November 2019 and it has won the best innovative product.

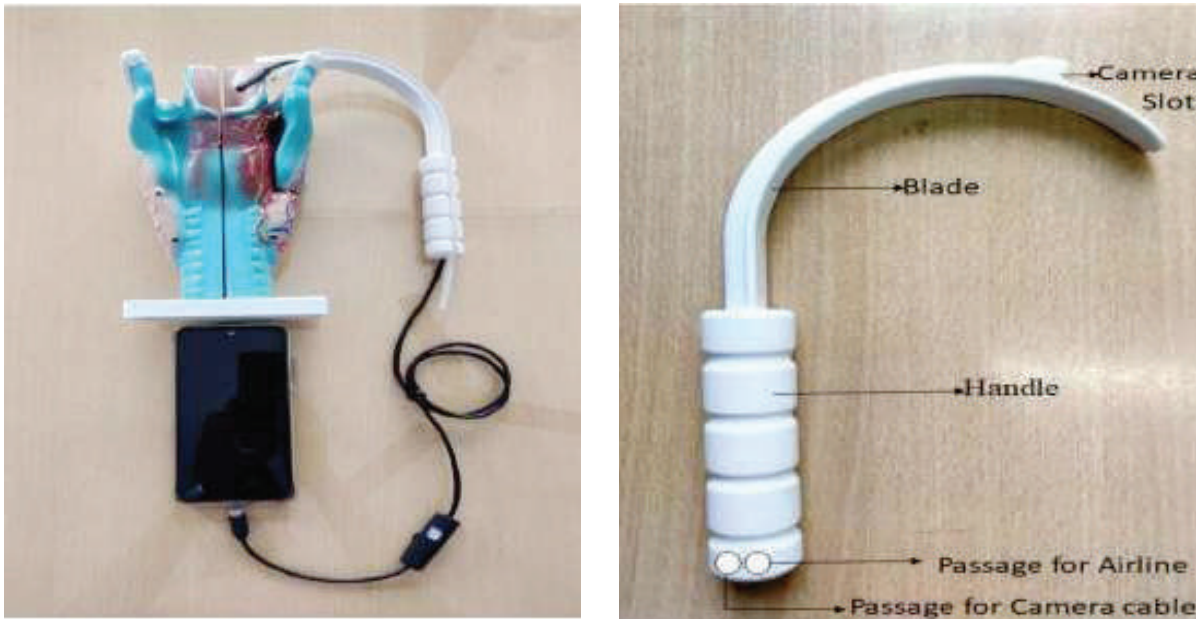


Fig : Video Laryngoscope

- **Self-locking shoes** for obese/ diabetic/elderly persons was designed and developed under a project implemented by School of Mechanical Engineering, Sastra deemed to be University, Tamil Nadu. A self- locking shoe has been developed for the specific target group which needs a minimal physical movement to wear a pair of shoes in order to protect their foot. This type of shoe will be a break-through in the footwear industry to cater an affordable, low cost, self- locking shoes without compromising on the quality of the product.

Fig.: Self Locking Shoes

- Multimodal Approaches in Teaching Science to Children with Hearing Impairment has been developed under a project implemented by Avinashilingam Institute for Home Science and Higher Education for Women, Coimbatore, Tamil Nadu. The product "**Vigyan Vidya**", a self-instructional technology-based package, aids students with hearing impairment in their academic work in both inclusive and special schools. The application has been successfully completed and has undergone rigorous testing/evaluation to ensure its functionality and effectiveness and ready for practical implementation.

- A Bio-Degradable Below Knee Prosthetic Limbs using 3-D Printing for disabled people has been developed under a project implemented by CMR Technical Campus, Hyderabad. Two new bio-degradable materials were developed, namely silver nanoparticles infused polylactic acid and copper nanoparticles infused polylactic acid. Based the results, the silver nanoparticles infused poly lactic acid had more strength and durability. The scan pro (3D scanner software) was used to convert the scanned image into design in order to develop the prosthetic leg. Below knee prosthetic leg was developed and tested with volunteers.

Fig.: Knee Prosthetic Limb

- Automated Home Amsler Grid (E-AMSLER) for Screening Sight Threatening Eye (Macular) Diseases has been developed under a project implemented by Manipal Academy of Higher Education, Manipal. The team had developed ME© Amsler grid

chart that allows the user to make markings on the grid which gives a novel scoring to each marking made on the grid. The screen can be used for patients, with central vision loss due to age related degeneration and diabetic macular problems, for real time home monitoring. Available tests have disadvantages of being expensive or difficult to perform and not always accessible to the patient. E-AMSLER helps as a telemedicine model for continuous monitoring of disease prognosis and is currently under trials.

Fig: E-AMSLER

3.6.4 Scheme for Young Scientists and Technologists (SYST)

The Scheme for Young Scientists and Technologists (SYST) programme focusses to engage and orient young researchers towards using science and technology (S&T) to tackle societal challenges. The ultimate goal of this programme is to promote the socioeconomic development of the country by leveraging the innovative and problem-solving capabilities of young scientists and technologists. Around 50 ongoing projects were successfully completed and more than 60 research papers were published as knowledge output. Some of the noteworthy achievements under the supported projects under the program are as follows:

- Engineering Intervention for Mechanization of Mozzarella Cheese Manufacture at Cottage Scale was carried out under a project implemented by Guru Angad Dev Veterinary and Animal Sciences University, Punjab.

Fig: Mechanization of Mozzarella cheese manufacture machine

- In-situ diagnosis and digital cataloguing of plant-pathogenic fungi through Foldscope Microscopy – A frugal science approach has been carried out under a project implemented by ICAR - National Institute of Biotic Stress Management, Indian Council of Agricultural Research, Chhattisgarh. Total 16 fungal diseases and their causal organisms were identified based on morphological structure of pathogen and host species such as Golovinomyces cichoracearum, Erysiphe polygoni, Erysiphe cichoracearum, etc. In addition, five biopesticides has been tested and two bioagent viz. Trichoderma viride and Pacelomyces spp has been successfully observed under Foldscope. As a capacity building initiative, 42 Foldscope demonstration cum hands on training on diagnosis of plant pathogenic fungal diseases organized, 1470 participants were benefitted because of these initiatives, in which 305 are college and school students and 93 are agricultural extension officers and Scientist/Professor from the state and central institutions. In addition, 31 rural youth were trained to demonstrate the Foldscope microscopy for crop disease diagnosis at village level. More than 297 foldscopic observations and its results has been published in the online platform called MICROCOSMOS.

Fig: Foldscope Microscopy

- A low-cost automation of farming tools for smart farming using Android Application (A Gaming Approach) has been developed by Kakatiya Institute of Technology and Science, Warangal. This tool can be assembled onto any existing tractor and operated via a custom-designed Android application. The KIT features that an IoT-based control system manages the tractor's steering, clutch, accelerator, and brake, utilizing an IoT environment for seamless operation. Additionally, the investigator has successfully developed a custom Automatic Manual Transmission (AMT) unit using linear actuators and an ESP8266 microcontroller, ensuring minimal cost for emergency stop without manual intervention. The tool has a comprehensive tractor health monitoring system that notifies farmers about the tractor’s fuel status, engine temperature, vehicle overload, and other vital conditions. This system uses trained machine learning models to predict

and communicate the tractor's health status, enhancing preventive maintenance. The KIT has undergone extensive field testing with various farming tools attached to the tractor, demonstrating its versatility and reliability.

Fig: e-tool assembled on tractor working on field

3.7 SCHEDULED CASTE SUB PLAN (SCSP) & TRIBAL SUB PLAN (TSP)

DST has the mandate of delivery of science led solutions and building up S&T capacity and capabilities of SC and ST population in the country through implementation of two Schemes, viz Tribal Sub Plan (TSP) and Scheduled Castes Sub Plan (SCSP), since 1991-92 and 1992-93 respectively. Both the schemes provide Grant-in-aid support to academic institutions and S&T based voluntary organizations to deliver science led solutions and development of location specific appropriate technologies for creation and improvement of sustainable livelihoods to solve the problems in livelihood system and to improve the Quality of Life of economically weaker sections of ST and SC while taking into consideration the strong and weaker points in five livelihood capitals viz., Human, Social, Natural, Physical and Financial. The focus is on development of tailor-made projects and programmes suitable to the specific needs for their holistic development, building Scientific Technical and Innovation (STI) Capacities and their empowerment focusing on entrepreneurship, employment and skill development.

During 2023-24 a total of 44 new projects were supported under the schemes for holistic development of SC/ST population in diverse areas of agriculture & allied activities, health & malnutrition, alternate energy, AI, traditional crafts, ethnic food items, climate resilience activities etc. These endeavors benefitted around 50,000 SC/ST stakeholders. Some of the significant achievements are as follows:

3.7.1 Individual Projects under SCSP and TSP

- Integrated Approaches involving nature based solutions are being adopted for enhancing productivity of degraded soil under Jhum cultivation, to meet the increasing food

demand in Karbi Anglong District of Assam. Plant growth promoting microbial consortia were developed using low cost carrier materials including rice husk and wheatbran and training were given to prepare these along with scientific cultivation of different crops like rice, lentils, lac etc. The project is benefitting 1000 beneficiaries practicing Jhum cultivation through use of farm machineries, trainings on bio input production and business development. The improved strategies have helped in fetching increased price of Rs. 450/kg for Lac over earlier price of Rs. 50/kg.

Fig: Training on bio input production at KVK Karbi Anglong, Diphu

- The under privileged communities in Karamadai and Periyanaickenpalayam areas of Coimbatore district are being empowered through smart technologies like smart foundry, 3D printing, IoT based poly house farming and solar powered cold storage units. Around 145 SC beneficiaries have been trained in modern technologies as trained workforce for upcoming manufacturing units as well as to promote self-entrepreneurship

Fig: Smart Foundry established in Kuniyamuthur, Tamil Nadu

- Anaerobic bokashi composting of biodegradable waste is being promoted to encourage the usage of organic soil amendments / soil conditioner and vermicompost fertilizers in Coonoor and Kotagiri Taluks of the Nilgiris District in Tamil Nadu. The interventions are sustainable and helping horticulture Department in converting to 100% organic. More than 200 SC beneficiaries are also trained on making bokashi bran powder using different types of bran such as wheat bran, rice bran and wood to bring out the best quality bran powder and take it up as an entrepreneurial activity.

Fig: Bokashi composting process

- Livelihood of 100 leather workers belonging to SC community in china munagala village in Konijerla Mandal in Khammam District of Telangana are being intervened with by replacing traditional rudimentary tools used in the leather product manufacturing with low cost machineries. A common facilitating center is established to facilitate R&D activities, product manufacturing and training to traditional workers on advanced machinery to fasten the production processes so that they can produce the traditional items with much ease and produce high quality products with less effort and time and able to earn good profits. Assistance is being provided to establish their own units for manufacturing leather products with the support of different external agencies. An E-Commerce site is built to provide market linkages. The proposed interventions have reduced the wastage of raw materials and increased the productivity & family income by 15-20%.

Fig: Leather cutting machine Embossing Machine

- Revival of 500-year-old intricate folk art of Hase Chitra is being carried out in Malenadu, Karnataka benifitting the Hasalaru Community. Digital preservation of this dying art form is done to preserve the techniques for future generations and empower communities like Deevaru, Kotevakkaliga, Hasala, etc to retake their cultural art form as a primary or secondary source of income. The interventions, apart from digitization, will teach the artisans to innovate the Hase Chittara art to suit the 21st century tastes while being strongly rooted in their 500 years old culture. The Hase Chitra art, culture and products are introduced at national level through innovation in art, digital marketing, and ecommerce, thereby increasing the demand for this art form. The platform follows a direct-to-customer delivery model, while identifying the most optimal and cost-effective logistics plan, with the help of artificial intelligence and data analytics. and takes care of demand generation, marketing, logistics, and tracking of return on investment. Support is also being provided to secure Geographical Indicator (GI) tag for this art form.

Fig: Hase Chitra art products

- The traditional food items like Tapyo, Pila etc., of Apatani tribes in lower Subansiri district of Arunachal Pradesh are being scientifically analyzed and value added products with standardized protocols are being prepared to develop entrepreneurial opportunity for these tribes. The phytochemicals, energy value, antioxidant activity, phenolic and flavonoid content, toxicity, bioactive molecules of these ethnic food items/edible plant are evaluated using some standard protocols. The minerals i.e. Na, K, Ca, P, Zn, Cu, Mg, Mn, Fe etc and heavy metals i.e. Pb, Mo, As etc are also estimated. The proposed interventions promote scientific validation and standardization of selected ethnic food items and technology/process development for large scale production and marketing to generate additional income. Around 10 villages with population of about 700-800 are getting benefitted with trainings for scientific preparation, packaging and marketing of these foods having high medicinal values.

Fig: Preparation and packaging of Tapyo

3.7.2 Science Technology and Innovation (STI) Hubs:

The STI hubs are being established at identified Tribal & SC knowledge institutions for delivering appropriate and relevant technologies to the identified beneficiaries. They are demonstrating and deploying the technological interventions and making efforts to create impact at grassroots level through dissemination of knowledge. The STI Hubs have backward linkage with Higher Educational/Scientific Institutions for harnessing and leveraging frontier technologies available with them for dissemination and demonstration at grassroots level. In current year 10 STI Hubs for SC and ST population have been established in the states

of Rajasthan, Karnataka, Andhra Pradesh, Mizoram, Maharashtra, Jharkhand, Assam and Odisha. Significant activities under STI Hubs are given below.

Fig: Biodiesel production, growing hydroponics, compost making

- The Science Technology and Innovation (STI) Hub in Kattumannarkoil taluk of Cuddalore district of Tamil Nadu State is improving the livelihoods and livelihood assets of 1500 SC population of Eachampoondi, Adhanur and Periakottagam villages by increasing their income by 40% over the existing one. It is addressing the weakest linkages identified in the predominant livelihoods (agriculture) with respect to agriculture productivity, yield, soil quality and fertility besides crop diversification and also providing alternate livelihoods based on abundant availability of raw material and agriculture waste. Technologies for the production of Biochar from agricultural waste, accelerated compost from market waste, biodiesel from waste cooking oil, liquid / detergent soap manufacture, industrial grade bio glycerol production, fly ash brick casting and nano particle impregnated polyurethane coating are being imparted to youth to make them industry ready or create their own enterprises.
- The STI Hub for Mising and Bodo women of Assam is directly benefitting 2510 members from Boginadi and Bordoloni blocks of Lakhimpur and Dhemaji district respectively, through technology interventions in the pig value chain. The technology for micro pig abattoir has been transferred to the beneficiaries to develop micro entrepreneurships. Artificial insemination introduced to improve the production performance of the pigs. Technologies and processes for different processed products have been standardized to eliminate the incidence of neuro- cysticercosis (due to the tape worm i.e. Taenia solium). A “Pig Help Line” system is being established to attend the issues of pig farmers.

Fig: Value added products from Pork at STI Hub

- 1682 beneficiaries belonging to 350 SC households in Anta block at Baran district of Rajasthan, benefitted through adoption of improved agriculture practices, water conservation techniques, improved animal feed etc. Various interventions like advanced techniques in agriculture (Arka Rakshak, Variety GNG 2144 for Gram, seed treatment with Rhizobium biofertilizer, L-883 cultivar inoculated with Mycorrhiza, Red Lady cultivar inoculated with Mycorrhiza, G-282 cultivar inoculated with Mycorrhiza and HD-3086 inoculated with Liquid biofertilizer), integrated nutrient management and micronutrient bio fortification led to improved bio fertilizer production leading to reduced crop abiotic stress. Crop diversification, high-density planting, introduction of local varieties along with high yielding varieties of tomato, Gram, Onion, Papaya, Garlic and wheat has led to improvement in yield ranging from 13% to 44% thereby increasing the income level by 7% to 54%. Several smallscale enterprises for production of vermicomposting & animal feed through azolla multiplication and production of protein rich animal feed has substantially improved the health of cattle as well as created sustainable income generation activities to SC population.

  The 47 STI Hubs established so far, are collectively benefitting more than 5,000 SC/ST Households directly and developing human resources (approximately 250 personnel) for finding solutions to specific livelihood problems faced by the SC/ST Communities. More than 500 Training and Capacity Building Workshops have been conducted to improve the STI capacities and capabilities of SC/ST communities for resilient and sustainable livelihoods. The efforts have also led to granting of 2 patents and publication of more than 30 papers with 6 being published in SCOPUS.

Scheduled Caste/Scheduled Tribe Cells in State Science and Technology Councils:

The program on the establishment of SC/ST cells in State S&T Councils is ensuring sustainable development of SC/ST Communities through collective cooperation between different stakeholders which includes government functionaries, industry, academia and the society at large. These cells are identifying the weakest linkages between the livelihood system and natural resources endowment of the target area for effective technology delivery mechanisms in areas of sustainable livelihood, better productivity and improved resource conservation. The role of SC/ST Cell is to act as a nodal coordination center and help in mapping of livelihood system for planning of development strategies, identification of technological gaps including mapping of technological needs, formulation of research/demonstration/ projects as well as specific programmes leading to socio-economic development of the community by utilizing local resources and skills of target communities. 11 SC/ST cells have been established so far since 2020-21 in the states of Arunachal Pradesh, Karnataka, Kerala, Mizoram, Punjab, Sikkim, Tamilnadu, Telangana, Tripura, Uttarakhand, West Bengal.

Particularly Vulnerable Tribal Groups (PVTGs):

A Programme for Accelerated development of Particularly Vulnerable Tribal Groups (PVTGs) has been initiated to address various vulnerabilities pertaining to livelihood systems of 75 PVTGs in the country. The program has been initiated in current financial year and is aiming at delivery of science led solutions and development & deployment of location specific appropriate technologies for comprehensive development and creation of sustainable livelihoods for PVTGs. The program will supplement the efforts of GOI to improve the socioeconomic conditions of PVTGs through Pradhan Mantri PVTG Development Mission.

CRISPR mediated genetic correction of Sickle Cell disease (SCD):

National Sickle Cell Anaemia Elimination mission has been launched by GoI in union budget 2023 to eliminate this debilitating disease by 2047, particularly among thousands of poor tribal population in India. DST supported consortia project on CRISPR based gene editing technologies, executed by CSIR-Institute of Genomics and Integrative Biology (CSIR-IGIB), New Delhi along with AIIMS- DELHI, ICMR-NIIH, SCI-Raipur, CSIR-IICT & NN-Bengaluru will help with one time correction of this disease. The genome edited hematopoietic stem cells (HSCs) engrafted in SCD patients will repopulate the bone marrow over time and reverse the SCD condition. The current medical treatment option available for curing Sickle Cell Disease (SCD) has a huge medical and financial burden and is not within the reach of mostly economically weaker sections of tribal population. The gene editing therapies developed under the present project will help in providing the requisite therapeutic cure to tribal population at an affordable cost.

3.8 National Good Laboratory Practice (GLP)

DST is implementing the National Good Laboratory Practice (GLP) Compliance Monitoring Programme for certification of Indian Test Facilities 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 a 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 Test Facilities among 39 member-countries of the OECD and 7 non-member full adherent countries to MAD, for assessment purpose, thus avoiding the need for duplicative testing and thereby substantially reducing the resources required for testing of chemicals.

To implement the National GLP Program in India, the National Good Laboratory Practice Compliance Monitoring Authority (NGCMA) was set up under the administrative control of Department of Science and Technology (DST) in August, 2002 and currently there are 61 GLP certified Test Facilities in the country including five government laboratories. Some of the major achievements during the period are as under:

- **Participation in 38th Meeting of OECD's Working Party on GLP:** Head NGCMA/GLP Cell, DST chaired the 38th meeting of the Organization for Economic Cooperation and Development (OECD) Working Party (WP) on GLP during April 16-18, 2024 at OECD Headquarters Paris, France. The WP brought together 160+ representatives from 50+ national authorities that monitor chemical test facility(ies) with GLP, to ensure quality data for regulatory decision- making, which saves governments and industry more than 300 million Euro per year. This is a matter of great pride for the country and would go a long way in keeping India in the lead role in framing policies on this quality system of GLP, which are for the benefit of the country.
- **Participation in training Course for GLP Inspectors organized by the Thailand GLP Compliance Monitoring Program:** Head NGCMA participated as faculty in the Training course for GLP inspectors organized by the Thailand GLP Compliance Monitoring Program during November 2023.
- **Harmonization of GLP certification scope of NGCMA:** GLP certification scope of NGCMA was harmonized through brainstorming meetings among NGCMA Secretariat (DST), members of the Technical Committee on GLP, subject matter experts from various academic institutions and R&D labs in the country, GLP inspectors and representatives from the regulatory authorities & industry.
- **GLP Certification:** During the financial year, 6 new Test Facilities were certified as GLP compliant after thorough inspection and review of their facilities and GLP studies conducted therein. Further, 14 existing Test Facilities were re-certified as GLP compliant

as per the laid down procedures of NGCMA. Also, a number of surveillance inspections for certified Test Facilities were conducted by the NGCMA, as per procedures.

- **Study Audits on request of Foreign Regulatory Authorities:** NGCMA conducted Study audits at various Indian GLP certified Test facilities at the request of respective foreign regulatory authorities as per the following details.
- 58 Study Audits on the request of United States Environmental Protection Agency (USEPA).
- 1 Study audit on the request United States Food & Drug Administration (USFDA).
- 2 Study Audits on the request of European Food Security Agency (EFSA).

Training Courses/ Capacity Building Programmes: To augment capacity building in the area of GLP, 5 training programmes were organized during the period.

Fig.: Refresher training course organized for the GLP inspectors at Institute of Pesticides Formulation Technology (IPFT), Gurugram

3.9 Technical Research Centres (TRCs)

Setting-up of 5 Technical Research Centres (TRCs) was announced during the budget speech of 2014-15. Accordingly, 5 TRCs were established in 5 DST institutions 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, Kolkata during 2015-16. The TRC at these centres have been given in-principle extension for next 05 years till 31.03.2026.

The significant achievements made under these TRCs during the year of report are given below:

3.9.1 The Technical Research Centre (TRC) at the Indian Association for the Cultivation of Science (IACS), Kolkata

The TRC-IACS focuses on design and synthesis of novel nanomaterials, quantum materials, functional polymers, organic and organometallic molecules, spintronics applications, strongly correlated electron systems, biomaterials, and bio-inspired materials. Some of the notable achievements under the TRC are as below:

Quantum Materials for Application

- Negative Capacitance: Stabilized logic states in Tunnel Field-Effect Transistors using negative capacitance.
- Artificial Synaptic Devices: Demonstrated digital and analog resistive switching in perovskite-based devices, mimicking classical Pavlovian learning.
- Spin Textures: Tailored spin textures in non-centrosymmetric systems to design functional quantum devices.

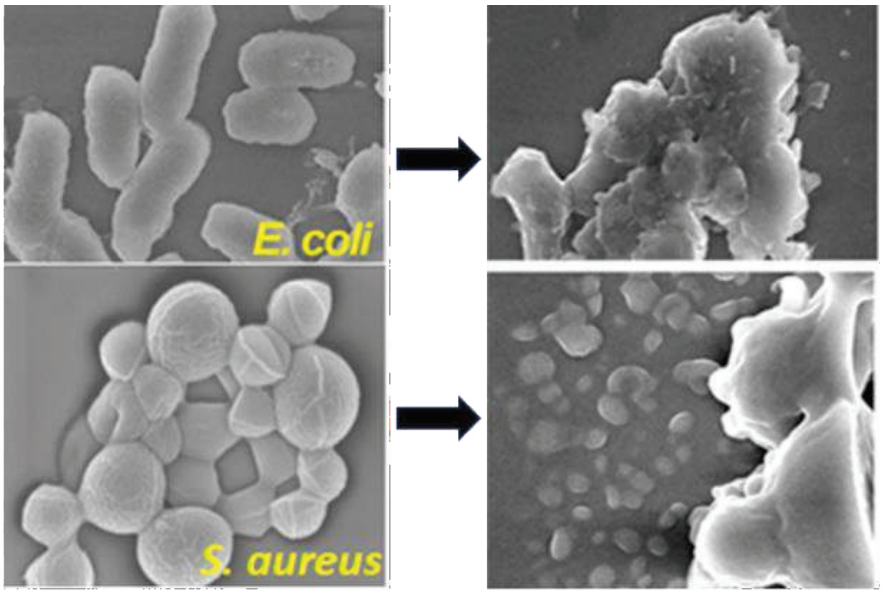
Materials for Energy and Environment

- Nanocrystal Synthesis: Achieved gram-scale synthesis of nanocrystals emitting blue, green, yellow, and red colors with photoluminescence quantum yields (PLQY) above 80%.
- High-Efficiency LEDs: Designed LEDs using crystal swelling and halide passivation techniques, promising higher efficiency than traditional organic LEDs.
- Flexible Photodetectors: Developed flexible and transparent photodetectors and thermal sensors.

Polymers, Disordered, Soft, and Nanobio Materials

- Antiviral Polyurethanes: Developed sulfated polyurethanes that exhibit chain- folding regulated uni-lamellar polymersome assembly, showing promising antiviral activity.
- Primary Tumor Cells: Established protocols for isolating primary tumor cells for drug screening.
- Targeted Drug Delivery: Developed stimuli-responsive soft materials for targeted drug delivery.

- Wireless Cell Therapy: Created ultrasound-responsive colloidal nanoparticles for wireless cell therapy.
- Biodegradable Polyesters: Innovated new synthetic methodologies for biodegradable polyesters with antibacterial properties.



A representative image showing complete destruction of Gram-negative (top) or Gram-positive (bottom) bacteria in presence of newly development polymeric nanomaterials

- Polymer-Drug Conjugates: Synthesized amphiphilic polymer-prodrug conjugates for intracellular drug delivery via glutathione-triggered cascade degradation.
- Molecules: Understanding, Making, and Commercial Viability
- Oligonucleotide Production: Developed a process for making morpholino oligonucleotides, advancing towards large-scale production for FDA-approved drugs for Duchenne muscular dystrophy.
- Biocompatible Hydrogels: Synthesized nucle oside-based biocompatible hydrogels exhibiting leishmanicidal effects without cytotoxicity on macrophages.
- Laser-Assisted Measurement: Fabricated a Laser Assisted Long-Path Liquid- Core Optical Guide (LLOG) for ultrasensitive absorption measurement.

3.9.2 The Technical Research Centre (TRC) at International Advanced Research Centre for Powder Metallurgy and New Materials (ARCI), Hyderabad

- TRC project at ARCI is to augment the translational research in the field of “Alternative Energy Materials & Systems” to reach a maturity level that is necessary for prototype

development and demonstration leading to commercialization of technologies by automotive and other energy related industries. The TRC comprises many sub-programs in the four broad areas: (i) Energy storage (batteries & supercapacitors), (ii) Energy conversion (fuel cells), (iii) Energy efficiency (Magnets for motors, waste heat recovery) and (iv) Renewable energy generation (Solar CSP, PV).

- ARCI and M/s ALTMIN have signed an agreement to set-up India's first semi-pilot plant for producing 50 kg/day of LFP cathode material at ARCI's AMTI. The facility, featuring indigenous equipment, was inaugurated on August 18, 2023. ARCI also supports N-Sure in the establishment of Li-ion battery pilot plant and training manpower.

Fig.: Agreement signing with M/s. ALTMIN Pvt Ltd., Hyderabad for establishment of Semi-pilot plant facility for the production of LFP at AMTI, ARCI & its inauguration.

- In case of fuel cell activity, patterned Pt plates for PEM based water electrolyzer has been developed and preliminary studies on the aspects of coating, patterning and half-cell studies have been completed. In magnetic programme, a high coercive anisotropic Sr-hexaferrite powders for manufacture of permanent magnets have been developed and are currently explored for manufacture of anisotropic bonded magnets in collaboration with industries.

- Performance validation of high temperature stable spinel nanocomposite coated receiver tubes using parabolic trough test-rig facility was completed and found that the performance of ARCI’s receiver tube is at par with commercial receiver tube. 1 kWh thermal energy storage prototype system was designed and fabricated based on Computational Modelling and Simulation.

- Broad-band AR coating technology on PV glass and CST cover glass tube has been demonstrated at industrial scale and validated. Technology has been transferred to Borosil Renewables Ltd and successfully implemented. Further, Prototype (50mm x 50mm), series interconnected PSC module with 12% efficiency and 1000 hours stability developed as per ISOS-D standard.

- During this period, ARCI also provided solutions to various industries including M/s. Borosil Renewables Ltd, Q-pi Volta, Toyota Kirloskar, Fluidtherm, Medha drives, Abhinav Rizel, TVS, and Aquasub for supply, testing and validation. ARCI has patented several inventions both in India (3 Nos) and globally (8 Nos.) and some of the patents (India:5 Nos & Inetrnational:1 No.) were granted. Further, the research work from different TRC sub-projects have been published (24 Nos.) in reputed international journals.

3.9.3 The Translational Research Centre (TRC) at Sree Chitra Tirunal Institute for Medical Sciences and Technology (SCTIMST), Thiruvananthapuram

- TRC-SCTIMST boasts state-of-the-art 3D bioprinting and CNC milling capabilities, propelling advancements in tissue engineering. Among its notable successes are Class D medical devices like Cholederm for wound healing and the Wipro 3D Emergency Breathing Assist System. Innovations within the institute have led to the formation of startups, including Alicorn Medical, and the creation of novel drug-eluting bioceramic beads for treating osteomyelitis. This technology has been successfully transferred to industry partners, showcasing the institute's ongoing commitment to healthcare innovation.
- The 56 projects in the second phase of TRC comprise of 15 Phase-I projects which were extended to complete animal experiments for product validation, and 37 new projects were selected in the core areas of Cardiovascular, Neuroprosthetics, and Hard Tissue Repair (Orthopedics and Dental).
- Projects in Biological and Combinational Products and In-Vitro Diagnostic Devices were included. Four new facilities are set to be developed: a Human Amniotic Membrane (HAM) bank, a usability engineering lab for medical devices, a common connected platform for infrastructure management, and a dedicated intellectual property management system.
- During this period, several major Class D devices, including the Aortic Stent Graft, Atrial Septal Defect Occluder, Flow Diverter Stent, and Left Ventricular Assist Device, reached the final validation stages. Other products, such as the Titanium Nitride coated coronary stent, Annuloplasty ring, Bioprosthetic Heart Valve, Spinal fixation system for thoracolumbar stabilization, Cavity conformable self-retaining stent retractor (Peacock Retractor), Pedicle Screw-Based Dynamic Stabilization Systems for the lumbosacral spine, and the NT-proBNP blood immunoassay kit, are approaching technology transfer.
- In 2023-24, TRC-SCTIMST achieved two technology transfers: the Lint Free Absorbent Dressing to Phraction Scientific in Kerala and Drug Eluting HA-TCP Ceramic Beads to Onyx Medicals in Uttar Pradesh. The wound dressing 'Cholederm,' made from the extracellular matrix of pig gall bladder, and the Real- time LAMP assay kit for detecting Mycobacterium tuberculosis received CDSCO approval for commercial production.

- Facilities at SCTIMST namely the Medical Device Regulatory Compliance Facility (MDRCF), the Industry Institute Partnership Cell (IIPC), and the Technology Business Incubator (TIMed) put together conducive ecosystem for sustained innovation and collaboration in medical technology development.

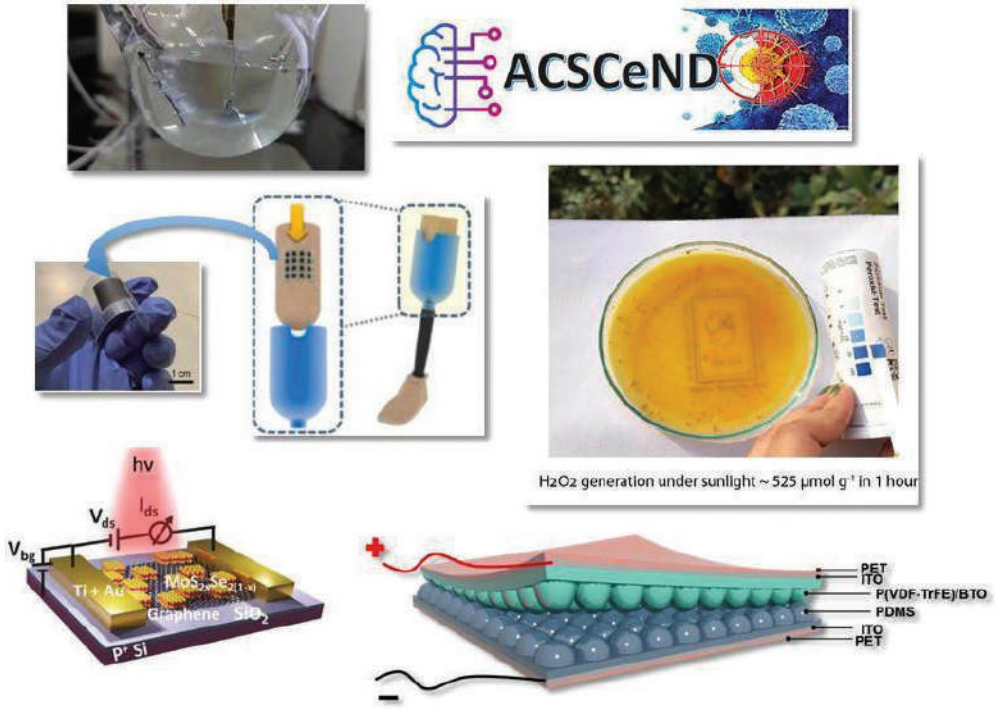
3.9.4 The Translational Research Centre (TRC) at S. N. Bose National Centre for Basic Sciences (SNBNCBS), Kolkata

- TRC-SNBNCBS has achieved significant milestones in materials science, nanotechnology, and biomedical instrumentation over the past year. Researchers have developed computational models for innovative materials, explored nano-fabrication for quantum technologies, and created biosensors using advanced spectroscopic techniques. The TRC's efforts in translational research are evident through 32 ongoing projects targeting practical issues such as food adulteration and environmental protection. The publication of 80 research papers and the awarding of four PhDs highlight the center's dedication to academic and scientific excellence. The team's comprehensive research paves the way for further advancements across various scientific domains.
- The TRC's activities focus on key areas including Health Care, Environment, Food Security, Low-Cost Instrumentation, and Computational Input. This year, the TRC secured 12 new patents, underscoring their innovation and practical application.

Major Developments:

- Triboelectric Nanogenerator for Prosthetic Sockets: A self-powered, flexible nanogenerator using biocompatible polymers was developed for real-time internal pressure monitoring. Patent filing is in progress.

- Covalent Organic Frameworks for Water Splitting: A new material capable of producing hydrogen peroxide from water splitting under sunlight was synthesized, with patent filing and scaling up underway.
- AI-based Cancer Stem Cell Profiler: An AI-driven software for identifying and quantifying cancer stem cells with high accuracy has been developed, pending patent filing and field trials.
- Flexible Optoelectronic Sensors: A large-area broadband phototransistor based on graphene-MoS2 QDs heterostructures was fabricated, with ongoing patent filing and device fabrication.
- Wearable Healthcare Monitoring Device: A high piezoelectricity thin film for self- powered health monitoring has been developed, with patent filing in progress.
- Moisture Measurement in Cosmetics: A spectroscopy-based method for precise moisture content estimation in cosmetics and pharmaceuticals is under patent filing.
- Hydrogen Evolution Reaction Material: A new inorganic material for hydrogen production in acidic solutions was synthesized, with efforts toward commercial scaling.
- Pathogen Sensing in Milk: A colorimetric pathogen detection technique and a prototype device for milk testing have been developed and submitted for patenting.



TRC-SNBNCBS : Mosaic of major achievements at TRC- SNBNCBS

3.9.5 The Technical Research Centre (TRC) at Jawaharlal Nehru Centre for Advanced Scientific Research (JNCASR), Bengaluru

- Since its inception, TRC-JNCASR has driven innovation by spearheading 24 R&D projects, facilitating 17 technology licenses, supporting 5 startups, securing 83 patents, publishing 38 research papers, and currently managing 25 promising translational projects.
- JNCASR hosted an Industry-Academia Meet on September 22, 2023, with around 25 organizations from diverse sectors, featuring a poster session of JNCASR's latest research to foster discussions and potential collaborations.
- The TRC has supported the filing of 20 patent applications across different regions: 8 in India, 5 under PCT, 3 in Europe, and 4 in the USA. Additionally, 7 patents were granted in India, reflecting the centre's robust IP protection strategy.
- TRC at JNCASR advances scientific research and industry collaboration by supporting R&D projects, robust IP protection and translating scientific advancements into solutions for global health, climate, and resource challenges.

3.10 National Spatial Data Infrastructure (NSDI)

National Spatial Data Infrastructure (NSDI), established with a vision to improve spatial data availability and accessibility had a significant role in sustaining the social, economic and environmental growth of the Country. Over the years, NSDI had played an important role in creation of technology, policies, standards, and human resources necessary to acquire, process, store, distribute, and improve utilization of geospatial data, services, and other digital resources. Following the recommendations of the Geospatial Data Promotion & Development Committee (GDPDC)'s Technological Sub-Committee in June 2022, the Interim Data Sharing Framework (IDSF) is being implemented. A Geo-Information Science & Engineering (GISE) Hub has been launched at the Department of Computer Science & Engineering (CSE), Indian Institute of Technology (IIT), Bombay to support the implementation of the NSDI and the State SDIs in a hub-spoke architecture. The National Data Registry (NDR) has been made accessible to the public. The proof-of-concept Geospatial Cloud-based Data Centre (NSDI Geo-platform) established in Survey of India (Hyderabad Campus) is demonstrating management of data life cycles. Cloud VMs on the platform have been made accessible to the State SDI's for setting up their Geo-Portal Prototypes. Strategies relating to standards governance, sensitisation/ awareness, inventory, need assessment, capacity development with active engagement of agencies like ISO/ OGC/ BIS has been initiated. Some of the significant activities during the current year is given below.

3.10.1 National Data Registry (NDR)

The public version of NDR was released in 2023. NDR built over a set of open standards from OGC, ISO and BIS, the NDR facilitates stakeholders to search, discover and access spatial data sets with the help of metadata, multi-layer visualization, and complex query execution for their use/re-use in utilization in applications. 624 geospatial data services from multiple agencies have been registered so far along with standards-based geospatial metadata and access URLs.

Working of the Registry has been demonstrated to several stakeholders through interactives meetings and workshops. There are several features like Dynamic Query Builder for metadata search for datasets and layers to perform complex cross- service, cross-domain and cross-layer spatial queries across multiple spatial data layers.

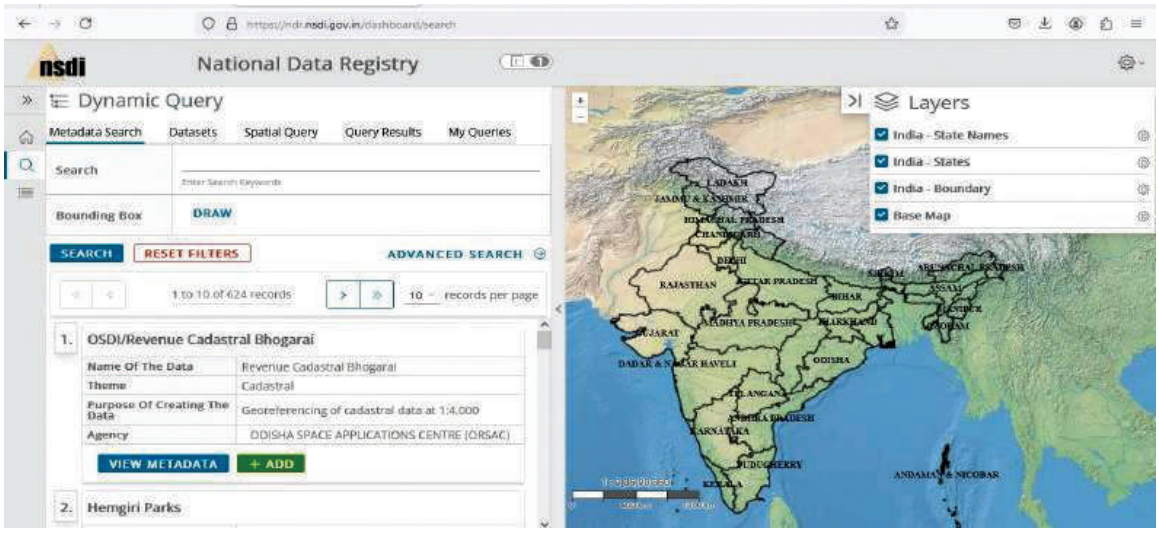


Fig.: Screenshot of Dynamic Query Builder

3.10.2 State Spatial Data Infrastructure (SSDI)

State SDI Partnering Agency Data Nodes provide interoperable access to map (display/ visualisation) services. Metadata and data services of the geospatial data nodes of the NSDI and State SDI partnering agency data nodes have been maintained in collaboration with the respective Ministries/ Departments and the State Governments for sustained access to their data sets. 14 State SDI's were established through cost-sharing between DST and State Governments in 70:30 mode. State Geo-portals are being upgraded and re-oriented to capture and share high resolution foundation data sets over the web for the line departments to add their thematic details, attaching attributes; geo-registering their maps; and linking & orienting their results of applications to the local landscapes. In Arunachal Pradesh and Odisha data gaps have been addressed by acquisition of fresh data sets and services registered on the NDR Geo-portal. Efforts are being made for preparation of panchayat and

ward level geospatial application services involving line departments. During the current year the geoportal of Jammu and Kashmir State had been successfully launched. The geoportal has a suite of GIS applications for decision and work processes of different departments; GIS applications for public services and citizens and is also hosting/publishing enterprise GIS solutions. High resolution LIDAR surveys for urban areas were carried out during the current year by Arunachal Pradesh State SDI for microlevel planning and developmental activities using high resolution geospatial datasets.

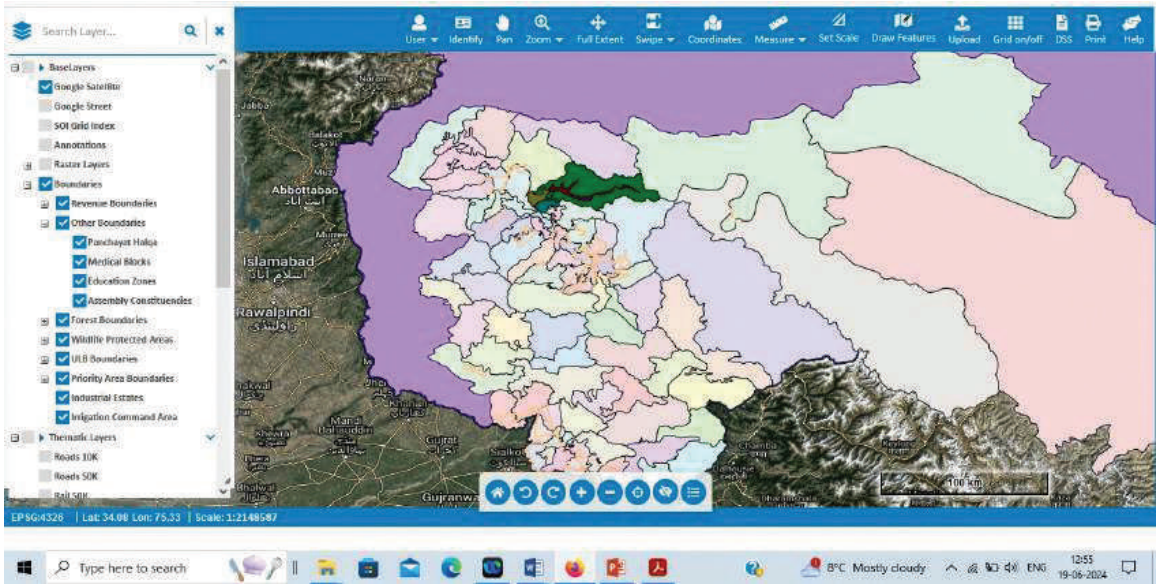


Fig.: Geoportal of J&K SSDI showing revenue boundaries

One of the potential applications of State geoportals is development of Unique Land Parcel Identification Number (ULPIN 2D) using data of Odisha and Karnataka geoportals where the vertices of the land parcel were used to create the Unique ID/ULPIN for the plots based on ECCMA standard. The process involves translation of coordinates of a polygon representing a property boundary into a string (PNIL) and back to the polygon within a specified Earth Coordinate System. Any change in property boundaries would create a different PNIL. Beyond its value as a natural identifier, PNIL is intended to display boundaries in any geospatial enabled system. 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.

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). Existing 2D data sets have been updated and fresh 3D data sets were captured using survey-grade drones, hosted

as standards-based web services from cloud- based Geo-platform in Survey of India, Hyderabad; and registered on the National Geospatial Data Registry (NGDR) to facilitate search and discovery**.** 105 feature data sets pertaining to Varanasi City can be accessed from the Relational Database as per the NUIS Data Model. 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 (X, Y, Z) or (Latitude, Longitude, Height) of the unit have been used to generate the ULPIN 3D/PNIU. Cloud-based Geospatial Platform hosting 2D and 3D data sets of Varanasi City have been used in the demonstration

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. It thus assumes immense importance for Nationwide Building Unit Data and Service integration.

3.10.4 Training and Capacity Building

Stakeholders/User groups from different domains and experts were sensitised on utility of NDR, State SDI services, application of cloud based geospatial platform through various events. NSDI had displayed exhibits in various forums like 23rd Edition of Geo-smart India, 2023" held on 16th -18th October 2023 at Hyderabad, 43rd INCA International Congress held during 06-08th November 2023 at Jodhpur etc. GISE-Hub and NSDI have conducted successful training programmes from Data Modelling to Advanced API based data sharing technologies. OGC Winter School, OGC summer School, Mapathon, OGC code sprint etc were conducted in which the officers of NSDI had participated. The implementation plan for translating the Integrated Geospatial Information Framework (IGIF) of the Committee of Experts of the United Nations Geospatial Information Management into a reality has also been discussed at various forums.

3.10.5 Interim Data Sharing Framework (IDSF)

Based on the recommendations of the Geospatial Data Promotion & Development Committee (GDPDC)'s Technological Sub-Committee in June 2022, the Interim Data Sharing Framework (IDSF) is under implementation. As of now, every month, the data sharing reports of 18 organizations are being compiled and shared. KAFKA messaging Service implementation is under study to get the activity connected to NDR Ver. 1.0. This facilitates data sharing and access as envisaged in NDSAP 2012 and Geospatial Guidelines 2021. This enhances the capacity of the data providing agencies as well as the benefits for the user community, having easy access to the geospatial data.

3.10.6 Creation of Data Content Standards and Support

In line with National Geospatial Policy (NGP) 2022, NSDI has been instrumental in coordinating and collaborating with ICAR NBSS&LUP, GSI and GISE Hub for development of Data Content Standards (DCS) for Soil, Forest and Geology and were submitted to BIS for wider circulation. NSDI is currently involved in the process of development of Cadastral Data Content standard for Geospatial Information. Apart from these, the nodal agencies of NSDI are also involved in development of DCS for other fundamental geospatial data themes by respective departments. These will be of immense benefit for implementation of application oriented geospatial services in the country.

Currently the concept and functioning of National Spatial Data Infrastructure (NSDI) is under active consideration by GDPDC to make the NSDI mechanism more robust, efficient and effective. The composition, powers and functions of existing NSDI Executive Committee will be realigned accordingly.

3.11 Science and Heritage Research Initiative (SHRI)

Science and Heritage Research Initiative (SHRI) aims to build capacity in human resources and encourage researchers to work in the areas of promoting scientific R&D activities for preservation, conservation and propagation of tangible and intangible Heritage. The program supports R&D on material deterioration processes, preservation techniques, intervention technologies, new materials, processes for restoration and diagnostic technologies, exploring new state-of-art technologies to preserve the heritage and artworks from ancient times, evolution and growth of human civilization, and promoting the application of advanced knowledge of archaeometric science.

SHRI Cell has three major components:

- Science and Heritage Research Initiatives
- Millet Program
- Science and Technology for Yoga and Meditation (SATYAM)

Science and Heritage Research Initiatives

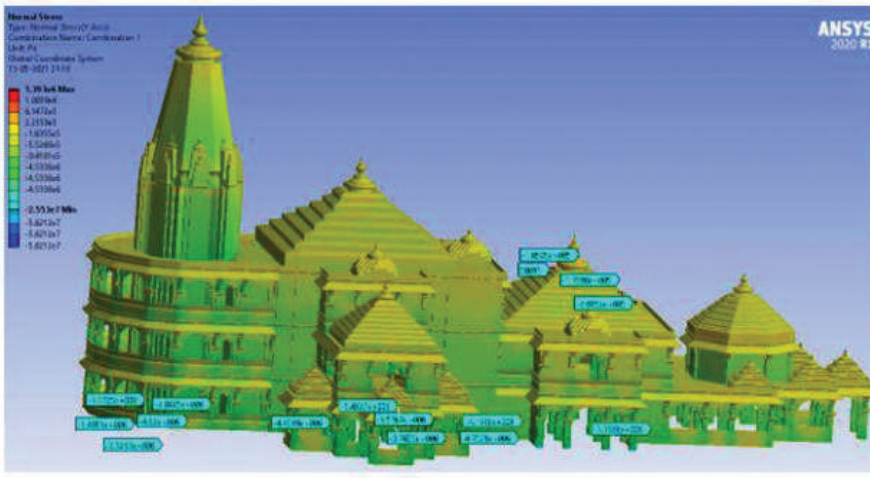
Some of the notable achievements under the SHRI program were:

- Technology development for Advanced Plasma Processing of Indian cultural heritage and Archaeological artefacts for Conservation and Feature enhancement: (1) Design and development of complete system for non-contact- based plasma cleaning of cultural heritage objects and (2) Design and development of prototype reactor for cleaning of objects of size 1cmx1cmx1cm to 15cmx15cmx15cm under plasma generated by different source.

- "Takshashila Centre for Multidisciplinary Heritage Science" was established at IIT Hyderabad and specialized laboratories to integrate technology with Indian cultural heritage i.e. Yoga Technology Research Laboratory, Immersive Experience Laboratory, Computational Music Laboratory, Heritage Structure Defect Mapping Laboratory, Heritage Art and Architecture Lab, and Heritage Computing & Data Science Lab were established. The Centre has also launched India's first interdisciplinary Master's and Doctoral degree programs in Heritage Science and Technology. The Centre has been developing innovative technologies like a semi-automated OCR post-processing method to enhance text alignment, quality, and readability in complex document scenarios, including multi-language and multi-column texts.
- Centre for Traditional, complementary foods of Western Himalayas at CSIR- IHBT Palampur was established for documentation and characterization of traditional complementary foods from the Western Himalayan region and processing technologies. The facility was inaugurated by Secretary DST in December 2023 and is now open for entrepreneurs to standardize their traditional food products. A compendium of 75 traditional recipes of Himachal Pradesh was released on the occasion. As consistent flavour, taste and shelf life are crucial factors for product acceptability by consumer, innovation was done in process standardization of traditional recipes of Himachal Pradesh viz. Seera, Sattu etc. The process of fermentation for Seera was standardized and its shelf life was enhanced using Modified Atmosphere Packing (MAP) technology. The standardized technology was transferred to pvt. company in Himachal Pradesh.

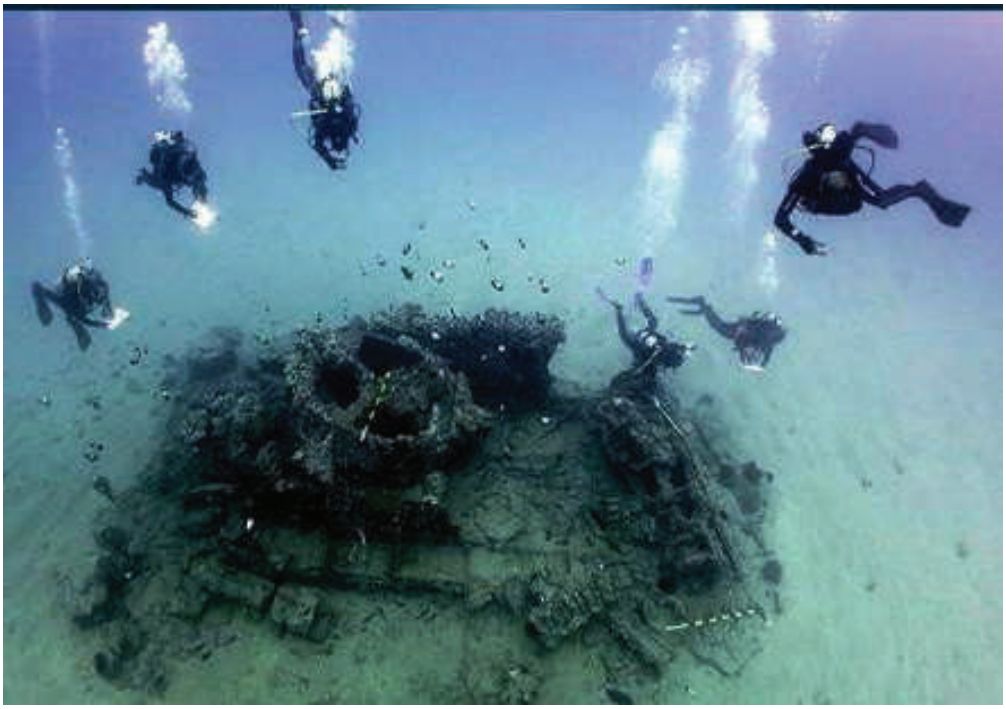
Fig.: Inauguration of Food Processing Facility by Prof. Abhay Karandikar, Secretary DST in December 2023 at IHBT Palampur.

- Centre for conservation of Heritage structures was established at CSIR-CBRI, Roorkee to conserve heritage structure and conducting research on several important aspects viz. non-destructive evaluation, material development, testing of heritage structure, data base development, health monitoring technologies, repair and restoration methodologies. The Centre developed a framework for seismic vulnerability assessment for Shri Ram Janmbhumi Ayodhya Temple and Akshardham Temple. The framework was adopted in Ayodhya temple. A copper- doped nano titania TiO_2-based coating has been developed. 200 manpower were trained for heritage construction and management of Indian Heritage Structures. Fire and smoke management inside Temples and other monuments have been analyzed and the framework is under preparation.



Structural analysis of Shri Ram Janmbhumi Ayodhya Temple.

- The **Surya Tilak project at Ayodhya** focused upon using mirrors and lenses for sunlight transportation. The design was optimized according to specifications created by CBRI that accounts for 19-year cycles with specific attention to visibility durations and optical dimensions. The system features a north-south zenith angle of 14 to 25 degrees and a field of view of 0.5 degrees, yielding visibility of approximately 8 minutes and partial visibility of 1 to 2 minutes around the event day. The optimized optical pathway includes a maximum beam size of 280mm between mirrors M2 and M3, and 250mm between M3 and M4. A reduction in tube size from 250mm to 200mm decreases visibility duration from 8 to 6 minutes. Adjustments in the beam size between M3 and M4 affect the beam footprint over the forehead, emphasizing the importance of precision in optical alignments to maintain signal strength and image quality over the tilak, with minimal impact on image shape despite positional errors.
- "**Digital Reconstruction of Underwater Heritage Site at Poompuhar**" submerged port city of Poompuhar which was one of the major ancient ports in the east coast of India nearly 3000 years ago is being investigated to bring out the socio-cultural architectural - maritime history of Poompuhar and past geodynamic and interface dynamics with the life history of poompuhar and its contribution to the extinction or submergence of Poompuhar. The spatio-temporal history of defunct of Poompuhar along with controlling geodynamics and other factors viz: tectonics, sea level rise, river migration, palaeo flood, storm surge, cyclone, tsunami and coastal erosion-deposition in the last 10,000-15,000 years and the zones of defunct during various periods were studied under the project.



- Ethnic foods are an integral part of Intangible cultural heritage, the traditions passed from one generation to the next. The indigenous tribal communities are the living heritages and are not static, but it continues to change and innovate with time. The tribal communities are the most important vehicle of cultural diversity through generations. Survey of land races/varieties of wild tubers, yams, fruits used by the tribal communities from different geographical regions of Kerala (Thiruvananthapuram, Idukki and Wayanad) was conducted under project scientific reinvention of Ethnic Food and Medicine from Kerala for functional food and drug development. A database for plant latex used in tradition health care system has been created, isolation and characterization of active chemical component from the latex of Tabernaemontana alternifolia, Calotropis gigantea, Jatropha curcas and Ficus auriculata is under process. Screening of wild plants for fixed oils traditionally used by the tribal communities were identified and documented.
- Development of environmentally friendly corrosion inhibitors from cow manure and their performance evaluation for combating corrosion of reinforced steel (rebar) in concrete

New bio-inhibitors processed via recovery of organic/inorganic agents from biomass (Cow Manure) in the form of liquid final product backed by detailed testing in actual concrete environment was developed in the form of corrosion resistant durable bio- compatible inhibitors for the protection of rebar against corrosion. Moreover, the efficiency of the inhibitors will be further improved for protecting the rebar from corrosion attack. Green extraction method using amply available cow manure was adopted to synthesize the environmentally friendly inhibitors, which eliminates the hazardous chemical usage.

Figure 1: Cattle breed from which the manure was collected. (a) Holstein Friesian breed, (b) Jersey breed, (c) Crossbreed of Holstein Friesian and Sahiwal.

Figure 2: Flow of the processes followed to prepare the inhibitor-electrolyte solution.

Millet Program

During the International Year of Millets 2023 SHRI Cell a dedicated Millet Program was initiated, inviting proposals under three thrust areas i.e. Capturing Traditional Knowledge Systems, Research & Development and Infrastructure Creation. Out of **378** concept notes received, **108** were recommended for the next level of evaluation and after further evaluations by the expert committee, 29 Individual proposals and 5 thematic clusters i.e. Vegan food products, Production and Post-harvest technologies, Millets Processing, Dairy and Sweets, and Fermented Beverages from Millet were recommended for financial assistance.

Science and Technology for Yoga and Meditation (SATYAM)

Under the SATYAM Program, out of 103 proposals received during the year 2023, 10 proposals were recommended for funding. New Yoga protocols were developed for the elderly population to promote innate immunity and mental well-being for post- COVID-19 patients, enhance pulmonary function, and reduce stress, anxiety, depression, etc. Websites, Mobile Apps, YouTube videos, and Tele Yoga Programmes have also been developed for the awareness of a large section of society. Some of the significant achievements under the programme include:

- **Yoga Intervention Improves the Metabolic Parameters and Quality of Life among Infertile Women with Polycystic Ovary Syndrome (PCOS) in Indian Population**

  This study illustrated that yoga intervention for 12 weeks improves the infertility domain of quality of life and improved the outcome of treatment. The results suggested that yoga intervention would help in pre-pregnancy optimization of metabolic parameters, reproductive outcomes, and quality of life among infertile women with PCOS but also reduce the burden of NCDs in long run.

- **A yoga protocol for healthcare workers was developed during COVID-19 and tested for management of stress**

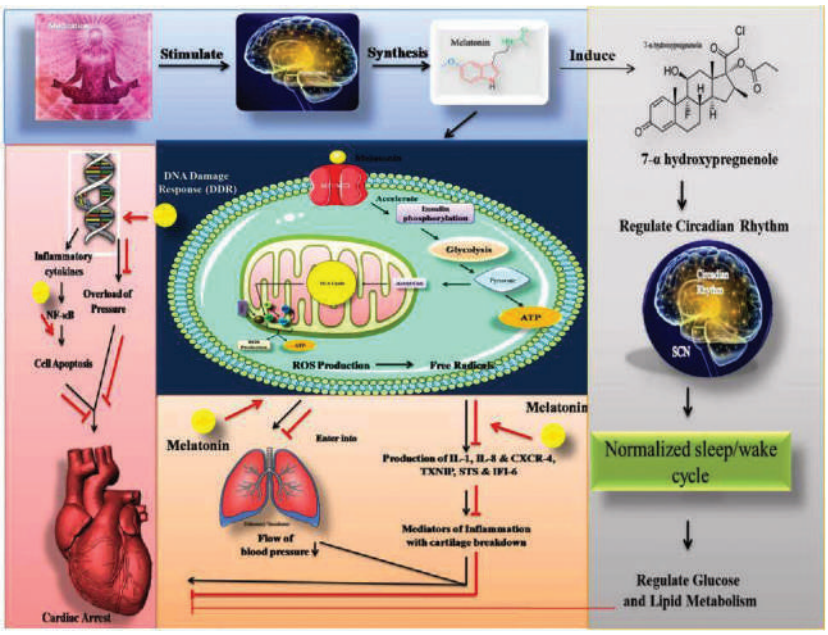
  Structured yoga even in community-based settings was found to be favourable in improving the glycemic outcome and lipid profile of individuals with diabetes. The study was found to be a feasible strategy in resource-constraint settings and low socioeconomic areas.

- **Electromyographic analysis of trunk and hip muscles during Yoga poses**

  The study concluded that some of the Yoga poses were effective in enhancing muscle strength and endurance of trunk, core, and hip muscles that are considered integral for the management of chronic LBP.

- **Exploring the Role of Melatonin in Meditation on Cardiovascular Health**

Meditation strategies were documented to improve some amounts of HPA. Data from the American Journal of Practice were taken from the report. Studies have shown that melatonin impacts ischemia-reperfusion, transient myocardial hypoxia, pulmonary hypertension, elevated blood pressure, valvular cardiac failure, artery disorders, and lipid metabolism.



Schematic diagram depicting the possible mechanism of meditation-mediated improvement in cardiac health through melatonin

3.12 Exhibitions and 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 Department of Science & Technology along with its organizations {Autonomous Institutions/Subordinate Offices/Professional Bodies} in science exhibitions. 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.

The activities of Exhibition Cell, DST during 2023-24 are as under:-

- Participated in the India International Trade Fair – 2023
- Participated in the 26th National Science Exhibition

- Participated in the India Mobile Congress-2023
- Participated in the Rise in India-2023
- Participated in the 10th Indian National Exhibition Cum Fair – 2023 during FY 2023-24.
- Participated in TechKriti-2024

Exhibition Cell was also instrumental in organizing the 9th edition of India International Science Festival (IISF) – 2023 at the combined campus of THSTI-RCB, DBT in Faridabad, Haryana, during 17-20 January, 2024.

CHAPTER 4

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

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) have been established in reputed institutes across the country in advanced technologies like AI/ ML, AR/ VR, Robotics, Cyber security etc.

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 are bringing out several technological solutions for people-centric problems. Each hub follows a technology life cycle approach, addressing all stages 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. TIHs 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/.

A few of the major achievements and technologies developed by these TIHs are as under:

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

- A unique technology product, blockchain-based **Transferrable Development Rights (TDR)** system has been developed which addresses existing land holding-related

issues (litigations, frauds, scams, etc.) and allows secure, transparent, and tamper-proof storage and management of development rights certificates (DRCs).

- It has developed **TTPs (tactics, techniques and procedures)**-based first-ever cybercrime (cyberattacks targeting human, e.g., insurance fraud, matrimonial fraud etc.) investigation framework and framework navigator tool to assist Law Enforcement Officers in investigating and tracking cybercrimes.

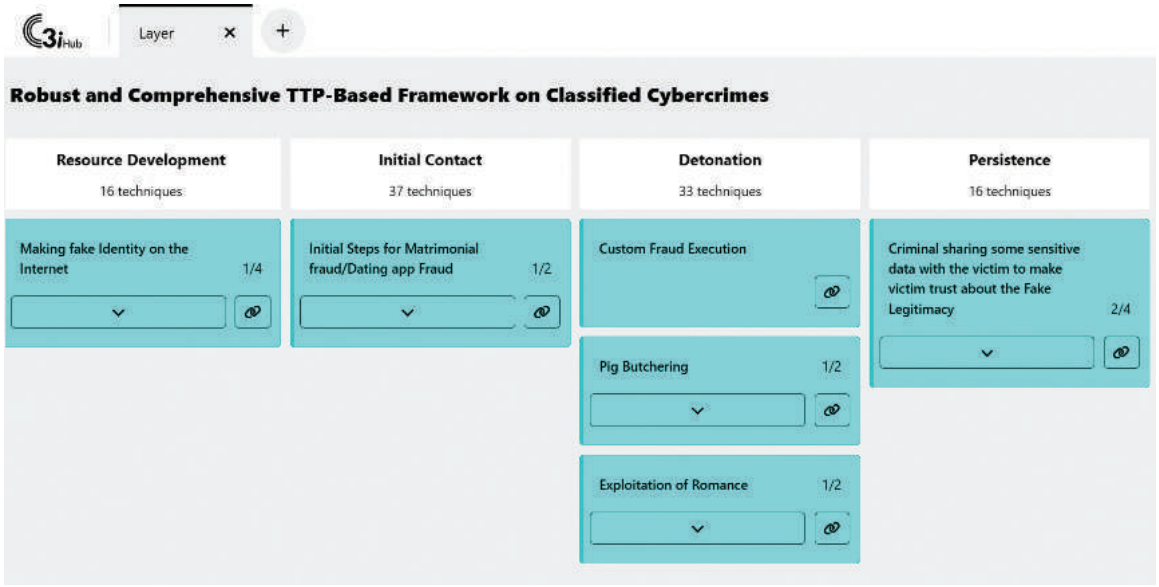


Fig. Tool Dashboard: Pre-Defined Crime Execution Path for Matrimonial Fraud

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

The startup incubated under the Hub **"Meister-Gen Technologies Private Limited"** provides non-invasive ERT-based subsurface analysis and AI-ML-based geophysical investigation. The start-up has successfully explored septic and underground sewer pipelines for various anomalies, detected underground hidden tunnels. The unique features of the technology developed are:

- Continuous monitoring with scalable depth analysis.
- Works in any environmental condition like snow, rainfall etc.
- Works in any soil with proper contact.
- Can adapt to existing RADAR, camera, and acoustic sensing systems.
- Resistance to jammer and other EM fields.

Fig. Sensing system for detecting underground hidden leak

Fig. Sewer & Septic Monitoring System

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

- The Hub has created **Bharat-FIRST (Framework of IoT Repository for SecuriT class compliance)** to support deployment of secure IoT devices in the country. The framework is developed to provide UID to each Bhartiya IoT Product. The portal assesses over two hundred security attributes of IoT devices and categorizes them into one of five security assurance classes. This initiative will aid in identification of specific security vulnerabilities of an IoT device and address any deficiencies to achieve appropriate assurance levels.

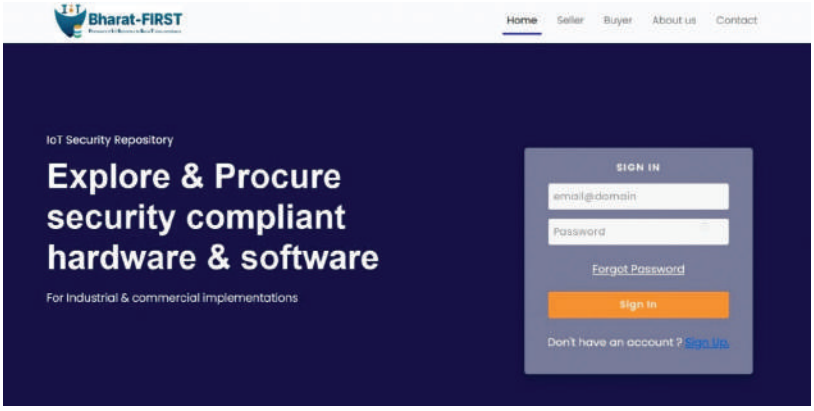


Fig. Dashboard of Bharat -First IoT security repository

- The TIH is also developing SOHAM, aLoRaWAN based smart and compact IoT solution developed by the Hub helps in monitoring the farm ecosystem by remotely monitoring the soil and crop parameters in the field and integrating various sensors to provide various timely advisories to the farmer on the iSARATHI mobile app. The farmer can view and visualize the data on a mobile application which also provide recommendations to manage crop health.

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

- **Twara Robotics,** a start-up incubated under the Hub is developing high-quality robotic components in India, from the ground up. The solutions are indigenously designed and locally sourced, thus expanding how automation can provide effective solutions. The startup has launched two products:

  (i) Actuator: It combines a gearbox, motor, and a motor controller to control movement of the joints of a robot. 2-4 of these can be used to drive AGVs (Autonomous Ground Vehicles), 6-7 of these come together to form a cobot; different permutations and combinations can form customized robots. These are high torque density and highly precise.

Fig. Actuator

(ii) Gripper: It is soft silicone-based and pneumatic for handling fragile objects. The gripper is ESD-safe and designed for use in the food, pharmaceutical and automotive electronics industries.

Fig. Gripper

- **AlgoFET,** another start-up incubated under the TIH has developed a Drone battery management system, the best-performing Drone battery pack, an autonomous Drone charging station, and a full-stack charging management system designed to cater to z-dimension commodities.

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

The Hub has established following Centres of Excellences and state-of-the art labs to develop and commercialize impactful technologies in the mining sector and revolutionise this sector globally.

- TEXMiN- ESRI India Geospatial Excellence Centre: For augmenting Geospatial capabilities through the latest technologies of ESRI, US.
- TEXMiN - Dassault Mining Technology Excellence Centre: For augmenting Mine planning capabilities through the latest technologies of Dassault Systems, France.
- TEXMiN-Carlson Geodesy Lab: For augmenting Geodesy capabilities through state-of-art US-based Carlson.

Fig. Centres of Excellences and state-of-the art labs at TEXMiN

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

- Kelvin 6k Technologies Pvt. Ltd,a startup incubated under the Hub has **designed concrete 3D printing robots** that can print houses onsite. The Robots are completely "Made in India". Concrete 3D printing robots in India could automate construction, reduce costs, create jobs, and promote green practices, fostering economic growth and innovation.

Fig. 3D printing robots

- The TIH is also developing a **2 kW Indigenous Brushless PM Motor for UAVs**. The novel features of the technology include Low-Cost Rectangular PM based design with Improved Cooling and Improved Efficiency at High Speeds. The technology would help achieve indigeneity in BLDC motors for UAVs used in defence, agriculture and disaster management in a cost-effective manner.

Fig. Indigenous Brushless PM Motor for UAVs

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"

- **Autonomous Vehicles – Map-based Navigation** developed under the Hub gives vehicles essential context about their environment and enables them to navigate complex road networks autonomously. The innovations in the technology include Driverless transportation, TiAND multimodal driving dataset (Camera, Lidar, Radar, and GNSS), Indigenous multi-sensor fusion autonomous driving stack, In-house developed Drive-by-wire (DBW) Technology, Digital-Twin map-based navigation technology, and Collision - Avoidance as per the ISO standards. Autonomous Parking and vehicle platooning are the special features enabled in the AV.

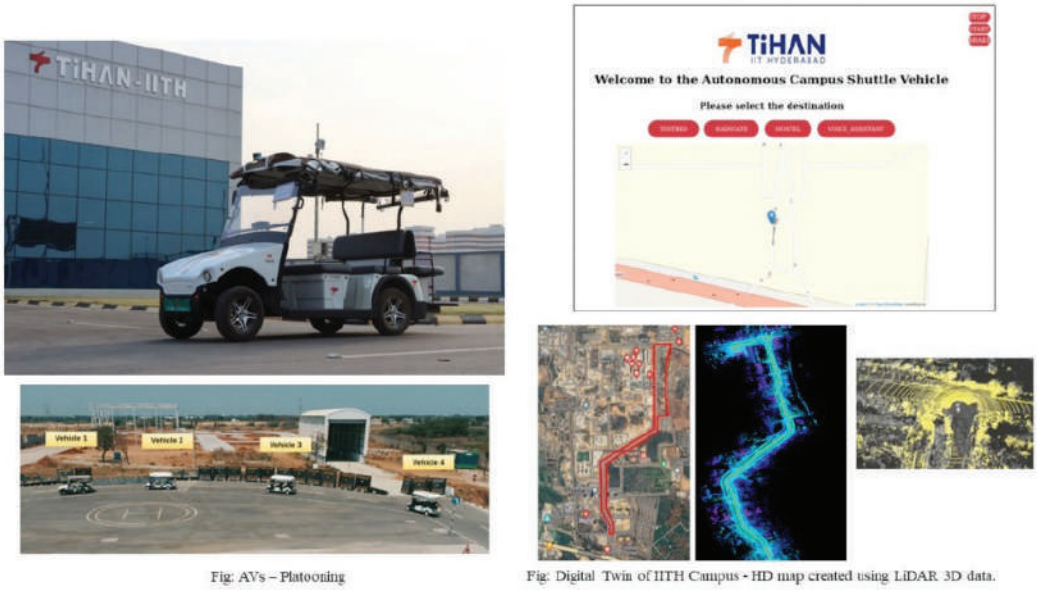


Fig: AVs – Platooning

Fig: Digital Twin of IITH Campus - HD map created using LiDAR 3D data.

Fig. Autonomous Vehicles – Map-based Navigation

- **Connected Vehicles – 5G CV2X, a Technology** developed by the hub that enables vehicles to communicate with other vehicles (V2V), infrastructure (V2I), pedestrians (V2P), and the broader environment (V2X) through cellular networks. C-V2X. This can enhance road safety by enabling vehicles to share real-time information to alert drivers about potential collisions, warn them of adverse road conditions, avoid accidents, and save lives.

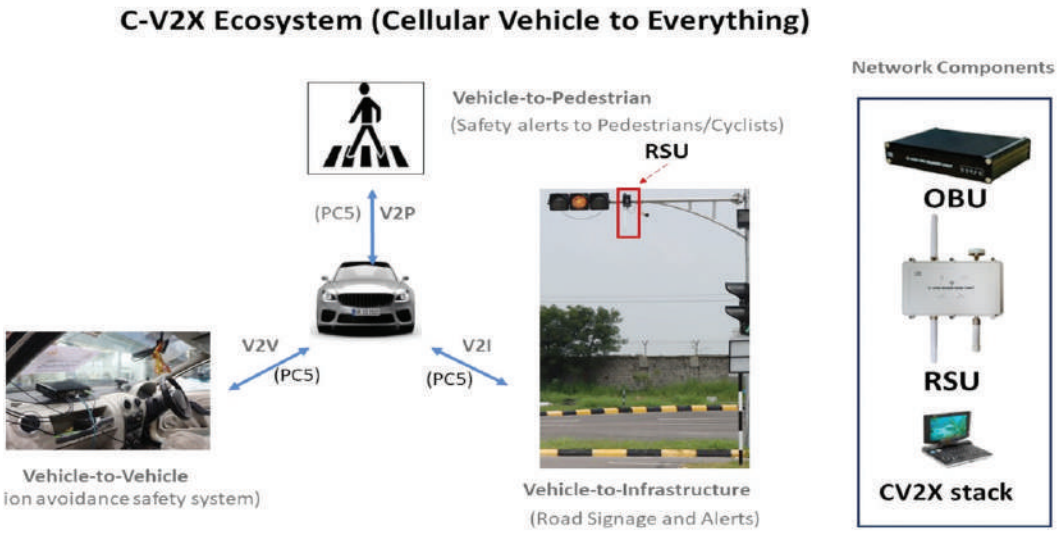


Fig. C-V2X Ecosystem (Cellular Vehicle to Everything)

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

- **Wearable Bioelectrical Impedance Analyzer** developed by the hub is a non-invasive portable hardware-software integrated device that accurately determines total body water, offering crucial insights into fluid distribution during cardiac surgeries. This could reduce postoperative complications and hospital stays, potentially alleviating the economic burden on patients and healthcare systems. Along with the physiological signal (dermal resistance) collected from participants, other comprehensive clinical parameters like age, stature, weight, spO2, ECG, etc. are also taken into consideration for total body water calculation making it a truly multi-modal cost-effective healthcare solution.

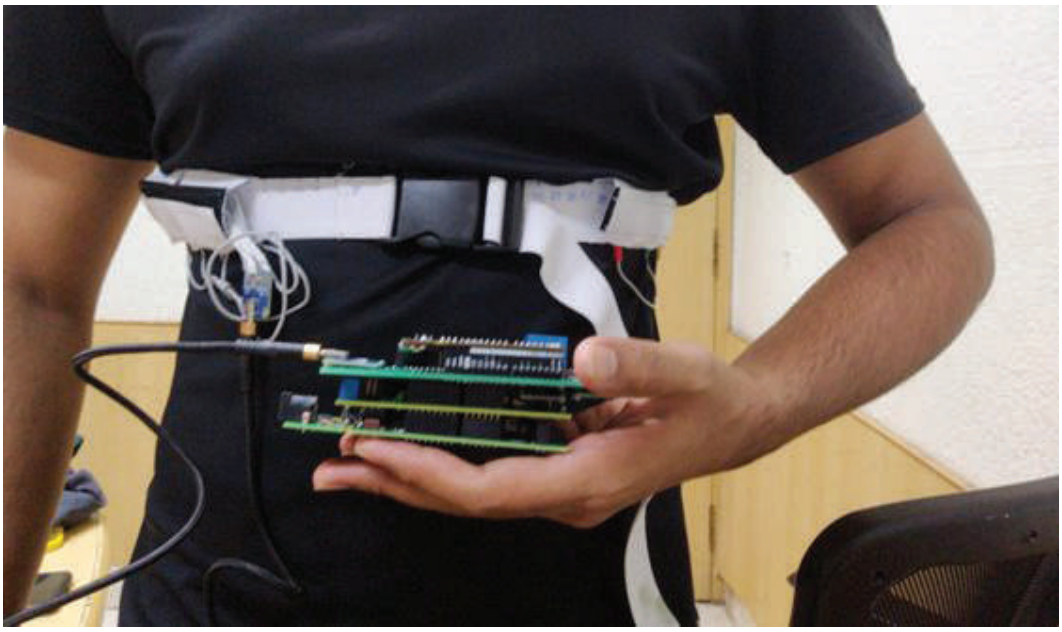


Fig. Wearable Bioelectrical Impedance Analyzer

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

- **TechXR**, a start-up incubated under the Hub aims to democratize AR/VR with an affordable 3D mouse for smartphones. The developed SenseXR, with 6 DoF Controller helps to enhance visitor experiences at cultural sites. The technology is commercially demonstrated at Shri Kashi Vishwanath Jyotirlinga Temple and Shri Mahakaleshwar Temple.

Fig. 3D mouse for smartphones

Fig. Cultural Sites

- iHUB DivyaSampark has conducted numerous training programs in AI, ML, drones, 5G, and IoT, particularly in hilly and remote areas. Over 47,000 individuals have been trained, with 50% being female, promoting gender inclusivity. These programs have been pivotal in enhancing technological literacy, especially in hilly and remote areas, providing hands-on experience and making participants industry-ready.

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

- The developed CPS device "**Beekeeper**" is a ground-breaking tool that monitors bees' health and status by analyzing the sounds they produce, which reflect their activities and communication within the hive. It serves as a vital tool for environmental monitoring and urban beekeeping, helping prevent Colony Collapse Disorder and mitigate the decline of honeybee populations.

Fig. Research team for Real Field testing

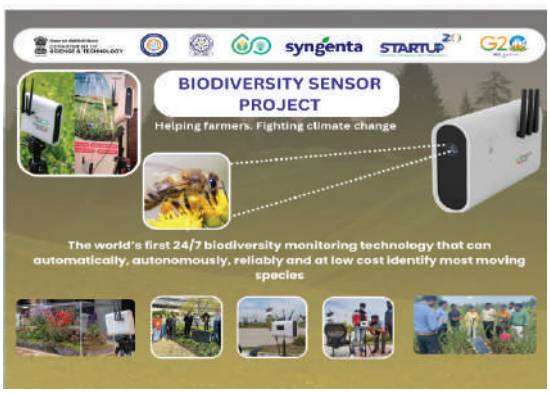


Fig. Beekeeper

- To expand the impact of CPS the Hub is establishing nodal CPS Skilling labs in partnership with institutes across the country. These dedicated labs equipped with CPS components serve as hubs for skilling initiatives, fostering innovation and entrepreneurship in their respective regions. Currently, the hub has set up three CPS labs at **NIT Delhi (catering to the NCR Region), NIT Jalandhar (catering to the Punjab Region), Tula's Institute (catering to the Uttarakhand region)**.

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

- **Medical Cobotics Centre (MCC)**has been established with collaboration IHFC- I-Hub foundation for Cobotics. It is a centre of excellence providing education, training, and skill development for Medical/Engineering/Science Students, Doctors, Surgeons, Engineers, Paramedical Staff, and other relevant personnel, creating best-in-class infrastructure for Research and Development (R&D) in the field of Medicine, Healthcare devices and equipment as well as offering a robust Startup Ecosystem for nurturing startups in this domain.

Fig. Medical Cobotics Centre (MCC)

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

- **Driver Alertness Management System (DAMS)** developed by the Hub is a Deep-Tech Computer-Vision based, Device-Led Technology in HCi. The technology will enable the prevention of fatal accidents by providing timely and personalized alerts to the driver.

The novel feature of this technology is that Indian Datasets have been used for the safety of public transportation.

Fig. Test run with camera Test data to run the algorithm

- The Hub is implementing **Drone Didi Program under PMKVY 4.0 to** provide skill training for the coveted role of Kisan Drone Operator, with special focus on women. Drone applications covering areas like precision crop pesticide spraying, real-time monitoring of field conditions and to carry out pesticide and crop nutrient application are covered under the training.

Fig. One of drone didi interacting with Hon'ble President Smt. Droupadi Murmu

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

- The Hub has developed the prototype of the **Josephson Parametric Amplifiers for superconducting qubits-based quantum processors** which are some of the lowest noise microwave frequency amplifiers, crucial for any superconducting quantum processor. It helps in achieving high fidelity measurements in a short amount of time. This makes them an invaluable tool for quantum error correction as well.

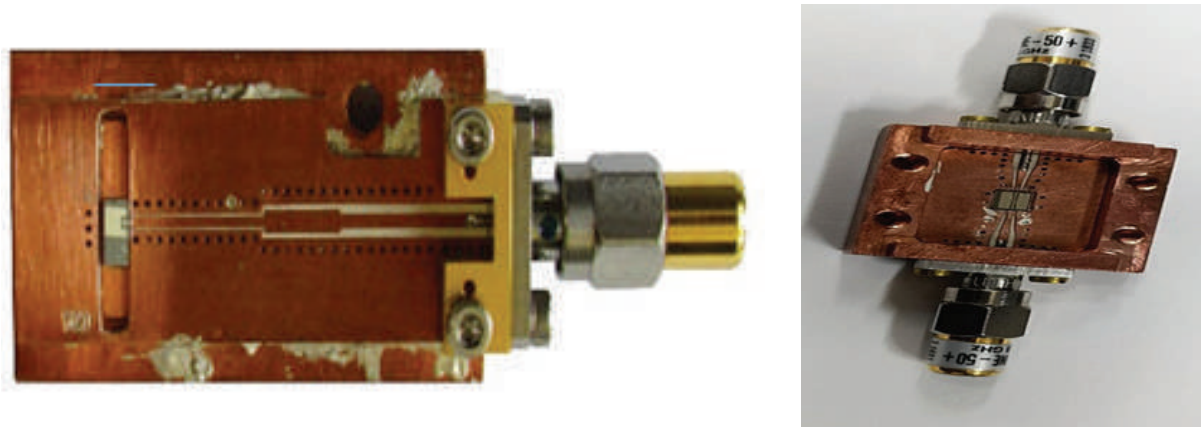


Fig. A picture showing the prototype Josephson Parametric Amplifiers.

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

- Arthaashastra Intelligence Databases Private Limited, a start-up incubated under the Hub has designed a **decision intelligence platform**, specifically for the manufacturers and traders for insights. The platform is designed for the Agriculture, Mines and Minerals sector and act as a single platform for commodity intelligence making pricing, buyer and supplier interfacing. The platform automates the data from different market places from both National and International using techniques like machine learning and Natural language Processing to make predictions.

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

- The Hub has fabricated a fully ready prototype of an Autonomous Underwater Robot Vehicle for 300 m depth applications & tested in Simulated Motion and in real environments up to 30 m depth. The vehicle having tilting thrusters with 6 DoF for manipulators & autonomous control systems will be useful for **Défense**, Marine and Off-shore oil & gas applications.

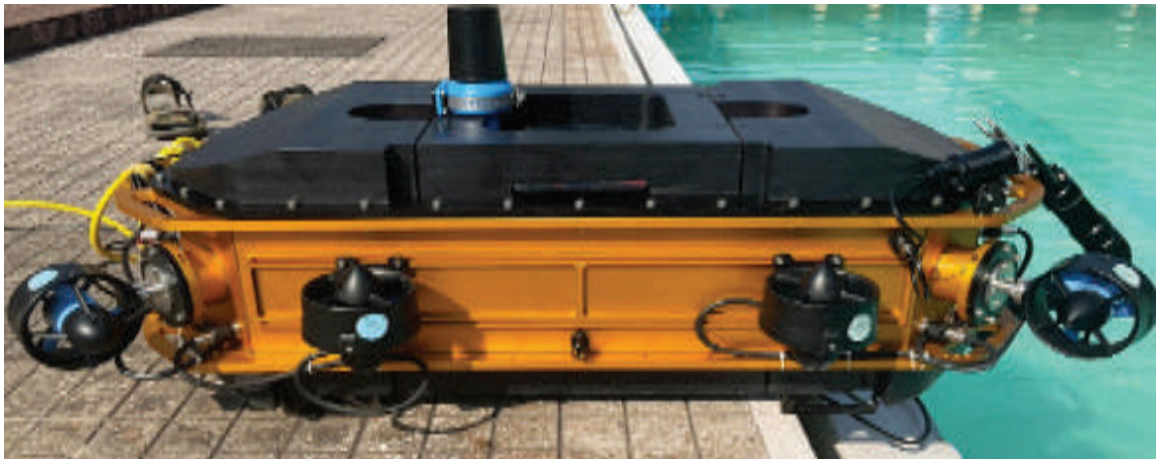


Fig. Autonomous Underwater Robot

- Vi Innovation Pvt. Ltd., a startup supported by the hub has developed an IoT based Assistive Tech for Automotives. The assistive technology consists of a mobile app and an electronic device to control automotive electrical devices using voice command without internet

4.16 IIITB Comet Foundation at IIIT Bengaluru working in the Technology Vertical "Advanced Communication System"

Two major technologies for the fifth and future generations of communication networks (5G, 6G, and beyond) have been developed by the hub:

- **Reconfigurable Intelligent Surfaces (RIS):** RIS is widely accepted to be one of the foundational technologies for 6G networks and can offer multifold increase in network capacity and lesser cost than deploying multiple new base stations.

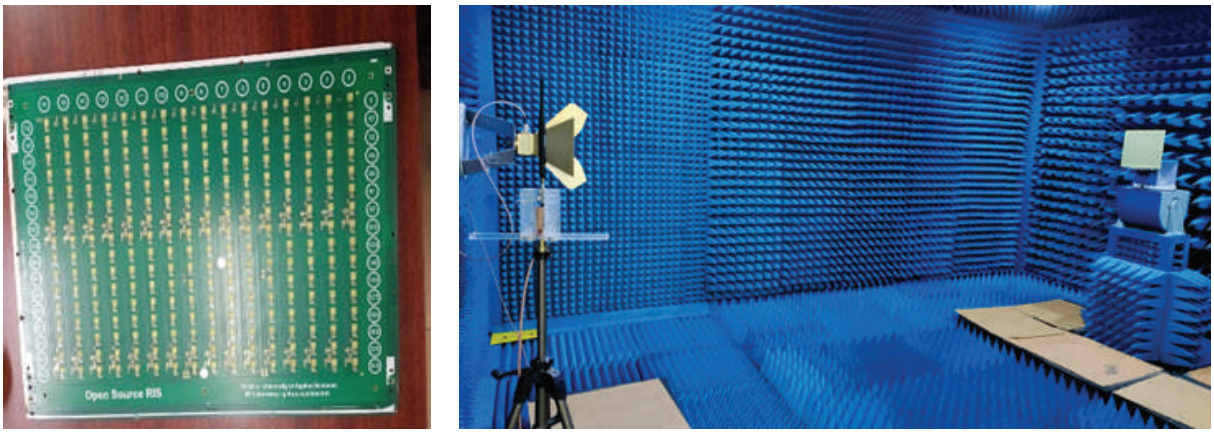


Fig. Reconfigurable Intelligent Surfaces (RIS)

- **Private 5G Box**: IIITB COMET's supported start-up Mantiswave Networks Pvt. Ltd., has developed an integrated in-house, portable 5G Network-in-a-Box that offers a secure, high-performance, 3GPP-compliant 5G network for innovative enterprise R&D solutions, with defence & civilian applications. The product is commercially available now.

Fig. Private 5G Box

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

- Some notable products developed by the hub include HemoProbe, a non-invasive RBC detector, a microfluidic device for isolating WBC at POC settings and a novel bio-electronic transistor-based biosensor for environmental analysis.

Fig. Products of Translational Projects

4.18 IIT Kharagpur AI4ICPS I-Hub Foundation at IIT Kharagpur working in the Technology Vertical "Artificial Intelligence and Machine Learning"

- iToFD, a technology developed by the hub is AI Enabled NDT Software for Auto Evaluation of Industrial Time-of-Flight Diffraction (ToFD) data. Ultrasonic ToFD method identifies weld defects by capturing and cleansing diffracted signals. This technology enables a 30X reduction in Time and Cost for Weld defect detection compared to existing x-ray tech and will have a major impact across all industries where welding is used. The technology patent has been granted recently.

Fig. Dashboard of AI-enabled NDT Software for ultrasonic ToFD

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

- **SAMIKSHAK,** a vision-based system developed for automated in-line inspection of tapered bearing rollers is integrated into the industrial production line to assist the human inspector in real-time surface defect detection on the machined workpiece for the factory acceptance analysis. This system utilizes a camera, Programmable Logic Controller, a processor for computations, and conveyor system to segregate the good and defective workpieces such as bearing rollers.

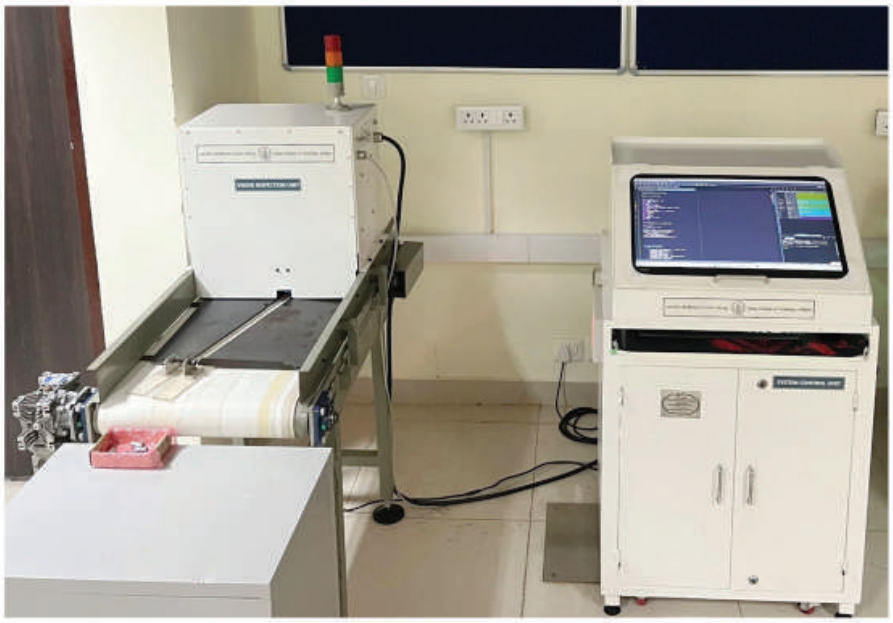
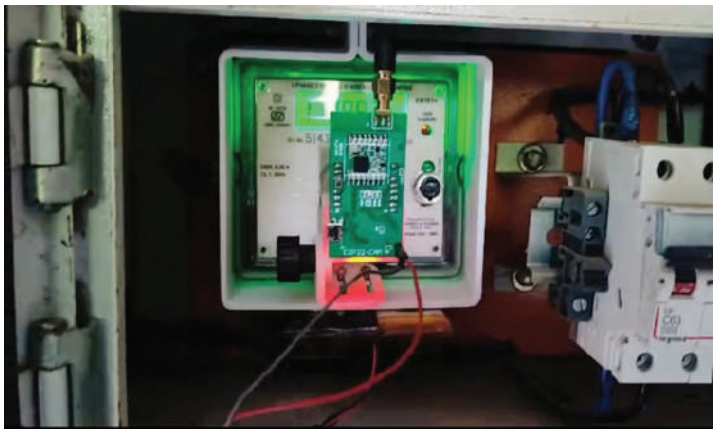


Fig. SAMIKSHAK

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

- A low-Cost LoRaWAN-enabled device to convert traditional meters into smart meters has been developed. This innovative approach eliminates the need for costly replacements, making smart meter technology more accessible. This advancement is particularly beneficial in areas with limited or no internet access. The device collects meter readings automatically, ensuring efficient and accurate data without manual intervention.



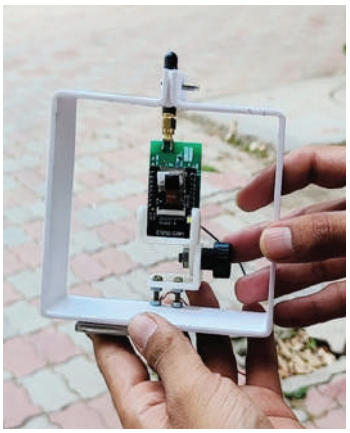


Fig. Smart meters

- A paper-based optical sensing device for quantitative monitoring of creatinine in serum samples has been developed. The device uses a modified chemical reaction to enhance selectivity and sensitivity. It has excellent selectivity toward creatinine in the presence of other proteins and ions.

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

- **Underwater Welding Program** implemented by the hub focuses on equipping industry professionals and researchers with advanced skills in underwater welding, a critical technique for subsea construction and maintenance. The program featured hands-on training sessions, innovative methodologies, and state-of-the-art equipments.

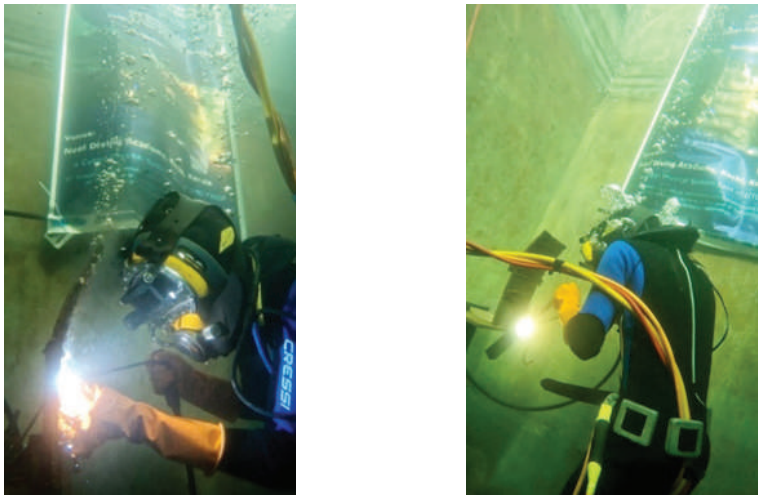


Fig. Underwater Welding

- The prototypes of **Underwater Biomimetic Robots,** inspired by the locomotion and efficiency of marine life, have been designed and developed by hub for advanced underwater exploration and monitoring. These robots could be instrumental in various applications, including environmental monitoring, underwater inspection, and marine biology studies.

4.22 IDEAS- Institute of Data Engineering, Analytics and Science Foundation at ISI Kolkata working in the Technology Vertical "Data Science, Big Data Analytics and Data curation etc"

- **SmartNLD**, a novel product that uses AI techniques for animal behaviour detection and generates acoustic and visual alerts through a network of connected devices has been

developed. The system employs a combination of technological features to create an innovative, ethical, and environmentally conscious solution to specifically target conflict animals and reduce habituation by wild herbivores and carnivores to mitigate wildlife-human conflicts.

Fig. SmartNLD for animal behaviour detection

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

- **Garudalytics Smart Mapping (GSM),** a technology developed by a startup supported by hub, is a pioneering voice-enabled mapping application that leverages advanced artificial intelligence and location intelligence technology to revolutionize geospatial operations. A standout feature of GSM is its voice-enabled interface, which simplifies map creation and geospatial data analysis by allowing users to interact with the application through voice commands. The 3D analysis feature allows for the modeling of three-dimensional spatial data, providing insights for urban planning, infrastructure development, and environmental monitoring.

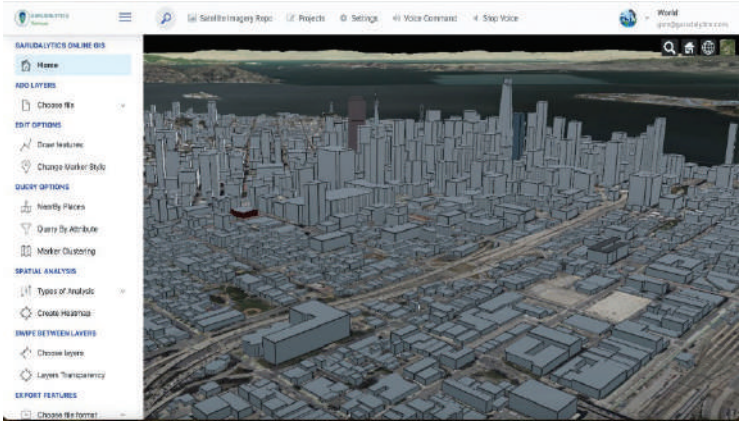


Fig. Garudalytics Smart Mapping

4.24 IIT Bhilai Innovation and Technology Foundation at IIT Bhilai working in the Technology Vertical "Positioning and Precision Technologies"

- **Accessible banking functionalities for Divyang (Visually Impaired) using smart ATM**, an innovative solution developed by the hub offers ATM functionalities with enhanced accessibility and advanced security features for the visually impaired and people with reduced mobility. It incorporates features like Touch-free technology& voice-guided interface, advanced security features and braille-based transition slips for withdrawal validation, balance information.

Fig. PoC of the ATM in National Association for the Blind (NAB), Raipur

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

- **Medhini,** a product developed by a startup supported under the hub is an artificial intelligence powered health-tech SaaS platform which uses deep neural technologies to provide accurate diagnoses for various diseases like melanoma, stroke, heart attack, pneumonia, and ailments related to liver and kidney. It screens for diseases in less than 1 minute and offers up to 99.31% accuracy.

Fig. Medhini, health-tech SaaS platform

- **CharakDT,** a technology developed under the Hubis a digital twin platform for high-resolution patient models for precise diagnosis and personalized treatment. It utilizes advanced data pipelines (synthetic data, NLP, image recognition) for robust analysis and integrates ML for real-time insights. It serves as the aggregator for integration for various digital healthcare technologies.

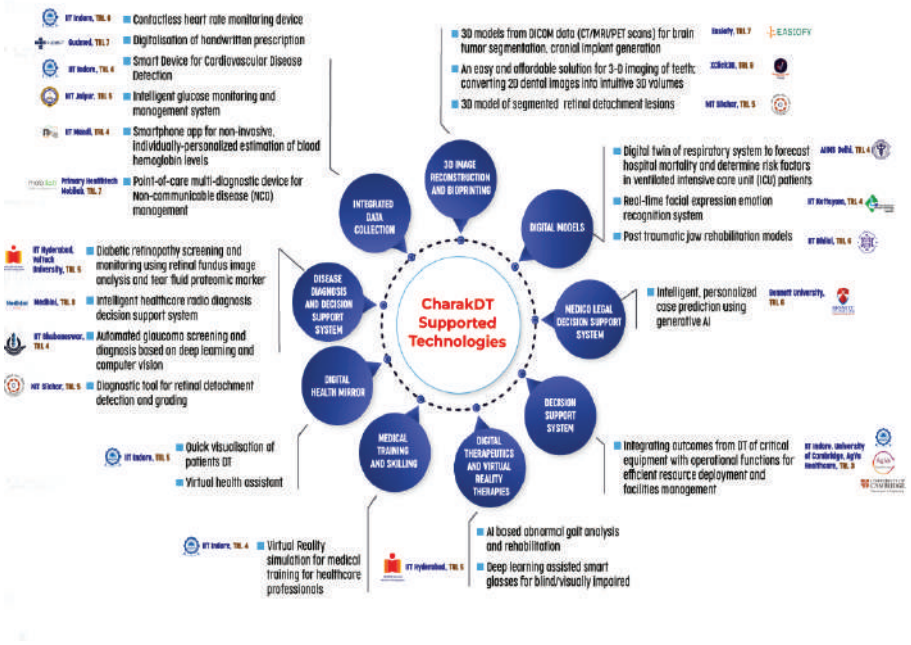


Fig. CharakDT, a digital twin platform for diagnosis

CHAPTER 5

AUTONOMOUS INSTITUTES

The Department of Science and Technology nurtures 24 Autonomous Bodies (ABs). These include 16 research institutions, 03 specialized knowledge and S&T service organizations and 05 professional bodies. 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:

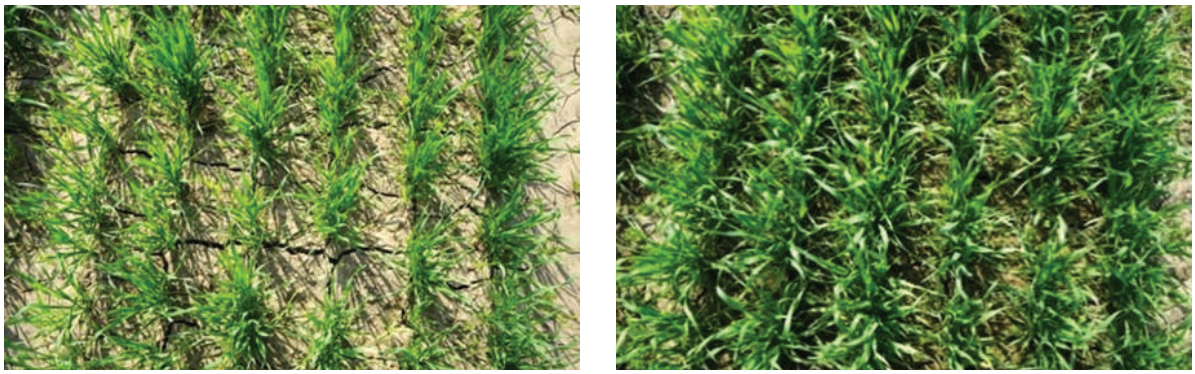
5.1 Maharashtra Association for the Cultivation of Science (MACS)-Agharkar Research Institute (ARI), Pune

The main areas of focus of the institute are Biodiversity & Palaeobiology, Bioenergy, Bioprospecting, Developmental Biology, Genetics & Plant Breeding, Nanobioscience.

Major Accomplishments:

- Fungal genera *Kevinia* and *Groenewaldia* and eleven new species were discovered from the Western Ghats, Maharashtra. Whole genome sequencing of *Fusarium indicum* and *Alanomyces manoharacharyi* revealed metabolite profiles for industrial applications. *Cladosporium*, *Alternaria*, and *Pseudohumicola* genera were found to be efficient melanin producers.
- Desiccation-tolerant vascular plants of the Western Ghats were studied. *Smilax turbans*, a native Indian species was rediscovered in Arunachal Pradesh after a gap of 98 years. DNA super-barcodes were developed for the medicinally important *Smilax zeylanica*. Over 150 species of diatoms were identified from the alkaline lakes of southeast coast of India. Two new species of foraminifera genus *Psammophaga* were reported from Rajapuri Creek, Raigad, Maharashtra.
- Microbiologically influenced corrosion (MIC) is caused by sulfate-reducing bacteria (SRB) and acid-producing bacteria (APB). Formation water samples were collected from offshore sites in Bombay High oilfields. Metagenomic sequencing was done to analyse the microbial diversity associated with MIC. Out of the fourteen SRB genera identified, key species included *Desulfobacter vibrioformis, Desulfotignum balticum,* and *Desulfomicrobium thermophilum.* APB contributed less to MIC. A mitigation strategy involving a combination of bacteriophages and biocides exhibited 80% reduction in SRB activity.

- A library of antitubercular 6-trione has been prepared and tested against active and dormant strains of *Mycobacterium tuberculosis* H37Ra (Mtb) responsible for Tuberculosis (TB). The results showed excellent inhibitory potential against active and dormant strains of Mtb. Iron accumulation in organs affects iron metabolism, leading to deleterious effects. We postulated that iron overload caused by chronic exposure to excessive dietary iron supplementation would play a role in iron dyshomeostasis and inflammation in Wistar rats.
- Wheat breeder seed, 193 quintals, was supplied to cover 1.5-2 lakh hectares in Peninsular India. Soybean breeder seed, 262 quintals, was supplied to public and private seed multiplying agencies and farmers in the country. Advanced wheat breeding lines carrying alternative dwarfing genes with improved seedling vigour were developed. These lines allow farmers to save one irrigation.



HD3086+Rht-1 HD3086+Rht18 improved seedling vigour

Fig.: Improvement in early vigour in wheat due to alternative dwarfing genes suitable for dry environments

- The developments made in research related to Nanobioscience were: Surface modification of titanium implants was done with cobalt and silver for improved osseointegration and as a prophylactic against periodontal pathogens; A novel *Acanthamoeba* expression system was developed to improve efficiency, quality and versatility of protein production; Mucin1 aptamer-tethered H40-TEPA-PEG nanoconjugates were developed for targeted siRNA-delivery and gene silencing in breast cancer cells; GLUT1 transporter-facilitated solid lipid nanoparticles loaded with anti-cancer therapeutics were developed for targeting ovarian cancer; Nanocarriers were developed for delivery of dsRNA for silencing lipase and chitinase target genes and achieving biocontrol of *Helicoverpa armigera*; The diversity of methanotrophs and their application as single cell proteins were explored.

Important Highlights of Major Programmes:

- One hundred and eighteen institutions benefitted from the services provided by the National Fungal Culture Collection of India and Ajrekar Mycological Herbarium. Fungi

from Western Ghats were investigated for metabolites and their applicability. *Diorygma dandeliense* was emended under *Diorygma karnatakense*.

- Report of the project on sustainable utilisation of medicinal plant resources of Maharashtra was submitted to RGSTC, Mumbai. Documentation of Smilacaceae in the Indian subcontinent was completed. Mula-Mutha river basin water quality monitoring programme using diatoms was initiated.
- The MACS Collection of Microorganisms became an affiliate member of the World Federation of Culture Collections. The endangered *Crinum* species were studied for their potential in treating Alzheimer's. Protocols for *in vitro* propagation using tissue culture of *Crinum* sp. were developed.
- Frontline demonstrations of new soybean varieties on farmers' fields led to 15.24% increase in soybean yield over traditional practice. Genomic evaluation of 3148 wheat germplasm accessions identified high-yield, drought-tolerant lines.
- A topical hemostatic based on chitosan and silica nanoparticles was developed. Molecular aspects of platelet activation and calcium release by the xerogel dressing were studied. Ovarian cancer cell spheroids were successfully cultivated using graphene-cellulose acetate-alginate nanomaterials.

Important Output Indicators:

Sr. No.	Parameters	Output
1.	Papers in Refereed Journals	73
2.	Books	03
3.	Chapters in Books	17
4.	Papers in Conferences	44
5.	Number of PhDs Produced	10
6.	Indian patents Filed/Granted	08
7.	Technical Manpower Trained	103
8.	Research Manpower Trained (Other than PhD)	55
9.	B.Tech/UG Project guided	14
10.	M.Tech/M.Sc/M.Phil. Project Guided	139

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

The Institute focuses research in the areas of Astronomy, Astrophysics and Atmospheric Sciences. The Institute operates a suite of optical telescopes and advanced instruments to study the Earth's atmosphere, Sun, Planets, Stars and Galaxies. Research at ARIES is being carried out on a variety of astrophysical sources in Galactic and Extragalactic astronomy covering both observational and theoretical aspects.

Major Accomplishments:

- 4m International Liquid Mirror Telescope (ILMT) has started regular science observations and the ILMT data has been made publicly available to the scientific community through its online portal.
- The observations with the 3.6m Devasthal Optical Telescope (DOT), the largest optical telescope of the country, operated as a national facility performed smoothly in two observing cycles.
- “Beyond Aditya-L1: Exploring the future of Indian solar physics from space" meeting was conducted at ARIES during 7-9 Nov 2023 to bring solar physicists together to discuss possible future space missions to study the Sun and space weather. Aditya-L1 Support Cell (AL1SC), a joint effort of ISRO and ARIES, conducted 3 workshops in different parts of the country to train budding solar physicists with concepts of sun and space weather and data analysis techniques to create a community of Aditya-L1 mission data users.

Important Highlights of Major Programmes:

- A novel methodology was developed to compute emission from accreting neutron stars. It was found that the change in plasma composition led to the difference in propagation velocities of the jets even if their initial parameters remain the same.
- A rare detection of optical light flickering at multiple temporal frequencies from a blazar 4.4 giga lightyears away helped estimate its mass limits. For the first time the secondary black hole in the binary system of a unique blazar 5.2 billion light years away was detected by measuring polarized light from it.
- Systems of two blue straggler stars orbiting around each other in an open cluster in our galaxy were discovered using the Ultra-Violet Imaging Telescope (UVIT) mounted on our Indian satellite, AstroSat.
- Persistent “hiccups” from a black hole at the center of far-off galaxy were explained as being due to a tiny black hole repeatedly punching through a larger black hole’s disk of gas. The groundbreaking discovery sheds light on previously unseen behavior in black holes.
- An extensive database was developed that connects giant solar eruptions to their birth places on the Sun, leading to many interesting results that show that giant solar eruptions bear imprint of their origins. This will enable space weather predictions.
- A novel technique for tracking the solar eruptions was developed. Astronomers also spotted a surprising solar eruption that maintained constant temperature.

- A study unveiled a pioneering approach to continuously quantify carbon monoxide (CO) contributions from fossil fuel combustion and biomass burning in the Central Himalayan region, addressing a critical gap. Its results are of paramount importance for targeted air quality management strategies.
- The origins of carbonaceous aerosols in the Himalayas were unveiled by using extensive high-resolution ground-based observations and found that the influence of fossil fuel combustion on air pollution in the Himalayas extends throughout the year with greater impact on warming than biomass burning.

Important Output Indicators:

Sr. No.	Parameters	Output
1.	Papers in Refereed Journals	117
2.	Number of Ph.Ds. Produced	16
3.	Technical Manpower Trained	115
4.	Research Manpower Trained (other than Ph.D)	273
5.	B.Tech/UG Project Guided	25
6.	M.Tech/M.Sc/M.Phil. project Guided	25

5.3 Birbal Sahni Institute of Palaeosciences (BSIP), Lucknow

The institute carries out research on fundamental as well as applied aspects of Palaeosciences that includes Evolutionary history of biota, Paleoclimate, studies of past Civilization, Human history and contemporary climate change issues, following an integrated and multi-disciplinary approach. Key research activities are: Understanding origin and evolution of life through time and space; Understanding climate change in recent and deep geological times; Understanding past civilization and human history; Application of Palaeosciences in exploration of fossil fuel.

Major Accomplishments:

- A group of scientists from BSIP and research scholars attended the 21st INQUA (International Union for Quaternary Research) Congress-2023, during July 13−20, 2023 and presented their research work. BSIP has won the INQUA 2027 Bid held recently at Rome, Italy. Thus, for the first time, India will host the prestigious International Union for Quaternary Research (INQUA) Congress in 2027.
- Industrial Micropalaeontology Laboratory" of BSIP received a consultancy project from Oil India Limited, Guwahati, Assam on the 28 August 2023 for 2 years to render the "Biostratigraphic Analysis of the sub-surface samples of Exploratory/Development well of Oil India Limited".

- A Centre for Promotion of Geoheritage and Geotourism (CPGG) was established at BSIP in the financial year 2023-2024. The CPGG has been established in the institute as an outreach effort by BSIP to meet the 2030 Agenda of the UNESCO Sustainable Development Goals.
- An information system 'The Indian Permian Seed Database (IPSD)' for ensuring the digital storage, safety, accessibility and recovery of the details of Indian Permian seed records in a selective manner has been developed. The database presently includes 28 genera and 44 species of compressed seeds described from Lower Gondwana (Permian), with all the details for access to researchers/academicians. Two consecutive volumes of the BSIPs in-house journal, 'Journal of Palaeosciences' were published in July 2023 and December 2023, respectively.

Important Highlights of Major Programmes:

- A study assessed the origin of two unusual morphotypes from the 1.6 Ga old Chorhat Sandstone, Vindhyan Supergroup, India. The study envisaged that both the morphotypes quite likely resulted from the movement of amoeba-like organisms which were prevalent in connection with microbial mats during 1.6 Ga. The existence of a protective microbial mat on top of the sandstone bed surfaces aided in the preservation of such delicate characteristics. These morphotypes raise questions about the Precambrian biotic structures during the Boring Billion (1.8–0.8 Ga) and the consensus prevailing regarding the appearance of motile life during the Ediacaran.
- Highly diversified megafloral assemblages consisting of 13 genera and 72 species of order Glossopteridales, Cordaitales and Equisetales were documented among which 37 taxa were newly reported from the Barakar and the Raniganj formations within the South Karanpura Basin. The palaeofloral entities and geochemical parameters suggested that the Permian climate was cooler in initial phase, and subsequently became warm temperate and humid.
- A study reported eleven fossil pollen form–species from the early Paleogene of India, enhancing our understanding of the evolution of four palm subfamilies: Arecoideae, Calamoideae, Coryphoideae and Nypoideae, on the Indian Plate prior to the India–Asia collision. The study suggested that the dispersal of diverse palms from Africa to India via the Kohistan–Ladakh Island Arc during Maastrichtian–Paleocene as part of the Africa–India Floristic Interchange. Subsequently, with wet and humid climates across much of the Indian Plate during the Paleocene–early Eocene, they underwent a phase of diversification and adaptation leading to habitat expansion. Thus, the Indian Plate served as an evolutionary hotspot for the diversification of palms during the early Paleogene. The study favoured the "Out–of–India" dispersal hypothesis for the Asian palms. The expansion of seasonal climates, and aridification during Neogene and Quaternary led extinction in numerous palm lineages on the Indian subcontinent.

- Global warming is likely to become one of the significant drivers of forest losses in the Hindu-Kush Himalaya (HKH) during the 21st century. Better understanding of how forest ecosystem will respond to global warming requires a precise knowledge of site- and species-specific responses to climate change. A study on dendrochronological technique to quantify and predict future growth trend of Himalayan cedar was carried out. Analysis of tree ring width and climate data revealed that the spring temperature and precipitation affected the growth of deodar negatively and positively, respectively. The study showed more drought stress to deodar trees growing in monsoon areas in mid-and low-latitude sites where less snow melts and low precipitation during the spring season are predicted to increase evapotranspiration. In comparison, in the higher latitude sites where there is a high snowfall due to western disturbances, the growth of deodar is predicted to increase. The study recommended installation of early warning systems along with the siphoning of the lake using available engineering techniques to mitigate the damage to life and property.

- A study first investigated the nature of organic biomarkers found in subaerial 'Rock Varnish' in the extreme conditions of Ladakh region, north India, resulting from the mineral-microbial interactions. The research threw light on the unexplored surface hydrophobicity properties of rock surfaces and their roles in microbial adhesion on the surfaces. The findings of the investigation have significant implications for the study of biogeochemistry as well as for the development of new techniques for studying microbial metabolites and interactions, along with the development of a new class of bioinspired geomaterials acting as a shield in harsh environments. The research also suggested the potential role of varnish formation in the biogeochemical cycling of Mn and Fe, as well as the potential use of varnish as a biomarker for past microbial activity on Earth and other planets.

- United Nations protection programmes under the UNESCO's Global Geopark initiatives have resulted in the establishment and recognition of 195 Global Geoparks in 48 countries to sustainably protect Geoheritage. Given an inclusive approach with local communities and the geoscientific communities as stakeholders, the UNESCO Global Geopark concept has gained popularity in India. Further, India provides a diverse range of geoheritage in terms of rock records from the Precambrian to the Holocene. Owing to its unique Geoheritage and geotourism potential, a case to propose Palasava locale as a "geosite" within the "Kachchh Geopark" was put forth via a published article so as to protect and conserve this geologically significant locale, to enhance sustainable geotourism in the region for the economic benefit of the local population and for the public to cherish.

Important Output Indicators:

Sr. No.	Parameters	Output
1.	Papers in Refereed Journals	116
2.	Books / General Articles & Reports	33
3.	Number of Ph.Ds. produced	14
4.	Research Manpower Trained (Other than Ph.Ds)	95

5.4 Bose Institute (BI), Kolkata

Bose Institute 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. The thrust areas of research 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; Identification of Drug Target and Validation of Bioactive Molecules for Therapeutic Intervention; Atmospheric dynamics and air pollution.

Major Accomplishments:

- Classified a subset of the Calabi-Yau geometries suitable for string phenomenology which is necessary for scanning the landscape of flux vacua. This marks a significant progress towards constructing a unifying theory of quantum gravity.
- Identified 14-3-3 protein as a molecular switch in regulating cellular signaling between MAPK and PKA. Since, 14-3-3x protein interacts with phosphodiesterase 8A (PDE8A) and reduces the catalytic activity of PDE8A, intracellular cAMP pool is enhanced, thereby sustaining PKA signaling while downregulating MAPK signaling.
- A simple method for the iodination of unsaturated sugars to form sugar vinyl iodides was developed under oxidant-free conditions using NaH/DMF/iodine as a reagent system at ambient temperature. A facile synthesis of C1-C2 interlinked disaccharides was achieved from readily available iodo-glycals and unsubstitutedglycals.
- Working on cancer cell-specific CRISPR- based gene-editing and transcriptional regulation to reduce on-target *genotoxicity* in gene-therapy, BI scientists have now developed a method for targeted genome engineering. They have also developed a method for small molecule presentation on CRISPR- enzyme.
- An antimicrobial peptide was isolated from Pseudomonas aeruginosa species. The purified peptide was characterized by mass spectrometric analyses. The characterized

pentapeptide revealed a broad-spectrum antimicrobial activity. The peptide was found to be stable at wide ranges of pH and temperature. The peptide also exhibited antibiofilm activity. This pentapeptide, may find use as a potential biocontrol agent in various commercial applications

- Fibroblast growth factors (FGFs) are expressed in developing and adult tissues and play important roles in embryogenesis, tissue homeostasis, angiogenesis, and neoplastic transformation. The elevated expression of FGF16 in human breast tumor and its potential involvement in breast cancer progression have been investigated. The present findings support potential clinical intervention of any of the members of FGF16-GLUT3-PFKFB4 axis to control the invasion of breast cancer cells.

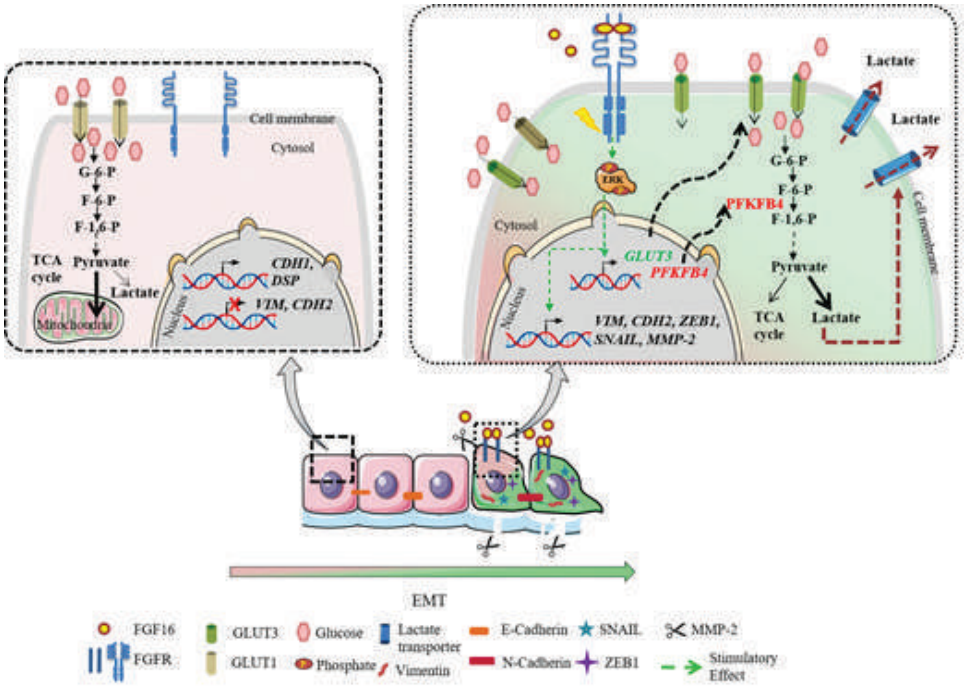


Fig. FGF16 rewires the whole cell transcription and metabolism to instigate EMT

Important Highlights of Major Programmes

- An antimicrobial peptide, isolated from Pseudomonas aeruginosa species, revealed a broad-spectrum antimicrobial activity, was found to be stable at wide ranges of pH and temperature, and exhibited antibiofilm activity, and could find use as a potential biocontrol agent in commercial applications.
- Profiles of aerosols and cloud layers have been investigated over a high-altitude urban atmosphere in the eastern Himalayas in India. For the first time, using a Raman LIDAR. LIDAR range corrected signal has been used to understand the growth of precipitation layer.

- A machine learning based prediction tool *LncRTPred* for longnoncoding RNA target prediction, which can be used to predict RNA-RNA mode of interaction mediated by lncRNA, has been developed. This can be used by the scientific community globally.
- Sequencing of microbiomes associated with six different freshwater sponges of Sundarbans have been achieved. Pilot experiments to achieve enrichment of desired genetic locus by pulldown for proteome identification have been successfully performed. The gene-specific primers to validate promising lignin-related pathway genes through qRT-PCR have been designed.
- Successfully demonstrated using co-immunofluorescence that a component of the *Giardia lamblia* proteasome also localizes to the mitosomes of this human parasite. This will help in furthering our understanding of how these rudimentary mitochondrial equivalents function and their role, if any, in the survival of this pathogen.
- Developed a redox-sensitive YFP sensor for the detection of intracellular reactive oxygen species (ROS) in planta. Also, a method for targeted genome engineering as well as for small molecule inducible CRISPR system is developed.

Important Output Indicators:

Sr. No.	Parameters	Output
1.	Papers in Refereed Journals	234
2.	Books	01
3.	Chapters in Books	22
4.	Papers in Conferences	18
5.	Number of PhDs Produced	18
6.	Indian Patents Filed/Granted	01
7.	Technical Manpower Trained	21
8.	Research Manpower Trained (Other than Ph.D)	102
9.	B.Tech/UG Project Guided	10
10.	M.Tech/M.Sc/M.Phil. Project Guided	40

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

The focus areas of the institute are Nanomaterials and Composites, Soft-materials, Meta

materials, Surfaces and Interfaces, Electro-optical devices, Sensors, Renewable energy, Energy storage devices, Energy generation and pressure-sensing devices, Memristors, Smart windows, Displays and Photovoltaics.

Major Accomplishments:

The major accomplishments of the institute were: Fabrication of affordable electrochromic smart windows, electrochromic supercapacitors, high entropy alloys as efficient catalysts for hydrogen production; Metal oxide-based electrocatalysts for energy efficient urea assisted hydrogen production, chemically activated spent catalyst for urea electrolysis; Demonstration of a resistive switching device, NbO_2 as a highly stable, ultrafast anode material for Li- and Na-ion batteries, 3R-NbS_2 as a highly stable anode for sodium-ion batteries, Biotene as a novel 2D material for batteries; Identification of the local atomic structure around dopants in double perovskites via EXAFS, Biogenic silver nanoparticles, Nanocomposites for desulfurization, Solution-based electrostatic assembly of 2D heterostructures; Antimicrobial coatings based on spiky metal oxides, Energy generation and pressure-sensing devices, Biomacromolecule supported N-heterocyclic carbene-palladium (II) as a novel catalyst for Suzuki–Miyaura and Mizoroki–Heck cross-coupling reactions, Dimer-parity dependent odd-even effects in photoinduced transitions to cholesteric and twist grain boundary SmC* mesophases, A new class of efficient boranil-like fluorescent benzoxazaborinines engendered from amino acid counterparts, Mesomorphic and dielectric properties of strategically designed chiral bent-core liquid crystals.

Important Highlights of Major Programmes:

- CeNS researchers have developed an affordable, energy-efficient glass window using a metal mesh electrode, thin WO_3 film, and Al^{3+} electrolytes and created a revolutionary electrochromic energy storage (EES) device with high switching contrast, area capacitance, and long cycling life. They developed a large-area smart window operating at 2 V, which powered a display.

- CeNS researchers have developed a stable and efficient electrochromic supercapacitor (ECS) using PMOANI polymer and WO_3 metal oxide. It showed stability and powered a timer display for over 20 minutes, indicating its potential as a power source. In the area of energy storage, CeNS researchers have reported a low-temperature synthesis of crystalline pyrite-FeS_2 through a solid-state annealing route, which was achieved using FeOOH, a metastable precursor, in the presence of H_2S gas. The as-synthesized pyrite FeS_2 was employed as an electrode for fabricating high-energy-density supercapacitors.

- Anode materials with fast charging capabilities and stability are critical for realizing next-generation Li-ion batteries (LIBs) and Na-ion batteries (SIBs). In LIBs, NbO_2 exhibited a specific capacity of 344 mAh g^{-1} at 100 mA.$g^{-1}$and stability over 1000 cycles, with 92% capacity retention and fast charging capability of 30s to reach a specific capacity of 83

mAh g^{-1}. For the SIB, NbO_2 exhibited a specific capacity of 244 mAh g^{-1} at 50 mA g^{-1} and showed 70% capacity retention after 500 cycles.

- Biotene, exfoliated from naturally abundant Biotite demonstrated a remarkable first-cycle specific charge capacity of 302 mAh g^{-1} for Li-ion and 141 mAh g^{-1} for Na-ion, with ~90% initial Coulombic efficiency. Impressively, the electrode displayed prolonged cycling stability, retaining ~75% capacity after 4000 cycles, even under higher current densities (500-2000 mA g^{-1}), marking a significant step towards the next generation of metal-ion battery anodes.
- It was studied that polyvinylidene difluoride (PVDF)-based piezoelectric tactile sensors with the addition of different nanofillers of zinc oxide and titania nanoparticles have improved piezoelectric performance with a maximum observed sensitivity of 10^3 mV/N for zinc oxide-incorporated devices. Flexible, and self-powered tactile sensors were realized using cost-effective fabrication mechanisms which are targeted towards implementation in the large area portions of prosthetic devices. Also, zirconia-polyvinylidene difluoride (PVDF) composite was employed to fabricate a security alert pavement unit. A wireless, Bluetooth-based security alert system supported by an Android application was developed and demonstrated as a promising application with the fabricated prototype.
- CeNS researchers have unveiled the UOR prowess of a rare earth nickelate - $NdNiO_3$ showcasing high urea electro-oxidation reaction (UOR) activity with a reduced burden of Ni mass loading for hydrogen generation. CeNS researchers have shown that 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 for a prolonged time in extensive alkaline conditions. The activated catalyst, $Ni(OH)_2$–Ni@CNT exhibits a TOF of 0.5 s^{-1} and Tafel slope of 30 mV/dec retaining activity for 60 h at ~75 mA/cm^2 in 1.6 M urea and 6 M KOH.
- An ultrathin alumina layer was introduced via atomic layer deposition (ALD) at the interface of $CsPbBr_3$/$CsPbI_3$ NC films. ALD alumina minimally affects structural or optical properties and restrains anion migration.
- CeNS researchers have developed an antimicrobial nanoformulation containing mixed metal oxides (MMO) of TiO_2, ZnO, SiO_2, CuO with silver nanoparticles (MMO-Ag) capped with a cationic surfactant. The nanoformulation exhibits excellent antimicrobial properties against gram-negative (E. coli), gram-positive (S. aureus) bacteria, and bacteriophage virus due to mechano-bactericidal effect and also shows self-cleaning properties on exposure to sunlight.
- Three-dimensional (3D) photonic crystals with complete photonic band gap (PBG) are fascinating due to the possibility of controlling light in all directions. Liquid crystalline cubic blue phases (BPs) called as soft 3D photonic crystals with complete PBG are achieved by doping with high refractive index nanoparticles.

Important Output Indicators:

Sr. No.	Parameters	Output
1.	Papers in Refereed Journals	63
2.	Papers in Conferences	02
3.	Number of PhDs Produced	08
4.	Indian patents Filed/Granted	11
5.	Number of Technology Leads Awaiting Transfers	01
6.	Technical Manpower Trained	10
7.	Research Manpower Trained (Other than Ph.D)	48
8.	B.Tech/UG Project Guided	01
9.	M.Tech/M.Sc/M.Phil. Project Guided	08

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

IACS focuses research in the areas of Biological Sciences, Chemical Sciences, Materials Sciences, Mathematical and Computational Sciences, Applied and Interdisciplinary Sciences and Physical Sciences.

Major Accomplishments:

- In the field of Applied and Interdisciplinary Sciences, the developments made were: Development of organic materials for energy storage / solid-state emission; Development of supramolecular functional materials / supramolecular polymers; Development of small molecule-based anticancer agents/morpholino antisense reagents; Development of non-peptide-based cellular transporter for the delivery of antisense reagents; Design/ fabrication of nanoelectronic and optoelectronic device applications.
- In the field of Biological Sciences, the developments made were: Self-aggregated lipid bases soft nanocomposites was identified as a theranostic agent for target-specific diagnosis and killing of cancer cells; Development of carbon dot-enabled starvation therapy in synergism with paclitaxel against breast cancer; Development of Self-assembling peptide-based soft materials for new antimicrobials and sustained release of drugs; Investigation of irreversible structural changes of single DS-DNA molecules by exogenous agents; Role of DNA repair enzymes in the nucleus and mitochondria in cancer chemotherapy is studied.
- In the field of Chemical Sciences, the developments made were: Development of Iron and Cobalt-based catalysts for hydrolysis of C-S bonds for desulfurization and oxidation

of organics with oxygen; Design and development of new strategies for novel organic transformations and synthesis of bio-active natural products.

- In the field of Material Sciences, the developments made were: Piezoelectric nanoparticle-based silica composite is developed for ultrasound-based water purification applications; Designed the synthesis of novel functionalized covalent organic frameworks for the separation of oil from oil-in-water microemulsion for adsorptive removal of pollutants from water; Development of a facile, scalable, and affordable synthesis process of 2D and Quantum materials; Design and development of efficient and stable energy harvesting and storage devices; Inorganic sulfides and metal oxide nanostructures decorated with 2D reduced graphene oxides are synthesized for supercapacitor applications; Different Halide perovskites have been investigated using crystal engineering for photocatalysis and solar cell applications.
- In the field of Mathematical and Computational Sciences, the developments made were: Reaction pathways related to hydrogenation of fullerene systems, C60, C70, and C36 via dehydrogenation of Ammonia–borane are analyzed; Dynamics of non-autonomous families of automorphisms of complex affine spaces is studied; 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 are proved.
- In the field of Physical Sciences, the achievements made were: Strongly correlated systems and statistical mechanics especially emergent and out-of-equilibrium aspects of many-body physics is studied; Investigated electronic structure calculations of novel magnetic systems, strongly correlated systems, low-dimensional quantum spin systems, magnetic properties of materials at the nanoscale, and disordered systems.

Important Highlights of Major Programmes:

- Scientist of IACS uncovered the fact that the pre-organization environment of the ATP hydrolysis reaction of kinesin-1 is critically dependent on the broken state of the Arg203-Glu236 salt bridge. This disruption is responsible for the HSP disease in humans.
- Three new Na-ion cathode materials are synthesized, performance is monitored in coin cell battery, and in-situ and ex-situ characterization is carried out to understand the mechanism behind the improved performance.
- 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 is designed and developed.

Important Output Indicators:

Sr. No.	Parameters	Output
1.	Papers in Refereed Journals	380
2.	Chapters in Books	10
3.	Papers in Conferences	30
4.	Number of Ph.Ds Produced	58
5.	Indian Patents Filed/Granted	08
6.	Research Manpower Trained (Other than Ph.D.)	60
7.	Technical Manpower Trained	09
8.	B. Tech/UG Projects Guided	23
9.	M. Tech/M.Sc./M.Phil Project Guided	61

5.7 Indian Institute of Astrophysics (IIA), Bengaluru

IIA focusses its Research and development on Astronomy and Astrophysics, Atomic Physics, Laser Physics and Astronomical Instrumentation development of facilities. The institute continues to be in the forefront of research and development, operates observatories and field stations across India, has a large academic program and outreach project.

Major Accomplishments:

- Polarized radiative transfer (RT) in three-dimensional (3D) media with angle-dependent partial redistribution (PFR), is solved for the first time. The results demonstrated that 3D RT is important for magnetic field diagnostics in the solar atmosphere.
- A comprehensive mid-infrared spectral catalogue of 126 Herbig Ae/Be stars is presented, expanding the database of young stellar objects. Their key findings include the detection of C60 bands at 17.4 and 18.9 μm in nine sources, with a notable 7.0 μm feature in HD 319896.
- Mechanism of gradient flows in information geometry describe geodesics, explore the related mechanics by introducing a constraint, and apply their theory to Gaussian model and black hole thermodynamics. They demonstrate how deformation of gradient flows leads to more general Randers–Finsler metrics, describe Hamiltonian mechanics that is derived from a constraint, and prove duality via canonical transformation.

- A newly developed MHD-based CME model SWASTi-CME is introduced and integrated into the Space Weather Adaptive SimulaTion (SWASTi) framework. It incorporates a non-magnetized elliptic cone and a magnetized flux rope CME model. Validation of the model's performance was done with in situ observation at L1 position.
- A novel numerical method was devised for solution for polarized transfer in spherically symmetric extended and expanding atmospheres including resonance line and electron scatterings with angle-dependent partial frequency redistribution (AD-PRD), and present the first numerical solution for this complex problem.

Important Highlights of Major Programmes:

ADITYA L1, the first Indian space solar mission of ISRO to observe the Sun and its outer atmosphere was successfully launched on 2nd September 2023 from Sriharikota. After multiple trajectory maneuvers, the spacecraft was placed in a halo orbit around the Lagrange point 1 (L1) of the Sun-Earth system on 6th January 2024. Currently different test observations are being carried out to check and calibrate the channels in Visible Emission Line Coronagraph (VELC). The VELC, one of the seven payloads onboard ADITYA L1, was designed and developed by IIA with help from different centers of ISRO. The 530.3 nm spectroscopic channel of VELC is now ready for routine observations.

Important Output Indicators:

Sr. No.	Parameters	Output
1.	Papers in Refereed Journals	176
2.	Chapters in Books	01
3.	Papers in Conferences	14
4.	Number of PhDs Produced	12
5.	Technical Manpower Trained	483
6.	M.Tech/M.Sc/M.Phil. Project Guided	38

5.8 Indian Institute of Geomagnetism (IIG), Mumbai

The Institute focuses its research on Earth Sciences - Environmental Magnetism and Paleoseismology, Probing the Lithosphere of Indian sub-continent and adjoining seas using gravity and magnetic signatures for structural mapping, Tectonics and Resource evaluation with emphasis on Deccan Volcanic Province, Hydrogeophysics & Water Chemistry, Archaeomagnetism, Polar Research, Forecasting of Geomagnetic Activity using real-time data assimilation, Lithosphere-Atmosphere-Ionosphere Coupling, Atmospheric Dynamics, Ionospheric Irregularities and Dynamics, Space weather, Theory and simulation of plasma processes in Earth's and other planetary environments.

Major Accomplishments:

- A new method is developed to compute true height profiles from ionograms by tracking the propagation path of radio waves over time, avoiding predefined polynomial functions and associated fitting errors. This Iterative Gradient Correction (IGC) method yields more accurate profiles than the widely used POLAN, especially at cusp and F2-peak regions, and performs best with high-resolution ionograms, being less sensitive to scaling errors.
- An advanced photogrammetric technique is used to analyze all Sky Imager night airglow observations from Kolhapur during March to May from 2016 to 2019. Image processing enhances target visualization and removes noise. The analysis shows systematic changes in pre-monsoon cloud fraction and movement direction, suggesting climate warming in the Northern Hemisphere may affect monsoon patterns and cause hydro-climatic changes.
- Cyclone Fani in 2019 exhibited extreme convection and lightning activity, especially in its outer rain bands. The lightning generated atmospheric gravity waves (AGWs), disturbed the ionosphere. VLF signal analysis showed increased AGW activity in the ionosphere during Fani, emphasizing the role of lightning in ionospheric perturbation.
- Ground magnetic data collected and interpreted by IIG between 72° to 78°E longitude and 16° to 20°N latitude provided valuable insights into sub-basalt structures. A recent ground magnetic survey within 20° to 22.5°N latitude produced the first crustal magnetic anomaly map of the DVP. This map reveals the westward continuation of the Main Peninsular Shear, several NW-SE and NE-SW lineaments, and high-frequency anomalies related to traps, suggesting a block-like geometry within the DVP. These findings update the composite magnetic anomaly map of India and adjoining regions published in 2006.

Important Highlights Major Programmes:

- The intense Equatorial Spread-F (ESF) over India, believed to be triggered by atmospheric-ionospheric perturbations on the 15 January 2022 from Hunga Tonga Hunga Ha'apai volcanic eruption is examined. The findings from the Canadian Advanced Digital Ionosonde data at Tirunelveli and Prayagraj, reveal simultaneous ESF at equatorial and low-mid latitude stations, likely induced by Lamb waves from the volcano. Iso-frequency analysis at Tirunelveli indicates gravity wave-like oscillations seeding ESF. GPS-TEC observations show dominant Traveling Ionospheric Disturbances similar to Lamb wave propagation.
- Growing concerns over particulate matter (PM) and declining air quality, linked to chronic health issues, have increased public awareness. By analyzing 111 samples from Paryagraj, Uttar Pradesh, from dust, soils, and leaf dust using a bio-monitoring approach, significant correlations were found, categorizing road sections into low, moderate, and high pollution zones. Vehicular traffic, especially along highways and intersections, is

identified as the primary pollution source. The study emphasizes the need for strategic environmental protection measures in Prayagraj's eastern region.

- The study examines the impact of solar variability on the Indian summer monsoon through large-scale circulations. Results show significant correlations between DMI and ISMR, AMO and ISMR, and negative correlation between Niño 3.4 SST and ISMR. Hadley cell circulation indicates stronger circulation over India during solar maximum, shifting northward during minimum. Strong low level jet is observed during maximum, while tropical easterly jet prevails during minimum. Regional rainfall patterns vary between solar maximum and minimum, with a weakening of the local Hadley cell during minima.

Important Output Indicators:

Sr. No.	Parameters	Output
1.	Papers in Refereed Journals	60
2.	Chapters in Books	11
3.	Papers in Conferences	47
4.	Number of PhDs Produced	06
5.	Technical Manpower Trained	09
6.	B.Tech/UG Project Guided	02
7.	M.Tech/M.Sc/M.Phil. Project Guided	14

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

The institute focuses on five research programs: Basic & Applied Plasma Physics; Advance Material Sciences; Mathematical & Computational Sciences; Biodiversity & Ecosystem Restoration Programme; Traditional & Modern drug discovery & diagnosis.

Major Accomplishments:

- A new nanogenerator device developed for harvesting light energy using organic material has the potential to power wearable devices on the go. The device boasts a fast response time of a few tens of milliseconds. The device holds potential for the development of various self-powered sensors for applications in healthcare and optoelectronics.

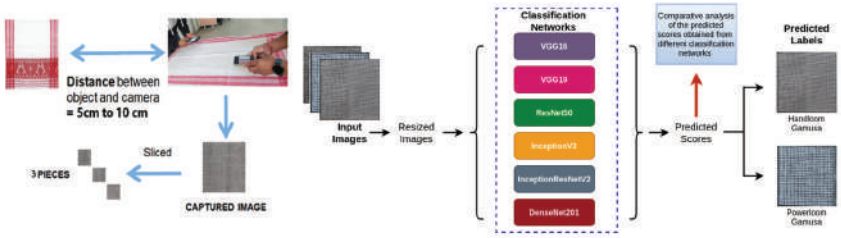
- Cyanoglycoside modified flexible superhydrophilic protein films with a high rate of transparency were successfully prepared from lysozyme and glycerol with varying amounts of amygdalin. Such superhydrophilic film show excellent antifogging and self-cleaning behaviours.

- A bio-composite, made of Banana fibre, chitosan and guar gum has been developed as an alternative and cost effective wound healing material which is biodegradable, bio-compatible as well as cyto-compatible. A green, robust, edible, chemically resistant

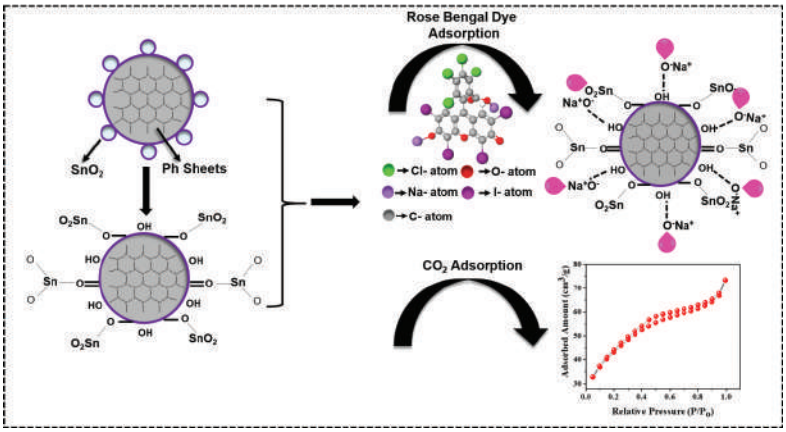
Mushroom based Nanofiber Composite Xerogel film has been developed which can also be used as a substrate for printing technologies, widening the scope of their use in packaging materials.

Important Highlights of Major Programmes

- The institute prioritizes research on recent advancements in molecular biology and interdisciplinary studies to develop immune modulators, bioengineered materials, phytomolecules, snake venom peptides and plasma therapies.
- A computer-assisted approach for automated differentiation between authentic handwoven "*gamucha*"s and counterfeit powerloom imitations—a groundbreaking recognition method has been developed. The methodology presented not only holds scalability potential and opportunities for accuracy improvement but also suggests broader applications across diverse fabric products.



- A deep-learning non-linear statistical model is created to train on the relationship between the predictor and predictand from a large ensemble of Atmosphere-Ocean General Circulation Models and past observational dataset, demonstrating the capability of identifying the significant precursors in the predictor across the entire tropical basin for generating skilful forecasts of the predictand at one month lead.
- A phosphorene-metal oxide composite made of phosphorene and SnO_2 was successfully synthesized which can very effectively adsorb CO_2 and hazardeous dye.



Important Output Indicators:

Sr. No.	Parameters	Output
1.	Papers in Refereed Journals	97
2.	Books Published	02
3.	Chapters in Books	16
4.	Papers in Conferences	57
5.	Number of PhDs Produced	13
6.	Indian patents Filed/Granted	17
7.	Technical Manpower Trained	102
8.	Research Manpower Trained (Other than Ph.D)	04
9.	B.Tech/UG Project Guided	11
10.	M.Tech/M.Sc/M.Phil. Project Guided	30

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

Research activities at 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.

Major Accomplishments:

- A dual-mode chemo-sensor is developed based on a molecular capsule for the selective detection of dopamine. Test strips incorporating the molecular capsule, exhibited visual colour and fluorescence changes in the presence of micro-molar concentrations of dopamine under physiological conditions.
- INST's scientist have designed for the first time a biologically relevant minimalist Cardin-motif peptide capable of binding ECM-derived glycosaminoglycans and explored Cardin-motif peptide and heparin-based biomolecular matrix by employing simple noncovalent interactions at the molecular level.
- Scientists of INST developed a green route for gold nano dendrite synthesis involving autologous serum proteins as both a template and stabilizer. These nano dendrites, also termed 'Plasmonic NanoSera' (PNS), possess a substantial extinction cross section in the near-infrared spectral regions. With a photothermal conversion efficiency of ~58%, PNS-mediated photothermal therapy suppressed tumor growth in a breast tumour model.

- A newly synthesised biocompatible therapeutic nano-micelle drug delivery system combined with anti-inflammatory drugs has been shown by INST researchers, having improved potential to cure rheumatoid arthritis at the lab level. It can help ameliorate the pain associated with the disease as well as cure the disease by restoring cartilage integrity which provides the flexibility to the bone.
- INST scientists have developed a catalyst by engineering hydrophobic–aerophilic interfaces to boost electrochemical N2 reduction to ammonia with very high (50%) Faradaic Efficiency. Photocatalytic CO_2 photo-reduction integrated with biomass oxidation, is attempted using metal-free catalysts, which are highly attractive to produce fuels and fine chemicals on a larger scale.
- INST scientist have reported extensive range of tunability achievable from a single 2D SnNBr structure emphasize the critical need for its experimental synthesis in cutting-edge applications such as futuristic nano piezotronics, electromechanical memories, smart robotics, and self-adaptive nanoelectronic devices. INST's researchers have developed excitation dependent luminescent nanomaterials for multimode anti-counterfeiting.

Important Highlights of Major Programmes:

- The major goal of Energy and Environment (EEU) unit is currently working on clean and sustainable energy solution for the present and future generation. Major research activities includes hydrogen production through photocatalytic, electro-catalytic and photo-electro chemical water splitting, carbon dioxide conversion to fine chemicals and fuels, energy storage devices, Hybrid energy storage and conversion device, apart from converting waste materials for energy applications. This unit also performing extensive activities on carbon nanomaterials, DNA based nano structures, framework materials, inorganic materials, organic & supramolecular materials and Optoelectronics.
- The "Quantum Materials and Devices Unit" is working on both experimental and theoretical research related to computational nanomaterials, thin films and 2D materials growth, spintronic and magnetic studies, Microfluidic and renewable energy devices.
- In the Chemical Biology Unit is working on the areas of subcellular nanostructures, epigenetic regulation of disease, nano immunotherapy, cancer nano-therapeutics, in-vivo imaging, soft peptide based nanostructure, tissue regeneration, nano-toxicology, photo-thermal therapy.
- INST has created a Nanobio incubation center, a Technology Business Incubator at INST Mohali. Currently, this incubation center is running through the project mode and a few projects are running by the scientists of INST, using this incubator facility and also the central instrumental facility of INST to develop end products for future translational application and technology transfer.

Important Output Indicators:

Sr. No.	Parameters	Output
1.	Papers in Refereed Journals	272
2.	Books	02
3.	Chapters in Books	28
4.	Number of PhDs Produced	26
5.	Indian Patents Filed/Granted	09
6.	Technical Manpower Trained	24
7.	Research Manpower Trained (Other than Ph.D)	46
8.	B.Tech/UG Project Guided	09
9.	M.Tech/M.Sc/M.Phil. project Guided	35

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

The institute is mainly focused in translational research in the areas of Automotive Energy Materials, Solar Energy Materials, Nanomaterials, Engineered Coatings, Ceramic Processing, Laser Processing of Materials, Fuel Cells, Carbon Materials.

Major Accomplishments:

- Know-how document pertaining to *'Transfer of Know-how for novel powder metallurgy process for fabricating dispersion strengthened tungsten plates technology*' was handed over to M/s Innomet Advanced Materials Pvt. Ltd.
- Altmin Pvt. Ltd., Hyderabad has set up a pilot plant facility for the '*Production of Lithium Iron Phosphate (LFP) battery material*' at ARCI's Advanced Materials Technology Incubator (AMTI). The facility was inaugurated on August 18, 2023. Also, technology Know-How Document for *Making LFP cathode powder material for Li-ion batteries (exclusive Rights in Territories other than India)'* was handed over to M/s. ALTMIN Pvt Ltd., Hyderabad.
- Tungsten weight balancing components fabricated at ARCI have obtained the provisional air-worthiness certification. EBPVD based Thermal Barrier Coatings on Single Crystal HP turbine blades of HAL-AERDC, Bengaluru were successfully deposited and evaluation in progress at HAL.

- A prototype for hard chrome replacement Nickel based alloy coating (by Pulsed Electro-Deposition) inside the actual gun barrel has been developed.
- The splitter plates of burner nozzle tips of a 200 MW boiler at NTPC's Farakka thermal power plant have been coated with Laser Clad-Coating Technology. Over a four-year period (Feb 2020 -Dec 2023), tests showed that the durability of the coated plates exceeded that of the base metal demonstrating the superior performance of the coating over conventional ones.
- Laser-assisted turning and milling processes were developed for nickel-based superalloys and compared with conventional methods, showing enhanced tool life. Sol-gel based coating developed on arc chute components for prevention of degradation of thermoset plastics facing arcing temperature, have successfully completed electrical endurance test of 10,000 cycles till date.
- Developed a highly conducting graphite foam for heat spreading application and also developed graphite-based piston rings for strategic sector that are undergoing real time testing.
- Demonstrated (in-house) charging of supercapacitor with regenerative breaking system for possible application in hybrid electric vehicles (e-rickshaws). Developed a spinel nanoparticle based thermic fluid for heat transfer and direct solar absorption application.

Important Highlights of Major Programmes:

- LiB Cells with a novel-top-lid assembly as a single component was designed and developed to facilitate degassing, robustness, safety and reduce production time of the cylindrical LiB cells. LFP cathode materials produced in large scale and was supplied to technology receiver and parallelly to M/s WMG, Warwick, UK who validated the material.
- ARCI developed Polymer Electrolyte Membrane Fuel Cell (PEMFC) using air cooled and open cathode for charging and other mobile applications. A large-scale AR-Coating demonstration at the industrial roller coating process at Borosil Renewables Ltd, Gujarat was carried out.
- ARCI prepared 70,000 litre coating sol for the production of 100000 m^2 of highly transparent Solar Cover Glasses. A cost effective and efficient nanocomposite PCM-based cascade latent heat thermal energy storage prototype system was developed and investigated for steam generation.
- A 50mm x 50mm size, prototype perovskite solar module with 12% efficiency was developed by printing method and its continuous operation in an outdoor environment was successfully demonstrated.
- HVAF coatings were demonstrated for the following: Refurbishment of critical parts of marine gas turbine; Hard and impact resistant coatings for extrusion of seamless tubes

used in boiler plants; Thin & hard wear-resistant coatings for nuclear submarine shaft sleeves; Coatings for ball valves & seats assembly.

- An indigenously developed sensing device and associated instrumentation was demonstrated for real-time integrity assessment of power plant components that is susceptible to high temperature and creep damage detection of superalloys.
- Established an automated Polymer Electrolyte Membrane Fuel Cell (PEMFC) line to produce stack up to 100kW/year, which is a first of its kind in India, focused on mass manufacturability of the PEMFCs, its components, standardization and simplification for possible practical application of PEMFCs in India. The stacks being fabricated employ in-house developed catalyst coated membrane, electrocatalyst, gas diffusion layer and bipolar plates.
- Grain boundary diffusion (GBD) process is one of the novel and commercially viable techniques to develop high coercive Nd-Fe-B magnets with very less/no heavy rare earth elements. ARCI has developed various techniques and GBD agents suitable for enhancing coercivity in commercial sintered magnets and found that GBD process carried out on Ce containing Nd-Fe-B offers the dual advantage of enhanced coercivity and corrosion resistance. This finding is significant for India, as the country has abundant reserves of rare earth ores containing cerium.

Fig. Automated PEMFC Components Stack Fabrication Pilot Line

Fig. Development of lid assembly for Li-ion cell, large scale milled LFP cathode material, PEMF C (30 W) using air cooled and open cathode, and rotary calciner for the bonded magnets

- Soft Tissue Anchors (STAs), are implants used widely for sports injuries and repairing tendon, ligament, and cartilage damage. Biodegradable (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. ARCI has developed Fe-Mn and Mg-Zn alloys through vacuum induction melting. Fe-Mn powders suitable for additive manufacturing of biodegradable and STAs were synthesized by inert gas atomization. About 23 kg of Fe-Mn powders were supplied to 3D WIPRO for validation, and approximately 2 kg were utilized for process parameter optimization using powder bed fusion technique at ARCI. The design of STAs suitable for powder bed fusion additive manufacturing was prepared in collaboration with the German partner.

Important Output Indicators:

Sr. No.	Parameters	Output
1.	Papers in Refereed Journals	113
2.	Chapters in Books	03
3.	Papers in Conferences	15
4.	Number of PhDs Produced	11
5.	Indian Patents Filed/Granted	33
6.	Foreign patents Filed/Granted	10
7.	Number of Technology Leads Awaiting Transfers	22
8.	Number of Technologies/Designs and other IP Commercialized	20
9.	Technical Manpower Trained	82
10.	Research Manpower Trained (other than Ph.D)	41
11.	B.Tech/UG Project Guided	86
12.	M.Tech/M.Sc/M.Phil. Project Guided	27

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

The Centre focuses its research on Chemistry and Physics of Materials, Engineering Mechanics, Evolutionary and Integrative Biology, Geodynamics, Molecular Biology and Genetics, Neurosciences, Theoretical Sciences, and New Chemistry.

Major Accomplishments:

- Theoretical Sciences Unit identified a quantum-based model system for a better understanding of new materials. The Chemistry and Physics of Materials Unit have identified a unique mechanism of electric polarization via magnetic ordering in a novel mineral named "$MnBi_2S_4$", which can be useful for energy-efficient data storage.
- A novel & highly efficient photocatalyst is synthesized that can convert carbon dioxide to high-value products, ethene and ethylene, which are used as fuel gases and also for the polymer industry.
- A material is synthesized 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.
- A precise atomic rearrangement is explored that occur in each phase transition of lead iodide perovskites due to altered temperature & pressure and their resulting effects on optoelectronic properties are studied.
- JNCASR is one of the top 4.6% of 19,788 universities globally, according to the latest World University Rankings. On the national front, JNCASR secured 30th rank in the "*Research Institutions*" category, as per recent NIRF rankings 2023. Further, JNCASR ranked 1st among the "*Research Institutions"* category out of 30 pilot institutions under DST GATI project and one among 12 successful institutions recognised as *GATI Achiever*. Several of our faculty members have received national and international honours and accolades in recognition to their remarkable scientific research this year.

Important Highlights Major Programmes:

- In the academic year of 2023-24, 121 students were enrolled to various degree programmes at the Centre - Ph.D.- 49, M.S. (Engg.)-02, Int. Ph.D. in Biological Science-08, Int. Ph.D. in Physical Science-18, Int. Ph.D. in Chemical Science-05, M.Sc. Chemistry-14, M.Sc. Inter-disciplinary Biosciences-20 and PGDMS-05. The current student strength at JNCASR is 373.
- JNCASR organised Industry Academia Meet on 22nd September 2023 which was

participated by 25 academic institutions and industries from Bengaluru and adjoining states engaged in the fields of health, energy, agriculture, services, life sciences, & manufacturing.

- The Education Technology Unit at JNCASR organised 16 science outreach programmes during the year 2023-2024 for school and college students and teachers across the country. The faculty members of the Centre and other scientific institutions presented popular science lectures for the students and clarified their doubts during the sessions.

Fig.: Science Outreach Programme - *Interactive Lecture Program in Geoscience*

Fig. Science Outreach Programme - *Fun with Science Experiments and Lab Visits*

Important Output Indicators:

Sr. No.	Parameters	Output
1.	Papers in Refereed Journals	263
2.	Books	1
3.	Chapters in Books	21
4.	Number of PhDs produced	27
5.	Indian patents Filed/Granted	8
6.	Foreign patents Filed/Granted	5
7.	Number of Technology Leads Awaiting Transfers	59
8.	Number of Technologies/Designs and other IP commercialized	02
9.	Technical Manpower Trained	15
10.	Research Manpower Trained (Other than Ph.D)	119

5.13 Raman Research Institute (RRI), Bengaluru

The institute focuses research on Astronomy and Astrophysics, Light and Matter Physics, Soft Condensed Matter and Theoretical Physics.

Major Accomplishments:

- A cluster of labs at RRI are at the forefront in developing quantum-enabled technologies, efforts of which have now got extended to the Institute's proposed participation in the National Quantum Mission (NQM).
- Scientists of the Quantum Information and Communication lab and their collaborators achieved a breakthrough research, involving demonstration of wave-and-particle-like properties of a photon. Further, the lab addressed the distortion of photon polarization over long distances, which is best applied in establishing secure long-distance communication using Quantum Key Distribution. Extending its expertise in quantum communications, RRI has decided to work towards the development of secure maritime communications for the Indian Navy.
- The Quantum Optics with Rydberg Atoms Lab performed India's first Rydberg atom experiment to demonstrate Rydberg excitation in cold atoms in a lab. This has the potential to open new avenues for Quantum Technologies with cold Rydberg atoms in India.
- As the sole Indian scientific representation involved in the Antihydrogen Experiment: Gravity, Interferometry, Spectroscopy working at CERN, Geneva, the Quantum Interactions Lab at RRI was involved in the experiment which achieved the first ever laser cooling of positronium.
- A research lead by scientists of RRI described an indigenously built experiment facility capable of simultaneously cooling and trapping of sodium and potassium atoms. They also developed a new image-correction technique capable of getting better images during the study of cold atoms or atoms at absolute zero temperature, enabling advanced study of the quantum mechanics-governed properties of atoms at cold temperature better.

Important Highlights of Major Programmes:

- The Indian X-ray Polarimeter (POLIX) -- conceived, designed and built at RRI -- was the primary payload onboard X-ray Polarimeter Satellite (XPoSat) mission launched on 1st January 2024 by ISRO. XPoSat is the first global X-ray mission to operate in the 8 – 30keV energy band and has successfully obtained first light.
- Ongoing efforts in search of the first light / signals from when the first stars and galaxies formed in the Universe, the radio astronomy team at the Institute undertook two successful

deployments in search of Radio Frequency Interference (RFI) – free sites. RRI led India's first winter scientific expedition to the Arctic and to the Andaman and Nicobar Islands and studies showed both to be potential sites for future experiments. As a space counterpart (with ISRO) to the above, a detailed mission concept and baseline design of a radiometer to be placed on the pristine radio quiet regions in space were completed.

Important Output Indicators:

Sr. No.	Parameters	Output
1.	Papers in Refereed Journals	108
2.	Papers in Conferences	02
3.	Number of Ph.Ds. Produced	15
4.	Indian Patents Filed/Granted	01
5.	Research/ Technical Manpower Trained (Other than PhDs)	94

5.14 Sree Chitra Tirunal Institute for Medical Sciences and Technology (SCTIMST), Trivandrum

The research areas of the institute are focused on Biomaterials Research and Development, Biomedical Device Development, Applied Biology, Technology Transfer and Industrial Partnerships, Quality Management Systems, Testing and Technical Services, Research, Advanced Patient Care in Clinical Super-specialties in Cardiac and Neuro Sciences along with Human Resource Development in the above said areas and Public Health.

Major Accomplishments:

- AG Chitra Tuberculosis diagnostic kit developed by Sree Chitra Tirunal Institute for Medical Sciences and Technology (SCTIMST), Trivandrum was launched at a formal function held at its Biomedical Technology wing campus. This kit is developed as an open platform system to provide affordable, fast, and accurate diagnosis of pulmonary tuberculosis. The technology has been licensed to M/S Agappe Diagnostics in Kochi.
- Central Drugs Standard Control Organization (CDSCO) approval obtained for commercialization of the following products: The spot tuberculosis kit, commercialised by Agappe Diagnostics; The mammalian wound dressing kit, commercialised by Alicorn Medicals Pvt Ltd.
- Percutaneous valve-in-valve mitral valve interventions and Mitra clip procedures were started by Cardiology; 75 TAVR (Transcatheter Aortic Valve) procedures were done, which is one of highest in the country. Pilot study of second generation Titanium Chitra Heart Valve Study (TC2) was done in 40 patients without complications.
- SCTIMST, Kerala State Higher Education Council (KSHEC), and Kerala Medical

Technology Consortium (KMTC) jointly organized an International Conference cum Hands-on Workshop in Biomedical Translational Research during 03 - 04 August 2023.

Important Highlights of Major Programmes:

- "HEATS" (Hospital Equipment Awareness Training Series) for imparting advanced technical training on various medical equipment and 'know your medical device' series were conducted. The Department of Anaesthesia organized a two-day CME and workshop on 'Comprehensive Monitoring of Patients in Neurocritical Care' on 13 and 14 January 2024 under the Department of Health Research and ICMR, Government of India.
- The Institute organized "SCTIMST Open Day 2024' on 23rd February, 2024. The Biomedical Technology Wing was opened to students, researchers, facility, health practitioners, the medical device industry and general public on this day to get exposed to the world of medical device development, health and public health related activities. More than 1000 participants visited the campus on this occasion.
- A state-of-the-art radiology Biplane Cath Lab was inaugurated. Day care ward started for day care services. Combination devices block became functional in the Biomedical Technology Wing for translation of devices where a combination of disciplines are required for technology development. Fontan clinic for pediatric cardiac disorders, and Heart in pregnancy clinic were started. Software programs were developed for day care procedures, billing section and accounts section. A dual degree DM/MCh with PhD course was started for the first time in India. A genetic neuromuscular clinic was established under Department of Neurology.

Important Output Indicators:

Sr. No.	Parameters	Output
1.	Publications in Refereed Journals	295
2.	Chapters in Books	21
3.	Papers Presented in Conferences	385
4.	Number of Ph.Ds. Produced	20
5.	Foreign Patents Filed/Granted	01
6.	Indian Patents Filed/Granted	79
7.	Number of Technologies/Designs Translated	10
8.	Number of Technology Leads Awaiting Transfer	04
9.	Research Manpower Trained: 162	162
10.	Technical Manpower Trained	318
11.	M.Tech/M.Sc./M.Phil/MPH Projects Guided	76

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

Areas of focus of the Centre are research on 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.

Major Accomplishments:

- A pattern-recognition based method has been developed for non-invasive diagnosis and classification of various gastric conditions. The new method exploits cluster analysis of breathomics dataset generated from the patented "Pyro-Breath" technology.
- Spectroscopic studies have been utilized to study the self-aggregation of citrate functionalized gold nanoparticles in presence of lead. The key findings will pave the path towards the development of low-cost lead sensor for monitoring of lead pollution in the ecosystem.
- A set up to measure the conductance of a single molecule through electronic transport measurements was designed by suspending an organometallic molecule (Ferrocene) between two gold electrodes on a flexible substrate. In this process it is observed that a highly conducting junction can be tuned by a mechanical gate like a transistor.
- In research related to the emerging phases in 2D ferromagnet it is observed that a unique electronic phase is emerging due to the spin reorientation transition in a van der Waal ferromagnets, Fe_4GeTe_2, exhibiting unusual electronic transitions leading to distinct transport behavior. Furthermore, those unveil the unusual temperature dependent anisotropy via ESR measurement.
- In research related to Correlation and Topology in charge density wave system, an unusual magneto-transport is observed in a topological semimetal which provides important insight about correlation-driven topological transitions. In LaAgSb2, featuring a square net crystal structure, multiple CDW transitions occur as temperature decreases. Large planar Hall (PHE) signals are found in the CDW phase, indicative of a chiral metallic phase, breaks the inversion symmetry and further leads finite PHE.
- Optoelectronics with 2D materials: A highly responsive broadband photodetector by tuning the light matter interaction in 2D/0D hybrid. By incorporating the PVP coated silver nanoparticle on WS_2 nanosheets, they have been able to observe tunable exciton-plasmon coupling, further leading to enhance optoelectronic performance.

- Hardy's argument constitutes an elegant proof of quantum nonlocality. Exotic applications of Hardy's nonlocal correlations in two-party communication setup exist in the literature. It has been shown that there exist such reverse zero-error channel simulation tasks where nonmaximally entangled states are preferable over the assistance with a maximally entangled state, even when the former states carry an arbitrarily small amount of entanglement. This research establishes that within the operational paradigm of local operations and limited classical communication the structure of entangled resources is even more complex to characterize.
- Nonlocality is considered to be the most striking feature of correlations present in space like separated events which has many practical applications in the quantum world. A protocol to distil nonlocality to significantly high degree starting from arbitrarily weak quantum nonlocal correlation has been proposed. It has several interesting facets: It demonstrates that a set of distillable quantum correlations has nonzero measure in the full eight-dimensional correlation space; it can distil quantum Hardy correlations by preserving its structure; it shows that (nonlocal) quantum correlations sufficiently close to the local deterministic points can be distilled by a significant amount. Finally, it also demonstrates efficacy of the considered distillation protocol in detecting postquantum correlations.
- Quantum materials with non-Kramers doublets are a fascinating venue to realize multipolar hidden orders. Impurity probes which break point group symmetries, such as implanted muons or substitutional impurities, split the non-Kramers degeneracy and exhibit a Janus-faced influence in such systems: they can destroy the very order they seek to probe. In research related to the quantum materials explores this duality in cubic osmate double perovskites which are candidates for exotic d-orbital octupolar order competing with quadrupolar states. This work also unravels this Janus duality in recent impurity nuclear magnetic resonance (NMR) experiments, with important implications for uncovering hidden order in diverse multipolar materials.
- The centre has started working to establish one Astronomical Observatory on Panchet hilltop, Purulia, West Bengal. The preliminary median seeing values are found in the range of 1.1 – 1.8 arcseconds which is very exciting and comparable to the values in typical astronomical sites across India. For detailed characterization of the weather and sky conditions, an Automatic Weather Station and a Mobile Observatory along with a Telescope Control Cabin have been installed at the hilltop. A Differential Image Motion Monitor (DIMM) system consisting of a 12-inch telescope along with necessary instruments, have been set up inside the Mobile Observatory to measure the ‘astronomical seeing’ at the hilltop.

Fig. Top-left panel: Mobile Observatory (Top-Left panel); Automatic Weather Station installed (Right panel) installed at Panchet hilltop, Purulia; 12-inch telescope inside the Mobile Observatory (Bottom-Left panel)

- In a study related to the vortices in a rotating holographic superfluid with Lifshitz scaling. This study indicates surprising results regarding dissipation in such a holographic superfluid. It is found that higher winding number vortices increase with higher values of imaginary chemical potential for values of z in the open interval (1, 2). This result is remarkable because it asserts that dissipation in the rotating holographic superfluid increases in the presence of Lifshitz scaling.
- Analytical investigation of the properties of s-wave holographic superconductors in the background of a massive gravity theory in the probe limit has been carried out by employing the Sturm–Liouville eigenvalue method. The results show that as one keeps on increasing the coupling parameters of the massive gravity background, the band gap energy increases compared to the holographic superconductors constructed in the Einstein gravity background. The results indicate that massive background is more favorable than Einstein gravity background for constructing a gravity dual of the strongly coupled superconductor as it enhances the value of the critical temperature.

Important Highlights of Major Programmes:

- International Conference on Photonics, Quantum Information, and Quantum Communication (ICPQIQC-2024) was held during January 29 - February 02, 2024. The five-day conference to commemorate one hundred years of Bose Einstein Statistics. The conference had brought out theoretical aspects as well as possibilities of practical applications of 'new quantum mechanics'. Speakers were invited from UK, USA, Germany, Australia, Japan, Spain, Hong Kong and different states of India, to make the five-day conference a buzzing hub for mutual inspiration and exchange of new ideas.
- S. N. Bose Centre hosts the state-of-the-art and unique Supercomputing facilities. Establishment of 838 TF Supercomputing Facility under the National Supercomputing Mission (NSM) jointly steered by the Ministry of Electronics and Information Technology (MeitY) and the Department of Science and Technology. S. N. Bose Centre's High Performance Computing facility was listed within top 50 supercomputers (CRAY XE6 and CRAY XC50) in India based on the survey carried out by CDAC Bengaluru. The cluster has a theoretical performance of 222.40 TF catering the computational need of the vibrant computational activity of the Centre.

Fig. Supercomputing Facility

Important Output Indicators:

Sr. No.	Parameters	Output
1.	Papers in Refereed Journals	234
2.	Papers in Conferences	02
3.	Number of PhDs Produced	31
4.	Indian patents Filed/Granted	14

Sr. No.	Parameters	Output
5.	Number of Technology Leads Awaiting Transfers	06
6.	Number of Technologies/Designs and other IP Commercialized	07
7.	Technical Manpower Trained	16
8.	Research Manpower Trained (Other than Ph.D)	40
9.	B.Tech/UG Project Guided	01
10.	M.Tech/M.Sc/M.Phil. Project Guided	26

5.16 Wadia Institute of Himalayan Geology (WIHG), Dehradun

The Institute is mandated to carry out fundamental and applied research to comprehend the surface and subsurface processes in the Himalaya using different disciplines of Geosciences: structural geology, geophysics, petrology, sedimentology, biostratigraphy, earthquake geology, engineering geology, hydrology, riverine science, glaciology, AI/ML to shed light on Geodynamics and mountain-orogeny, Geo-hazards (earthquakes, landslides, glacial hazards and avalanches, flash floods), Geo-resources (hydrocarbons, minerals/ orebodies, geothermals, cold springs), glacial dynamics, biotic evolution, climate-tectonics, etc.

Major Accomplishments:

- Research led by scientists of WIHG showed that Lithospheric evolution of the Himalaya witnesses the subduction of Indian continental crust penetrating beneath the Eurasian plate and equilibrated in the ultrahigh-pressure condition, as a consequence of the failure at the leading edge of the Indian plate following the upward trajectories through the subduction channel and exhumed back at the mid-crustal level.
- Scientists of WIHG deciphered the geometry and kinematics of subsurface structures that classified the geologic formations with special reference to the Tipam and Barail litho-units of northeast India, based on artificial intelligence and machine learning (AI/ ML).
- Studies on the ground and analyses of high-resolution LiDAR data show that chronic slides in the Joshimath region are attributed to several contributing factors, out of which the role of surface and sub-surface water is seen to play a significant role.
- The inter-seismic geodetic observations from the frontal part of the Siwalik hills as well as within the Dehradun basin show that the crust is undergoing periodic annual and semi-annual loading/unloading in both vertical and horizontal components apart from their secular variations.

Important Highlights of Major Programmes:

- The magnetotelluric investigation along the Rohtak-Delhi section characterizes the junction of the contact zone of Delhi Hardwar Ridge (DHR) and Delhi-Sargodha Ridge (DSR). The DHR has been found striking NE-SW with a very shallow central axis (less than 400 m) having a width of 12–15 km forming half grabens on both limbs supported by shallow faults. The seismicity in the Rohtak and surroundings is located at the bifurcation points of DHR and DSR and at a reverse fault.
- Sedimentary structures have been imaged in the western part of the Indo-Gangetic Plain that reveal soft alluvials with extremely low shear wave speed at the top ~400-700 m of the surface which is useful information for earthquake hazard estimation in the highly populated cities over the IGP.
- For the first time, a diverse assemblage of micro-mammals has been reported from the Siwalik sediments exposed around Pathankot District. The taxonomic assessment provides useful information on the age of the fossiliferous locality. Also, a significant assemblage of Ichnofossils has been described, for the first time, from the Miocene Siwalik sediments These ichnofacies indicate well-oxygenated, low-energy deposition exposed to air and represent the fluvial environment.
- Glaciological investigations reveal a 61% increase in the total area of supraglacial lakes (SGLs) over the three decades, with the most notable growth occurring in the last decade (2010-2020).

Important Output Indicators:

Sr. No.	Parameters	Output
1.	Papers in the Refereed Journals	112
2.	Number of PhDs Produced	16
3.	Research Manpower Trained (Other than PhDs)	341
4.	Lecture/Conference/workshops organized	61

5.17 National Innovation Foundation (NIF), Ahmedabad

The areas of focus of National Innovation Foundation (NIF) includes 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.

Major Accomplishments:

- Improved prototypes of 34 technologies were developed in the Fab Lab of NIF. Few of these technologies include Bed with integrated wheel chair, Pepper Thresher, Vegetable Deseeding Machine and Sugam Walker are ready for mass manufacturing and 17 technologies were validated in different laboratories/universities.
- Station trials of 27 varieties and 11 herbal technologies were carried out at sixteen research institutes. Further, Advanced Varietal Trials (AVT) of five plant varieties were undertaken with the support of ICAR-AICRP centers on vegetables. Farmers' participatory On-Farm Trials for Guava, Cauliflower, Turmeric, and Onion were conducted at 337 farmers' field in 15 states.
- In-vitro bio-efficacy testing of six potential herbal leads were conducted using different solvents based on their polarity index. The antifungal efficacy of the potent leads are identified. A total of 11 herbal technologies were also tested against Apple scab, Brinjal pests, and Coconut weevil. Clinical trials for value added indigenous six herbal formulations were held in treatment of blood pressure, Cataract, Osteoarthritis and in controlling obesity.
- A poultry herbal outstanding traditional knowledge practices was standardized for dosage and demonstrated positive influence on growth performance of broiler chicks. It had shown better liveability percent, Better Villi: Crypt ratio thereby enhanced digestibility of nutrients.
- With the objective of celebrating Atmanirbharta under Azadi Ka Amrit Mahotsav through rural innovations, four Innovation Yatras of 11 days were organised by NIF-India in association with Ministry of Culture, Government of India, in four regions of the country. The yatras travelled across 13 States sensitizing common people on innovation/ entrepreneurship, disseminating grassroots innovations, and reaching out to over 12,000 people in the journey of 7500 km.
- Two indigenous technologies to combat mastitis in dairy animals and poultry feed supplement were transferred Indian Genomix Pvt Ltd., Hyderbad. Paddy straw cutter for mushroom bed preparation was transferred to Supreme Enterprises Dhenkanal Odisha. Multi-seed decorticator and Tamarind de-seeder (Manual and power-operated) was transferred with Hindustan Machinery Koraput Odisha.
- In the North Eastern states, over 400 saplings of G Vilas Pasand - Improved guava variety, were distributed to farmers in eight districts of Assam and three districts in West Bengal. The seeds of cauliflower were distributed to farmers in North Bengal region. Fruit nippers and manual arecanut cleaning machines were provided to beneficiaries in North Bengal and Kamrup, Assam as well in Mizoram.

- NIF in association with Ministry AYUSH launched 48 monographs which will add new plants in Indian pharmacopoeia. This will enable technologies based on these herbs to reach market, which is an important contribution to the country.
- The roundtable "Inclusive Development through Entrepreneurial Advancement (IDEA)" was jointly organized by NIF and University of Kashmir, to discuss challenges and develop a roadmap for innovation and entrepreneurship in the valley. Participants from organizations like the Department of Science and Technology, SIDBI, Amazon India, and J&K Entrepreneurship Development Institute shared their insights and recommendation.

Important Highlights of Major Programmes:

- The Festival of Innovation and Entrepreneurship (FINE) 2023 and 11th National Grassroots Innovation and Outstanding Traditional Knowledge awards were successfully concluded at Rashtrapati Bhavan with 51 conferred with the award. This year tow grassroots innovators first recognized by NIF were recognized with Padma Awards.
- NIF has collaborated with Academy of Scientific and Innovative Research (AcSIR), which will help to train student and students will be registered for doctorate degree to work on NIF projects.
- NIF through INSPIRE MANAK, in association with DST, Govt. of India more than 8.54 lakh student innovations were attracted from all States & UT's of the country. A total of 60 students were recognized amongst the 441 invited during 10th edition of NLEPC (National Level Exhibition and Project Competition).
- NIF organized the 4th ASEAN India grassroots Innovation Forum (AIGIF) held at Malaysia during November 2023. Two Grassroots Innovators and one student innovator made the country proud by winning the grassroots innovation and student innovation competition.
- NIF was the coordination and implementation agency for organizing the 9th edition of India International Science Festival (IISF). The theme of this edition is 'Science and Technology Public Outreach in Amrit Kaal'. IISF 2023 provided a platform for inspiring public at large and individuals with diverse levels of interests like students, educators, scientists, researchers, industry professionals, entrepreneurs and science communicators. IISF 2023 showcased scientific achievements offering diverse benefits to participants and the general public through 17 themes. During IISF 2023, the NIF has established international partnerships with the objective to advance Science, Technology, and Innovation (STI) co-operation and enhance global connections. Collaborations were established with institutions in various other countries.
- NIF facilitated the participation of grassroots and student Innovators in the National Technology Week (May 11-14) at Pragati Maidan in New Delhi, which was inaugurated by the Hon'ble Prime Minister. On May 12, Union Minister of State (Independent Charge)

Science & Technology also interacted with the school students and inspired them to take cue from the various Start-up entrepreneurs making headway in niche sectors.

Important Output Indicators:

Sr. No.	Parameters	Output
1.	Papers in Refereed Journals	12
2.	Books	03
3.	Chapters in Books	01
4.	Indian Patents Filed/Granted	184
5.	Number of Technology Leads Awaiting Transfers	27
6.	Number of Technologies/Designs and other IP Commercialized	25
7.	Technical Manpower Trained	06
8.	Research Manpower Trained (Other than Ph.D)	36
9.	B.Tech/UG Project Guided	04
10.	M.Tech/M.Sc/M.Phil. Project Guided	05

5.18 Technology Information Forecasting & Assessment Council (TIFAC), New Delhi

Areas of focus of TIFAC are Technology foresight exercises, Technology Vision 2035, Technology Vision 2047, nurturing innovation, patenting support, Intellectual Property Rights (IPR) Management, supporting MSME clusters, capacity building, Technology Assessment in the areas of Advanced Materials, Clean Energy, Climate Change, Health Data generation, IT Tools for Agriculture e-vehicles etc.

Major Accomplishments:

- SAKSHAM is a dynamic portal developed by TIFAC for mapping the skills of Shramiks vis-à-vis placement requirements of MSME and other industries has been licensed for large scale implementation on self-sustainable / revenue generation model. More than 20 lakh placements made with the help of this portal.
- A total of 15 consultation workshops conducted at IITS, NITS, TIFR, State S&T Councils, Universities, Academic institutions on identifying future technologies for Viksit Bharat 2047.
- Prepared a report on “Leveraging Global Innovations for Sustainable Progress: Navigating Technology Transfer in India's Decarbonization Journey” for facilitating negotiations for release at COP 28, Dubai.

- TIFAC in collaboration with CSIR-Central Salt and Marine Research Institute (CSMCRI) and ICCSIR, Mandvi-Kutch, Gujarat successfully completed a project '*Technology assessment for edible seaweed production (Monostroma sp.) and seedling production (Gracilaria dura)*'- An initiative towards large scale PPP model in seaweed cultivation.
- TIFAC has completed a tele-digital health pilot demonstration project in collaboration with IIT M Pravartak Technologies Foundation and C DAC- Mohali for assessment of sensor-based technologies for providing tele-diagnostic services through generation of health data in the form of Electronic Health Record (EHR).
- Prepared a compendium featuring 125 technologies at various TRL levels. The barriers, challenges, issues towards commercialization of these technologies were identified and models suggested based on best practices being followed by developed economies.

Important Highlights of Major Programmes:

- The study on Climate Smart Livelihood and Socio-ecological Development of Biodiversity Hotspots of India, launched in partnership with the Institute for Social and Economic Change (ISEC), Bengaluru, has been completed successfully to identify the shift in monsoon, change in temperature, loss of crop due to drought and flood were projected.
- Technology Roadmaps for the Defence Sector and Space Sector are being prepared by TIFAC. Technology Needs Assessment (TNA) report, supported by DST for a period of 2 years is under preparation to assess the strategic response by India to the challenges of climate change.
- TIFAC is implementing a project on "Preparation of select chapters for India's First Biennial Transparency Report (BTR-1), Fourth Biennial Update Report (BUR-4) and Fourth National Communication (4NC)" sponsored by NATCOM Cell, MoEF&CC. The first draft of BUR4 has been submitted to MOEF&CC.
- Under TIFAC MSME Programme, Industry Sensitization Programmes/ workshops for Technology Gap Analysis for six MSME clusters were organized. Two workshops on IPR were conducted in North East India. 100 women joined the one-year training programme which started on January 23, 2023 under WISE Internship in programme of KIRAN Division of DST. Three new projects initiated under Assessment of Technology Maturity for Aatma Nirbharta (ATMA). A project for impact assessment of the conversion / replacement of about 40 no. of coal-fired furnaces to gas-fired furnaces in the Moradabad Metal Cluster has been taken up. The project is being financially supported by SIDBI.

Important Output Indicators:

Sr. No.	Parameters	Output
1.	Papers in Refereed Journals	04
2.	Books	01
3.	Chapters in Books	01
4.	Papers in Conferences	22
5.	Indian Patents Filed/Granted	33
6.	Technical Manpower Trained	409
7.	Research Manpower Trained (Other than Ph.D)	30

5.19 North East Centre for Technology Application and Reach (NECTAR), Shillong

NECTAR focuses on providing last mile guidance and support to north-eastern States in technology applications for socio-economic activities.

Major Accomplishments:

- The Centre has established a Skill Development Centre & Geospatial Lab in Guwahati with advanced technology and acquired complete in-house resource capacity on Remote sensing and GIS application including Drone Technology having indigenous, high endurance and type certified drones along with high resolution sensor systems.
- Implementation of NECTAR's project to establish and expand saffron cultivation in North East (NE) region has been successful and thereby highlighting the suitability of the region to this expensive spice in 16 sites in the NE, involving approximately 27 quintals of saffron corms and 32000 saffron flowers harvested across all the locations in the NE with Sikkim and Arunachal Pradesh showing the highest potential.

Fig. Saffron Cultivation in NER

- 15 stand-alone Solar Dehydrators were installed in North east Region (NER) for solar drying of ginger, turmeric and other spices thereby benefiting individual farmers. NECTAR initiated two major projects under the PM-DeVINE scheme - Value Chain on Utilization of Banana Pseudo Stem for Value-Added Products and Promoting Scientific Organic Agriculture in NE India. MoU have been signed with various agencies for implementation of these two projects and other activities such as construction of common facility centre, training to farmers and master trainers, technology transfer, etc.
- Survey and Mapping of reserve forest areas of Meghalaya using Aerial and UAV technology through LiDAR, and Hyperspectral sensor was implemented with significant progress. Drone technology mapping has been done to accomplish 80 sq. km. of Coal Mining Area Mapping, 70 sq km plantation area mapping in Meghalaya and about 10 missions of flights of data collection for precision agriculture mapping.

Fig. Geospatial activities and Drone Mapping

- Project Management Information System (PMIS) for internal project monitoring application was developed and officially inaugurated during North East (NE) startup and entrepreneur's conclave held at Guwahati during March 2023.
- Mawkynrew 89.6 FM Community Radio has been established in Meghalaya and Community Radio in Manipur is underway, to broadcast content that fosters agricultural growth, improves rural livelihoods and contributes to holistic community development.

Fig. Mawkynrew 89.6 FM Community Radio in Meghalaya

Important Highlights of Major Programmes:

- Honey Mission project for scientific beekeeping in North East India was implemented focusing on extensive training and Skill development for 500 bee-keepers on Honey production and associated activities. 1st Phase of Technology implementation on improving sustainability of traditional terracotta and pottery business in Asharikandi, Assam was successfully completed.
- Various training and capacity building programmes were also successfully conducted across various domains for livelihoods and also geospatial domains through NECTAR-BCDI, ESRI and other agencies and also under PMKVY central scheme covering beneficiaries from different demographic and economic backgrounds.

Fig. Training programme on bamboo basketry and packaging

5.20 Indian Academy of Sciences (IASc), Bengaluru

Indian Academy of Sciences was founded with the main objective of promoting the progress and upholding the cause of science. The main area of focus of IASc are the following: Dissemination of science by publishing scientific journals, magazines; Recognition of scientific talent and accomplishment through identification of Fellows and Associates, Promotion of science and scientific activities at various levels; Providing support to the Government of India in determining policies that pertain to science and translation of the policies, and other activities in promotion and dissemination of science.

Major Accomplishments:

The number of journals currently published by the Academy is 11. The well-known journal *Current Science* is co-published, covering all major disciplines in science & technology. Under the Summer Research Fellowship programme, 942 students and teachers underwent 2 months' Fellowship and worked with Fellows and other mentors. 41 Lecture Workshops and 5 Refresher Courses were held on various topics of science. A total of 34 outstanding scientists from India were inducted into the Academy Fellowship and 28 promising young scientists were selected in science & engineering as Associates. The Academy has organized annual scientific meetings, symposia, public lectures in order to provide a means for the exchange of scientific knowledge among scientists and to bring new knowledge to the attention of the whole scientific community.

Important Highlights of Major Programmes:

- In 2023-24 the academy published over 1500 peer-reviewed articles comprising of 17470 pages in 9 thematic journals. Nine special publications of topical interests were published in the journals. Over 2000 print copies of the monthly journal *Resonance journal of science education* were circulated to individuals/universities/institutions. Worldwide visibility to Academy journals increased with more submission of articles. The impact factor of the many Academy journals is above 2.
- The academy annually elects distinguished scientists of the country to its Fellowship. It also elects as Honorary Fellows working in institutions outside of India, who are distinguished for their contributions to science or engineering. A total of 34 outstanding scientists from India were inducted into the Academy Fellowship and 3 Honorary Fellows were elected (with effect from 1 January 2024). 28 promising young scientists of the country were selected in science & engineering as Associates.
- Towards attempts to improve the state of higher education and teaching of science in the country, major activities are implemented under this programme. Under the Summer Research Fellowship programme, 876 students and teachers underwent 2 months' internship and worked with Fellows and other mentors located in about 210 research

institutions of the country. Under the Focus Area Science and Technology Summer Fellowship Programme 66 students and teachers underwent 2 months' internship and worked with Fellows and other mentors located in 46 research institutions of the country.

- Under an on-going initiative of the Academy termed the Repository of Publications of Fellows, it is intended to make available research and review papers published by Fellows in peer-reviewed journals. The total metadata available as of 31 March 2023 is 1.25 lakh.

Important Output Indicators:

Sr. No.	Parameters	Output
1.	Journals Published	11
2.	Summer Research Fellowship	942
3.	Lecture/Workshop Organized	41
4.	Refresher Course Organized	05

5.21 Indian National Academy of Engineering (INAE), New Delhi

Major Accomplishments:

- Translational Research is encouraged through Abdul Kalam Technology Innovation National Fellowship, launched jointly with erstwhile SERB (now ANRF) in 2017, to promote translational research in public funded institutions. Ten nominees were selected for this year.

- The INAE Youth Conclave 2023 was held under the aegis of erstwhile SERB (now ANRF) -INAE Innovation Hackathon during November 3 - 4, 2023 at GITAM University, Vishakhapatnam to encourage the youth activities in science. The theme of the conclave "Innovation and Technology for Global Challenges," highlighted the importance of technological advancements in addressing global issues. The specific focus areas were: AI in Healthcare; Space & Robotics; Green energy and storage; Circular manufacturing; Biomedical engineering and devices and Smart City & Urban Planning.

Fig. Students exhibiting their models in INAE Youth Conclave 2023

- Proposals were invited and selected under the SERB (Now ANRF) -INAE Online and Digital Gaming Research Initiative launched at the behest of DST as a unique program to leverage Digital Gaming Research and Industry and achieve self-reliance in advanced Augmented Reality/ Virtual Reality technologies.
- INAE and SERB (Now ANRF) jointly organized a two-days Symposium for Young Women Engineers during November 20-21, 2023 at Tezpur University, Assam on the topic “Technologies for sustainable developments in North-Eastern Region” to encourage women engineers. Young women engineers from engineering and technological Institutions/Universities covering all the states of North-Eastern region participated in this programme.
- Engineers Conclave 2023 (EC-2023), was organized jointly organized by INAE and UGC-DAE- Consortium for Scientific Research (CSR), Indore, with the DAVV and IIT Indore as the partner institutes from October 5th-7th, 2023 at Raja Ramanna Centre for Advanced Technology (RRCAT) in Indore. The two themes were "Laser Technologies for Emerging Engineering Challenges” and “Engineering and Technology for Clean and Green India @2047". Actionable recommendations are being finalized for follow-up actions with concerned Government Departments/Agencies.

Fig. Panel discussion in Progress-EC 2023

Fig. Release of Abstract Booklet in EC -2023

Important Highlights of Major Programmes:

- The 17th National Frontiers of Engineering symposium was organized by INAE in collaboration with Birla Institute of Technology Mesra under the aegis of INAE-SERB Conclave on *Atmanirbhar* Technologies- Engineering Secured Future during June 24-25, 2023. Four themes covered during the event were (i) Mining Technology - Mastering Depth & Exploration (ii) AI, GPT & Robotics - Technology of Future (iii) Smart Water Harvesting & Cleaning - Engineering Water (iv) Embracing Futuristic Technologies to make Engineering Education Alluring.
- Innovation in Manufacturing Processes– 2023 conducted by INAE and BIT Mesra on June 26, 2023, was a national level project competition open to all engineering students and practitioners with the endeavour to engage with the engineering youth of the country.
- A Seminar on “Green Hydrogen: Indian National Academy of Engineering (INAE)-Royal Academy of Engineering (RAEng), UK Exchange program” was held at CSIR- National Chemical Laboratory (NCL), Pune on January 31, 2024- February 2, 2024. The objective of this exchange program was to explore opportunities for cross-national learning to aid acceleration towards Green Hydrogen transition in India and UK.

Important Output Indicators:

Sr. No.	Parameters	Output
1.	Books/Monographs	01
2.	International Conferences Organized	02
3.	National Conferences Organized	10
4.	Popular Science Books/Newsletters Published	02
5.	Number of participants in various science outreach programmes/ conferences/Scientific Lectures etc.	1500
6.	Scientific Lectures/Training Programmes Organized	25
7.	Number of Manpower Trained	20

5.22 Indian National Science Academy (INSA), New Delhi

The areas of focus of the autonomous body are the recognition of scientific talent, promotion of science in India and harnessing scientific knowledge for the cause of humanity and national welfare.

Major Accomplishments:

INSA is a national body of Indian Science devoted to the pursuit of identifying, nurturing excellence in sciences, assisting stakeholders with aspect of policies on science. INSA worked towards the election of eminent Indian & foreign scientists to fellowship of the academy along with selection of INSA Associate Fellows and INSA Distinguished Lecture Fellows. INSA was also the knowledge Partner for Science20 which is a part of G20 engagement group under India's presidency.

Important Highlights of Major Programmes:

- The Academy elected 45 Fellows and 06 Foreign Fellows to the Fellowship during the year 2023-24. 40 young researchers were selected by the Academy for the INSA Associate Fellows for the year 2023. 10 INSA Distinguished Lecture Fellows were selected for the year 2023.
- The Academy launched the "INSA Distinguished Public Lecture Series" an initiative aimed at promoting science and fostering intellectual discourse by hosting eminent scientists and researchers to share their insights with the wider community.
- Indian National Science Academy (INSA) and National Centre for Good Governance (NCGG) jointly organized Leadership Development Program in Science & Technology (LEADS) 2023, from 12th to18th July 2023 at INSA, New Delhi. The primary objective of this program is to bolster the leadership capabilities of participating scientists, equipping

them for effective governance within scientific institutions and laboratories. Total 44 Scientists from different prestigious institutes participated in this program.

- The Academy supports a scheme under which lecture-cum-interaction meetings were organized at schools/colleges in areas which were away from the urban areas. 44 lectures were delivered during FY 2023-24 under this scheme.
- Partial assistance is provided by INSA for participation in International Conferences abroad sponsored by agencies other than International Science Council (ISC) and its listed bodies. Forty-seven scientists were supported during 2023-24.
- Science20, one of the engagement group summits of G20 under India's presidency in 2023, was coordinated by INSA as the Knowledge Partner. The Science20 (S20) Engagement Group supports G20 by fostering official dialogue with the scientific community of member states. The Academy drafted the final Science20 Communique under the theme "Transformative Science for Sustainable Development" and its subthemes. The Academy incorporated all suggestions and feedback from the G20 member academies to reach a consensus. A Science20 Brochure summarizing all meetings held under the Science20 engagement group and major recommendations were compiled for presentation to the Government at the Final G20 Summit in New Delhi on September 9-10, 2023. More than 15 Science20 Outreach activities were organized in different institutes and organizations in India to spread awareness about the Science20 and its themes.
- 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.

5.23 Indian Science Congress Association (ISCA), Kolkata

The Indian Science Congress Association (ISCA) is working on the popularization and advancement of science by organizing seminars, symposia, discussions, popular lectures, quiz contest etc. throughout the year.

Major Accomplishments:

- An inspection and workshop on 'Working on Computer in Hindi' was organized in ISCA from 1- 2nd May 2023. The St. Joseph's College, Tiruchirapalli organized an International Conference on The Impact of Disruptive Technologies in association with ISCA Chennai Chapter during 8 - 9th January 2024. ISCA Rohtak chapter organized international conference Advanced Materials for Green Chemistry for Sustainable Development during 15-16th February. ISCA Rohtak Chapter also organized a national conference 'GPSTSD 2023' in which 300 research papers were presented. ISCA Shimla Chapter organized an International Conference on 'Recent Trends in Science and Technology for Environment Conservation and Sustainable Development' during 29-30th September, 2023.

Important Highlights of Major Programmes:

- ISCA Amravati Chapter organized 'Celebration of Wild life' in collaboration with Melaghat Tiger Reserve from 3 -7th October 2023 .Patna Chapter organized one day workshop on 'Commercial Applications of Chemical Sciences' on 13th October 2023. ISCA Dharmnagar Chapter organized two-day national conference on 'Role of Science and Technology in Building a Sustainable Future, Global Perspective' on 17th November 2023. ISCA Bilaspur Chapter organized two days national conference on "Recent Trends in Microbiology, Biotechnology & Biochemistry" during 11-12th December 2023. ISCA Coimbatore Chapter organized. ISCA Hyderabad Chapter organized a national conference on 'Global Perspective on Science and Technology for Sustainable Future' on 18th January 2024.
- ISCA Bilaspur chapter organized a state level 'Talkathon on Recent Trends & Technology' on 6th January 2024. ISCA Tirupati chapter organized a contest on 'Robotrac' from 17-18th February 2024.
- ISCA Coimbatore chapter organized an International Conference on 'Socioeconomic Impact of Pollution in Water Bodies and Remedial Measures (ICPWRM -2023)' on 18th December 2023. ISCA Coimbatore chapter also organized a Computer Literacy Programme for School Children and a digital literacy programme for village people on 16th February 2024. A workshop on 'Gardening-Horticultural approach for Recreational, Economic Reliance and Conservation of Traditional Crop Varieties for Health Care' was conducted by ISCA Coimbatore Chapter on 31st March 2024

Fig. International Conference by ISCA Rohtak Chapter

Fig. International Conference by ISCA Shimla Chapter

5.24 National Academy of Sciences (NASI), Allahabad

Area of focus of the NASI are Promotion & Popularization of Science & Technology to aid & advise in Policy Making. The Academy continued to promote Science & Technology by regularly organizing several activities with the help and support of its Fellows and Members.

Major Accomplishments:

- The academy published the journals Proceedings of NASI, Sec. A & B and National Academy Science Letters in collaboration with the Springer Nature. Publications of the Academy are also regular; and are achieving the desired milestones with good impact factor. Special Issues on "Advances in Memory Materials" was also published by NASI. 341 papers were published in 17 issues of the above-mentioned journals.
- NASI elects Fellows/Foreign Fellows to recognize the outstanding contributions of the established scientists, on the other hand it also selects bright scientists as Members to enthuse the good work done by them in the realm of Science & Technology.
- Popular Science Lectures are delivered by eminent scientists, industrialists and technologists on current scientific-societal issues to make the students/general mass aware about the burning topics; as well as to inspire them to draw their attention towards finding the solutions to the existing problems by proper scientific intervention.

Important Highlights Major Programmes:

- Scientific Programmes/Workshops/Symposia/Seminars on different aspects of science & society are organized. These activities are organized to deliberate in detail on different aspects/issues related to science & scientific phenomenon. A well planned activity is chalked out by the members of the Chapter/region/institution, as per priority areas of their region, and problems associated with them. In the end, recommendations are finalized to suggest the means to cope up with the existing challenges.
- Organization of sensitization workshops especially in rural areas are unique activities of NASI, focusing on the rural mass awakening on socio-scientific issues, such as personal health & hygiene; safe water problem; sanitation; malnutrition, especially among the children and women etc. The academy also organized several workshops on technological empowerment of women in different parts of the country. These sensitization programmes are very popular and fruitful, giving boost to the zeal of women scientists to work and inspire the young women scientists. SWATI Portal has been created for easy access of information/data regarding the Women in Science, on a multidimensional web-portal. The portal is the first-of-its-kind in India which has a complete interactive database. Several activities like 'Children Science Meet', 'Summer & Winter Schools', 'Vocational Training Programmes', 'Scientific Writing Contest', etc. are organized for students.

Important Output Indicators:

Sr. No.	Parameters	Output
1.	Journals Published	03
2.	Books	01
3.	Technical Manpower Trained	Approx. 3000
4.	Research Manpower Trained (Other than Ph.D)	Approx. 500

CHAPTER 6

ANUSANDHAN NATIONAL RESEARCH FOUNDATION (ANRF) (ERSTWHILE SERB)

ANRF (Erstwhile SERB) serves as a premier national funding agency and the mandate is to promote R&D activities through appropriate policy interventions and to provide extramural funding to the researchers associated with various academic institutions, research laboratories and other R&D organizations for carrying out competitive basic or fundamental research in all frontier areas of Science and Engineering. ANRF strives to serve the needs of the researchers by making timely funding decisions and responding to their queries.

Major accomplishments:

6.1 Support for Core Research & Innovations:

- SERB-Core Research Grant (CRG) is a flagship programme, provides competitive-mode projects to individual researchers from academic institutions, research laboratories and other R&D organizations to carry out basic research in all frontier areas of science and engineering. The CRG programme has played a pivotal role in building research capability across the country and sustaining the research interests of scientists. A total of 1345 projects were sanctioned under the 18 research verticals including special calls in the reporting period.
- SERB-Mathematical Research Impact Centric Support (MATRICS) scheme provides fixed grant support to active researchers with good credentials in Mathematical Sciences, Theoretical Sciences and Quantitative Social Sciences. In the reporting period, a total of 179 grants were sanctioned.
- SERB-Scientific and Useful Profound Research Advancement (SERB-SUPRA) the aims to explore new scientific breakthroughs, challenging the existing hypothesis and offering disruptive technologies in cutting-edge research areas. In reporting period, a total of 7 proposals supported under the SERB-SUPRA scheme.
- SERB-Empowerment and Equity Opportunities for Excellence in Science (EMEQ) scheme is aimed to provide research support to Scientists belonging to the Scheduled Caste and Scheduled Tribe. The basic idea was to encourage them for undertaking research in newly emerging and frontier areas of Science and Engineering and to involve them in the national science and technology development process. Support

consists of a project grant upto Rs. 50 lakh plus overhead charges. This scheme has been successfully implemented since its launch in 2013. In the reporting period 276 new projects were sanctioned in the reporting period.

- SERB-Teachers Associateship for Research Excellence (TARE) scheme intends to facilitate mobility of faculty members working in regular capacity in state universities, colleges and private academic institutions to carry out research in an established public funded institutions such as IITs, IISc, IISERs, National Institutions (NITs, CSIR, ICAR, ICMR labs and other central institutions) and Central Universities, preferably closer to the institution where the faculty member is working. A total of 75 TARE Associateships were sanctioned, in the reporting period.
- SERB-Promoting Opportunities for Women in Exploratory Research (SERB-POWER), aims to mitigate gender disparity in science and engineering research funding in various S&T programmes in Indian academic institutions and R&D laboratories. SERB-POWER is specially designed to provide structured support towards enhancing diversity in research and to ensure equal access and weighted opportunities for Indian women scientists engaged in R&D activities. The funding framework consists of two categories: SERB – POWER Research Grants and SERB – POWER Fellowship. In the reporting period, one call for proposal under SERB-POWER Scheme was solicited. A total of 105 projects were sanctioned. For SERB POWER Fellowship, 14 were sanctioned sanctioned in the reporting period. In SERB-POWER Mobility program, a total of 5 grants were supported in the reporting period.
- SERB-Technology Translation Award (SERB-TETRA): The scheme was initiated to challenge scientists executing SERB grants to establish an effective, functional and synergistic working collaboration with an industry partner to elevate their breakthrough results and technologies to TRL level 5 and beyond. The awardees are supported with an unstructured research grant of Rs.15 lakh per year including overhead for a period of two years. In the reporting period 9 projects was sanctioned.
- SERB-Fund for Industrial Research Engagement (SERB-FIRE) intents to address the challenges in the research and innovation space in India, by creating an ecosystem that would accelerate the growth in the research work with national impact and drive the R&D landscape efficiently and effectively. 7 projects were sanctioned under this programme in the reporting period..

6.2 Fostering the Young Researchers:

Young researchers in the country received overwhelming support through the following programmes/schemes:

- SERB-Start-up Research Grant (SRG) Programme aims to assist researchers to initiate research careers in a new institution which enables them to establish themselves and

move on to the mainstream core research grants. A total of 463 projects were sanctioned under SRG in the year 2023-24.

- Ramanujan Fellowship is meant for brilliant Indian scientists and engineers working abroad who aspire to take up scientific research positions in India. This fellowship supports young researchers below the age of 40 years with a proven outstanding track record. The Ramanujan Fellows can work in any of the scientific institutions and universities across the country. The amount of fellowship is Rs. 1,35,000 per month with a research grant of Rs. 7 lakh per annum and overhead charges of Rs.60,000 per annum for a period of five years. In the reporting period, 40 Ramanujan Fellowships were sanctioned.
- SERB-Research Scientists (SRS) Scheme was initiated in 2018-19 to provide a platform for sustainment of research careers of INSPIRE Faculty and Ramanujan Fellows for an additional period of two years. The amount of fellowship is Rs.1,25 ,000 per month and in addition a research grant of Rs. 7 lakh per annum and overhead charges are provided. In the reporting period, 13 fellowships were sanctioned.
- SERB-National Postdoctoral Fellowship (NPDF) programme is designed to support and foster highly potential young researchers in leading research labs with accomplished mentors. The support consists of fellowship of Rs. 55,000 per month plus HRA, research grant of Rs. 2 lakh per annum and overhead for a period of two years. A total of 270 SERB NPDF fellowships were sanctioned.

6.3 Partnership Programme – National and International:

- Prime Minister's Fellowship program for Doctoral Research is a prestigious initiative of SERB towards the advancement of university research in line with industry requirement. This scheme is aimed at encouraging young, talented, enthusiastic, and result-oriented scholars to take up industry relevant research. Under this scheme, fulltime PhD scholars get double the JRF/SRF as scholarship. While one-half of this scholarship comes from the government, the second half comes from a partner company which also works closely with the candidate on the research project. The scheme is implemented in partnership with CII and FICCI.
- SERB-IMPRINT (Impacting Research Innovation and Technology), is a programme piloted by the Ministry of Education (MoE) and Department of Science and Technology. The programme aims to address and provide solutions to the most relevant engineering challenges faced by our nation by translating knowledge into viable technology (product and processes) in selected domains. IMPRINT-IIC.2, consortium-based approach was also initiated under this programme, to include strong and complementary expertise from different discipline to address major technological breakthrough in designated areas towards addressing societal/industrial importance. A total of 1 project was supported

under IMPRINT-II C.2, while the ongoing projects of IMPRINT-II received continued support in the reporting period.

- Accelerate Vigyan is an inter-ministerial initiative scheme conceptualized and steered by SERB. The aim of the scheme is to expand the research base, with three broad goals – consolidation and aggregation of all national scientific training programs, initiating High end Orientation Workshops and creating opportunities for Research Internships. During the reporting period, A total 507 applications were recommended for support in the reporting period.

6.4 Awards & Recognitions

SERB offers various Awards and Fellowships to exceptionally distinguished individuals through its schemes namely - J C Bose Fellowship (46), Abdul Kalam Technology Innovation National Fellowship (10), National Science Chair (6), SERB Science and Technology Award for Research (SERB-STAR) (18), (in bracket the number of Fellowships sanctioned/supported are shown).

6.5 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, 692 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, 1502 participants recommended for financial support under the scheme.

6.6 Important research highlights of major programmes:

- **Integrative structural and functional characterization of desmosomal plaques:** Desmosomes are large protein assemblies that connect the cytoskeleton of adjacent cells and mediate cell-cell adhesion. Despite their importance, little is known about the macromolecular structure of desmosomes. Structures of large protein assemblies such as desmosomes are challenging to characterize using experimental methods such as X-ray crystallography and cryo-electron microscopy. Here, we characterized the molecular architecture of the desmosomal outer dense plaque (ODP) using integrative structural modeling. Using Bayesian inference via IMP (Integrative Modeling Platform; https://integrativemodeling.org) we integrated information from X-ray crystallography, cryo-electron tomography, immuno-electron microscopy, yeast two-hybrid experiments,

co-immunoprecipitation, in vitro overlay, in vivo co-localization assays, in-silico sequence-based predictions of transmembrane and disordered regions, homology modeling, and stereochemistry information to generate an integrative structure of the ODP (Fig 1). The structure was validated by additional biochemical binding information not used in modeling. We identified previously unrecognized protein-protein interfaces between DP and Dsc, DP and PG, and PKP and the desmosomal cadherins. Possible structural hypotheses for defective cell-cell adhesion in Naxos disease, Carvajal Syndrome, Skin Fragility/Woolly Hair Syndrome, and cancers were revealed via mapping of disease-related missense mutations on the structure. We point to aspects of the structure that could confer resilience to mechanical stress, such as the interlocking of PG and DP, and the embedding of cadherins amidst the other proteins. Taken together, we contribute the most complete and robustly validated model of the desmosomal ODP so far, providing mechanistic insight into the function, regulation, and assembly of desmosomes. This work is being carried out at NCBS, Bangalore.

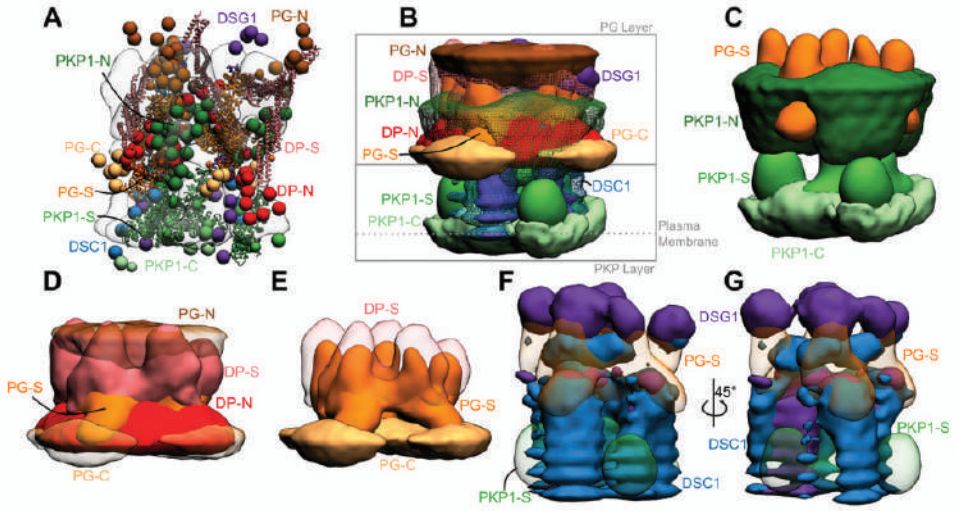


Fig.; Integrative structure of the desmosomal ODP A) The cluster center bead model for the major structural cluster with the cryo-tomogram (EMD-1703) superimposed in translucent gray. **B)** Localization densities of the major cluster. The densities are at a cutoff of approximately 15% for PKP1-C, PKP1-S, PG-S, DP-S, DSC1, DSG1 and around 30% for disordered termini regions (PKP1-N, PG-N, DP-N, PG-C). **C)** Localization densities for PKP1 layer (PG-S density is shown for reference). **D)** Localization densities for PG-layer. **E)** The densities for PG-S and DP-S with PG-C as a reference. **F-G)** Localization densities for the cadherins. Panel G is a rotated view of Panel F.

- **High efficiency GaN based LEDs using dot in a wire with increased quantum confinement and large internal/external quantum efficiency:** In this research work, it is demonstrated that surface preparation greatly impacts the device performance as it changes the surface potential significantly. The surface conduction band edge can bend upward creating surface depletion, which enhances quantum confinement. This, in

turn, increases electron-hole overlap and enhances luminescence by increasing internal quantum efficiency . The effects of surface potential, quantum confinement, excitons, strain relaxation has been studied in great detail. The radial strain distribution for the dot in a wire and disk in a wire structures were also observed. This provides distributed strain relaxation along the radius. Hence, the energy band diagram and the position of the bound states is also found to change radially. This brings an advantage in the form of the fabrication of a broad band LED with high luminescence, which is suitable for solid-state lighting.

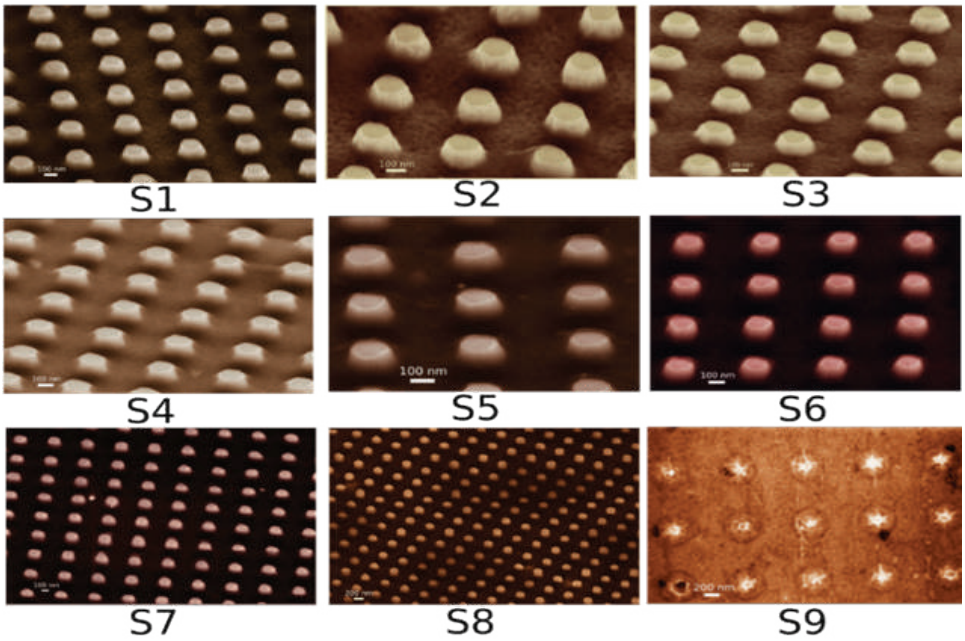


Fig: The cross-sectional SEM images of the array of dot in wire structure. The devices show enhanced luminescence due to quantum-confinement.

- **Design and commercialization of an indigenous lever-operated orthotic knee:** Individuals with low residual thigh muscle strength (eg. with post-polio syndrome) need to be given a Knee-Ankle-Foot Orthosis (KAFO) to enable them to walk. A gravity-operated drop-lock type knee joint is used in most of the KAFOs prescribed for such individuals. To sit down, the user needs to slide the drop lock on either side upwards. The lock is awkward to operate, may get stuck in clothing causing unreliable locking, and is extremely difficult to use for bilateral KAFO users, but is widely used as it is the only indigenous low-cost option.

  A new cable-operated design has been developed at IIT- Madras, that provides reliable locking, easy unlocking for even bilateral users and has an appealing form factor. In the course of this project, feedback from short-term user testing with multiple iterations have ensured a finalized user-centric design. Currently, manufacturability issues are being

addressed and the next set of 50 prototypes are in production for long-term user trials at Mobility India in Bangalore.

The new device is expected to be functionally superior to the existing drop-lock knee, while being more suitable and affordable than imported alternatives to the drop-lock. Commercialization potential is very high with an estimated 100 crore KAFO users in India.

Finalized version to be deployed for long-term user testing

- **Gaussian Belief based Pedestrian Intent Tracking:** The study aims to design a novel pedestrian intent detection and tracking algorithm using Gaussian Priors. The algorithm utilizes both a monocular camera and a 2D depth camera to initially detect pedestrians and subsequently track the intentions of individuals within the robot's field of view. It employs sensor fusion to iteratively estimate and correct the predicted human intent within a Kalman filter framework, continuously updating as new data points are observed. To effectively monitor multiple individuals within a crowded environment, the study has devised a pedestrian manager module which facilitates tracking over an extended period. The algorithms will be tested on four-wheeled robot 'Yati', which is equipped with Nvidia AGX Orin NX for computing, in addition to an Intel RealSense 435iF 2D depth camera, Zed X stereo camera, and a 2D Lidar for autonomous navigation.

(a) Identification of pedestrians from monocular camera images (b) YATI, the robot used for experiments

Important output indicators:

S. No.	Parameters	Output
1.	Papers in refereed journals	7268
2.	Papers in conferences	1797
3.	Indian patents filed/Granted	339
4.	Research Manpower sanctioned (other than Ph.D) **(JRF, SRF, RA etc.)**	2413

CHAPTER 7

TECHNOLOGY DEVELOPMENT BOARD

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.

7.1 Agreements signed during 2023-24

During the year 2023-24, TDB has signed twelve (12) national agreements and three (03) International Bilateral Projects for providing financial support to various industrial concerns. The details of the same are as under:

National Agreements

- TDB has signed an agreement with M/s WellRx Technologies Pvt. Ltd., Rewari to provide financial support for the "Development and Commercialization of Next Generation Technologies for Oil & Gas Wells to Boost Hydrocarbon Production in India". The Board has agreed to provide financial assistance of ₹9.43 crore out of the total project cost of ₹19.81 crore to the company vide loan Agreement dated 25.04.2023.
- TDB has agreed to provide financial support to M/s Alchemy Recyclers Pvt. Ltd., Bharuch, Gujarat for the "Development of an Integrated Plant for the Recovery of Precious Metals from E-waste, Jewellers Waste, and Automobile Catalyst Waste". The Board has pledged to provide financial support of ₹1.14 crore out of the total project cost of ₹1.90 crore to the company vide Loan Agreement dated 07.08.2023.
- TDB has supported M/s Noccarc Robotics Pvt. Ltd., Pune for the "Commercialization of Digitally Enabled Advanced Universal ICU Ventilator". The Board has agreed to provide financial support of ₹3.94 crore out of the total project cost of ₹7.89 crore to the company vide Loan Agreement dated 09.08.2023.

Fig. Signing of Agreement with M/s Noccarc Robotics Pvt. Ltd., Pune

- TDB has signed an agreement with M/s TIEA Connectors Pvt. Ltd., Bangalore to provide financial support for the "Commercialization of More-Electronic Harsh Environment Connectors and Terminals". The Board has agreed to provide financial support of ₹3.81 crore out of the total project cost of ₹8.20 crore vide Loan Agreement dated 10.08.2023.

Fig. Signing of Agreement with M/s TIEA Connectors Pvt. Ltd., Bangalore

- TDB has supported M/s Chemlife Innovations Pvt. Ltd., Obadenahalli, Doddaballapur, Karnataka for the "Commercialization and Manufacturing of Bio-Trace Minerals Used

in Feed for Animals". TDB has agreed to provide financial assistance of ₹ 0.84 Crore out of the total project cost of ₹1.43 crore to the company vide Loan Agreement dated 18.08.2023.

- TDB has extended financial support to M/s Bariflo Labs Pvt. Ltd., Balangir, Odisha for the "Development and Commercialization of Intelligent Water Body Management System (IWMS)-TAMARA". The Board has agreed to provide financial assistance of ₹0.89 crore out of the total project cost of ₹1.50 crore to the company vide Loan Agreement dated 31.08.2023.
- TDB entered into a Loan Agreement with M/s Aloe Ecell Pvt. Ltd., Lucknow on 04.09.2023 to provide financial assistance of ₹1.91 crore out of the total project cost of ₹2.98 crore for the project "Commercialization of Eco-Friendly 1.5V AA Size Aloe Vera-Based Batteries".
- TDB has supported M/s Eco Recycling Pvt. Ltd., Mumbai for the project "Recycling on Wheels-Smart ER." The Board has agreed to provide financial assistance of ₹6.00 crore out of the total project cost of ₹12.00 crore to the company vide Loan Agreement dated 06.09.2023.

Fig. Signing of Agreement with M/s Eco Recycling Pvt. Ltd., Mumbai

- TDB has extended financial support to M/s Lekha Wireless Solutions Pvt. Ltd., Bangalore for the "Commercialization of Tactical Advanced SDR for Space, Defense, and Aviation Applications". TDB has agreed to provide financial support of ₹4.17 crore out of the total project cost of ₹1 7.92 crore to the company, as per the Loan Agreement dated 26.10.2023.

Fig. Signing of Agreement with M/s Lekha Wireless Solutions Pvt. Ltd., Bangalore

- TDB has signed an agreement with M/s Om Banana Craft Pvt. Ltd., Madurai to provide financial support for the "Modernized Equipment Development for Banana Fiber Extraction & Value Addition". TDB has agreed to provide financial support as a grant of ₹0.18 crore out of the total project cost of ₹0.36 crore to the company, as per Grant Agreement dated 27.12.2023.
- TDB has signed an agreement with M/s Alchem Synthon Pvt. Ltd., Mumbai to provide financial support for the "Development & Commercialization of Advanced Pharmaceutical Intermediates, Fine & Specialty Chemicals". TDB has agreed to provide ₹8.60 crore as loan assistance out of the total project cost of ₹19.01 crore to the company, as per the Loan Agreement dated 01.03.2024.

Fig. Signing of Agreement with M/s Alchem Synthon Pvt. Ltd., Mumbai

- TDB has signed an Agreement with M/s Remine India Pvt. Ltd., Sitarganj, Uttarakhand to provide financial support for the "Setting up a Commercial Plant for Recycling of Li Battery and E-Waste using Indigenous Technology". TDB has agreed to provide loan assistance of ₹7.50 crore out of the total project cost of ₹15.00 crore to the company, as per the Loan Agreement dated 27.03.2024.

International Bilateral Projects

- **India - Republic of Korea Joint Applied R&D Programme 2020**

  Under the above International Bilateral Program, TDB has signed an agreement with M/s Minionlabs India Pvt. Ltd., Chennai to provide financial support for the "Development and Demonstrative Implementation of Interface Technology between HPDS-PLC Power Load Control Platform and Minion Energy Management Solution". TDB has agreed to provide financial support as a grant of ₹2.23 crore out of the total project cost of ₹4.46 crore to the company, as per the Grant Agreement dated 15.09.2023.

- **India-Israel Industrial R&D and Technological Innovation Fund (I4F) 2021**

  Under the above International Bilateral Program, TDB has extended financial support to M/s Quicksand Design Studio Pvt. Ltd., New Delhi for the "Production of Digital Financial Solutions for Last Mile FMCG Value Chains in Emerging Markets". TDB has agreed to provide conditional grant assistance of ₹1.22 crore out of the total project cost of ₹5.41 crore to the company, as per the Conditional Grant Agreement dated 13.03.2024.

- **India-Spain Program of Co-operation on Industrial Research & Development 2022**

  Under the above International Bilateral Program, TDB has signed an agreement with M/s Peptris Technologies Pvt. Ltd. and Foundation for Neglected Disease Research, Bangalore to provide financial support for the "ANAGRANINF- Development of a Novel Class of Antibiotics against Gram-Negative Bacterial Infections". TDB has agreed to provide conditional grant assistance of ₹0.75 crore out of the total project cost of ₹1.5 crore, as per the Conditional Grant Agreement dated 13.03.2024.

7.2 Call for Proposals

This year, TDB issued a specific call for proposal under Chemicals & Petrochemicals sector. The details of the same is given in succeeding paragraphs:

7.2.1 "Making India a Global Manufacturing Hub in Chemicals & Petrochemicals"

The Chemicals and Petrochemicals sector has been integral to daily life, influencing everything from agrochemicals to motor fuel. As the second fastest-growing manufacturing hub in the world after China, the Indian chemical industry has held vast untapped potential.

India’s large local marketplace and high-quality manufacturing capabilities have made it an attractive destination for global chemical and petrochemical production, drawing substantial foreign investment.

Recognizing this, TDB launched a Special Call for Proposals in the Chemical and Petrochemical Sector to foster innovation and commercialization. This call aimed to support Indian companies with innovative and indigenous technologies, promoting advancements in specialty chemicals, chemical waste management, green chemistry, green energy transition in the oil, gas, and chemical industries, petrochemicals, downstream manufacturing, agrochemicals, APIs from petrochemicals, polymers, and sustainability in the chemicals and petrochemicals industry.

By focusing on these areas, TDB sought to drive growth, enhance environmental sustainability, and solidify India's position as a global leader in the chemical and petrochemical sectors.

7.3 National Technology Week-2023 celebration at Pragati Maidan, New Delhi

TDB organized National Technology Week 2023 to commemorate the 25th anniversary of India's landmark technological achievements. The event took place from May 11th to May 14th, 2023, and was inaugurated by the Honorable Prime Minister, Shri Narendra Modi. With a central theme of 'School to Startup’ - Igniting Young Minds to Innovate,' the event aimed to celebrate and promote innovation and entrepreneurship in India.

The National Technology Week witnessed an extraordinary turnout, with over 5,000 young minds, 1500 visitors, 800 exhibitors, 200 student exhibitors, and 100 startups converging from all corners of the nation. The event featured more than 10 technical sessions, strategically designed to encourage the transition from technopreneurs to entrepreneurs.

Hon'ble Prime Minister Shri Narendra Modi's emphasis on nurturing young talent and innovation, coupled with the impressive achievements highlighted during the National Technology Week 2023. The event not only celebrated the innovative spirit of the nation but also demonstrated how Atal Tinkering Labs and Atal Innovation Centers are playing pivotal roles in shaping the future of India's youth.

The innovative exhibits displayed at the event, ranging from AI-assisted road safety solutions to advancements in medical technology, underscored India's potential as a global technological leader. The valedictory ceremony served as a fitting culmination, highlighting the collaborative efforts and entrepreneurial zeal driving India's technological progress. This event not only celebrated the present achievements but also set the stage for a future where India aspires to be a world-class technology ecosystem, fostering innovation, growth, and self-reliance.

CHAPTER 8

STRENGTHENING SURVEY AND MAPPING ACTIVITY

8.1 Survey of India

Survey of India (SOI), the National Mapping Agency of the country under the Department of Science & Technology, is the oldest scientific department in the country. It was established in 1767 and has evolved rich traditions over the years. SOI has transformed for more than two centuries from explorers to an organisation generating paper-based maps, then from paper-based maps to digital maps and now an organisation responsible for building the robust Geospatial Infrastructure and Geospatial ecosystem in the country.

The Government of India has notified the National Geospatial Policy (NGP) on 28th December 2022 with a vision to make India a world leader in the Global Geospatial space. Survey of India (SOI), the national mapping agency has been given the role of an overarching nodal agency for Geospatial Data and for generation/ maintenance of foundational data.

As per NGP, SOI has been assigned the responsibility for following;

a. Maintenance and Upgradation of National Geodetic Reference Frame

b. Ortho-imagery

c. Elevation (DEM)

d. Functional Areas (Administrative Boundaries) and

e. Geographical Names (Toponymy)

Geodetic Reference Frame, Ortho-imagery, Elevation will be pivotal for all other fundamental Geospatial Data Themes as together they will provide the Geodetic Framework and Digital Spatial Framework that will act as common reference (X,Y,Z) and foundation for the assembly and integrated geospatial information management of other Fundamental and Sectoral Data Themes. The Ortho-imagery and Elevation will act as the source for other Fundamental and Sectoral data.

SOI is responsible for developing and operating the National Geospatial Data Registry (NGDR) and the Unified Geospatial Interface (UGI). The NGDR and the UGI are intended to provide access to all Fundamental and Sectoral Geospatial Data Sets and other Central/ State Government datasets.

8.1.1 About SOI Activities and Projects:

- **Functional Areas (Administrative Boundary Database):**

  The Functional Areas (Administrative Boundaries) comprises of International boundaries, State boundaries, District boundaries, Sub-district boundaries, Revenue village boundaries. It also includes other functional Areas – Municipal corporation, Municipalities, Block, Constituencies etc. SOI in collaboration with ORGI and MoPR has initiated harmonization of Administrative Boundary Data Base (ABDB) and this data base will be made available to every user free of cost from SOI online maps Portal https://onlinemaps.surveyofindia.gov.in/

- **Toponymy (Geographical names/ Topographical names):**

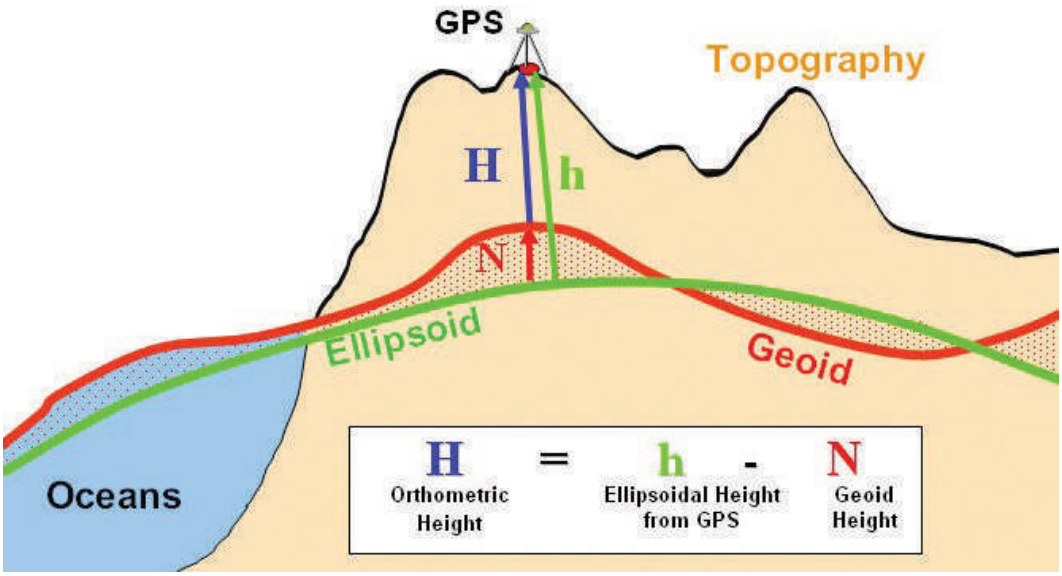
  SoI has transliterated the Toponymy layer in 22 languages. This database shall be referred as base Geographical Name Data Base (GNDB). A National Geographical Name Information System (NGNIS) shall be developed, maintained and disseminated by SOI for access by all the users through a Geoportal. The GNDB shall contain**:**

  - Existing Geographical Names in vernacular script.
  - Latitude, Longitude
  - Audio byte file(s) linked with the place name
  - Description of Geographical Name e.g. village, town, rive, mountain etc.
  - Reference to sheet Nos. 1:50K
  - Data source.
  - Variant / Alias Name
  - Reference system- Datum
  - Notified Name

- **Continuously Operated Reference Station (CORS) Network:**

SOI has undertaken modernization of Geodetic Reference Frame of the country by establishment of Continuously Operating Reference Stations (CORS) network of 1000+ Stations across the country. The CORS services have been launched by SOI for entire country on Aug, 2023 through an online portal https://cors.surveyofindia.gov.in/. As on date 4889 users are registered on the CORS Portal for availing different types of services.

- **Geoid Model Development:**



SoI is developing the Geoid Model for the entire country with the accurate relationship between the geoid 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 in India has been completed.

- **International Boundary:**

The Joint Technical Level Meeting (JTLM) between the Survey departments of India and Bhutan was held at Guwahati, Assam, India on 26-27 October, 2023 which was led by Sh. Rajiv Kumar Srivastava, Director, Megh & Ar. Pradesh GD, Shillong along with other representatives from IBD (SGO), New Delhi, MHA, MEA & from respective state Govt. while Butani delegation was led by Mr. Sangay Dorji, Director, International Boundaries, Thimpu, Bhutan.

Fig.: Indian and Bhutani delegation at JTLM, Guwahati

- **SOI Onlinemaps Portal (*https://onlinemaps.surveyofindia.gov.in/*):**

  The Online maps portal provides a range of digital products – Topographical Maps in .pdf and shapefile 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 products are free to all users.

  - 112431 Individuals/private users and 651 Govt. organization are registered on the Portal
  - 932006 Free products (PDF) downloaded.

- **Spelling of Geographical names:**

  New names / Change names requests processed for 48 Railway Station names and 31 place names for provision of Standardised Romanized and Devnagari spelling as per Indian System of Transliteration. These requests are duly verified in the field by State Geo- spatial Directorates before submission to the DST & MHA.

- **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, Geodesy & GIS. Besides training to officers and staff of

Survey of India, NIGST also imparts training to other Government Organisations, Private Individuals, Scholars from various Afro-Asian countries and for the students from the neighbouring developing countries.

NIGST is well equipped with traditional as well as modern technology / equipments for Surveying & Mapping, Geodesy, Conventional and Digital Cartography, Photogrammetry and UAV/ LiDAR and is manned by highly qualified and experienced faculty. NIGST has trained 1598 trainees (Departmental /Extra Departmental / Private and Foreign) across various courses during the current FY.

- **SVAMITVA:**

SVAMITVA Scheme was launched by Hon'ble Prime Minister of India on 24th April 2020 for surveying the land parcels in rural inhabited area using Drone technology. The scheme is a Central Sector scheme of MoPR. The survey is being done across the country. About **3,73,344** village are to be covered in a phase wise manner over the period of four years (2020 - 2025). As on date Drone Survey for about 293000 villages has been completed.

- **National Hydrology Project (NHP):**

  This World Bank assisted Project aims to improve the planning, development and management of water resources as-well-as flood forecasting and reservoir observations in real time. Survey of India (SoI) is one of the Central Implementation Agency in execution of this project. 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.

  Achievements:

  a) **Generation of 0.5 m Digital Elevation Model (DEM) for 71,204 Sq. Km:**

Activities	Data Capturing (Sq.km.)	Data Processing (Sq.km.)	DEM Generation (Sq.km.)
	67,860	67,481	54,394

  b) **Generation of GIS data & 3-5 m Digital Elevation Model (DEM) for 8,35,742 Sq. Km:**

  » Digital Data generation -7,80,640Sq.km.

  » Final data supplied -3,77,364 sq.km.

- **National Mission for Clean Ganga (NMCG):**

  NMCG aims towards effective abatement of pollution and Conservation & rejuvenation of the national river Ganga. Survey of India has been entrusted for generation of High-Resolution Digital Elevation Model (DEM) of 0.5 metre resolution and GIS based for the part of river Ganga and river Hugli covering up to 10 km extent on either side of the river using latest Technology.

  Total Project area is 44,526 Sq km

  Achievements:

Activities	Geoid Model Development	0.5 m DEM
	Completed	44358 sq.km.

- **Large Scale Mapping (LSM) for State of Haryana:**

  SOI is executing Large scale mapping project for Haryana State to generate up-to- date digital data on 5cm resolution for entire state of Haryana for 44,212 km^2 area using Professional Survey Grade Unmanned Aerial Vehicle / Drone.

- **Large Scale Mapping (LSM) for State of Karnataka:**

  SOI is executing Large scale mapping of Bengaluru city and five districts of Karnataka for about 51000 km^2 using Professional Survey Grade Unmanned Aerial Vehicle / Drone.

- **Large Scale Mapping (LSM) for State of Andhra Pradesh:**

  SOI is executing Large scale mapping in Andhra Pradesh State for about 126,000 km^2 using Professional Survey Grade Unmanned Aerial Vehicle / Drone.

- **Large Scale Mapping (LSM) for Andaman & Nicobar:**

  SOI is executing Large scale mapping in Andaman & Nicobar UT for about 1000 Km^2 using Professional Survey Grade Unmanned Aerial Vehicle / Drone.

- **Publication of Indian & Hugli River Tide Tables:** Indian Tide Table-2024 & Hugli River Tide Table -2024 have been published

8.1.2 Other Important activities during the period:

a) Nationwide CORS Network & Stakeholder Conference on ORI & DEM Generation was organized by Survey of India, Department of Science & Technology, Govt of India on 12th October, 2023 at India Habitat Center, New Delhi. The conference was inaugurated by Hon'ble Minster Science & Technology (Govt. of India) Dr. Jitendra Singh.

Fig.: Hon'ble Minister, Ministry of Science & Technology (Govt. of India) Dr. Jitendra Singh and SGI at Nationwide CORS Network & Stakeholder Conference, New Delhi

b) A Memorandum of Understanding (MoU) was signed between Survey of India and Board of Revenue, Government of Uttarakhand for Survey/Re-Survey mapping of the entire revenue recorded land (Other than forest and 14 ULB's') with Hybrid Technology for Large Scale Mapping under the Digital India Land Record Modernisationn Programme (DILRMP) in Uttarakhand State.

Fig.: Sh. Pardeep Singh, Deputy Survey General (Tech), Survey of India representing SoI and Sh. Chandresh Kumar, IAS, Board of Revenue, Govt. of Uttarakhand

c) A Memorandum of Understanding (MoU) has been signed between Survey of India (SOI) and Satellite Application Centre (SAC), Ahmedabad on 06.01. 2024 at Ahmedabad. This agreement was signed by Sh. Hitesh Kumar S. Makwana, IAS, SGI, and Sh. Nilesh M. Desai, Director, SAC, Ahmedabad under which SOI will play a important role to facilitate SAC's NISAR mission by extending its positioning services, including CORS and other ground reference point data for necessary calibration and validation work. SAC and SOI also agreed to conduct joint research on crystal deformation studies and work together to create suitable IT and communication infrastructure.

Fig.: Sh. Hitesh Kumar S. Makwana, IAS, SGI with Director, SAC at MoU event in Ahmedabad

d) Geospatial Data Promotion and Development Committee (GDPDC), the apex national body for formulating and implementing appropriate guidelines, strategies and programmes for promotion of activities relate to collection, generation, preparation, dissemination, storage, publication, updating and digitisation data along with associated products, solutions and services was constituted on 04.03.2021. GDPDC secretariat has been opened in Survey of India.

e) A MoU was signed between Survey of India & Geological Survey of India at New Delhi on 08 February, 2024 for collaboration on mutual data sharing and for R&D and capacity building for the benefit of both the parties. Shri V. L. Kantha Rao, Secretary, Ministry of Mines, Professor Abhay Karandikar, Secretary, Department of Science and Technology Govt of India and Shri Hitesh Kumar S. Makwana, IAS, SGI were present on this occasion.

8.2 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 is the only thematic mapping organisation in the country. NATMO has a total strength of 468 employees. A large number of qualified professionals including geographers, geologists, statistician, mathematician, professionals of Geospatial technology are engaged in preparing thematic maps and atlases in this organization.

NATMO's journey started with compilation of National Atlas in Hindi by Prof. S P Chatterjee way back in the year 1956. Today, it is the pioneering organization engaged in Thematic

Cartography, Atlas Cartography, Geographical Research and Training. Documentation Centre and Library, including its remote sensing archive give sufficient support and strength in every sphere of its activities. NATMO provide services not only in the field of thematic cartography and geo-spatial technology, but also to extend wide services to a good number of technocrats, professionals, research scholars, planners and students as well. NATMO library is very famous for rare books/CD, journals, topographical sheets, maps etc.

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.

The mandate of this organization is:

- 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 2023-24

8.2.1 Extra departmental Projects:

- NATMO has made a significant achievement in collaborative projects with Department of Telecommunications, Government of India. Detailed Project Proposals for two projects on Mobile Tower Mapping and Panchayat Boundaries have been submitted for final approval.
- NATMO shared land use data to GDC of Geological Survey of India for the states of Meghalaya, Manipur, Jharkhand.

8.2.2 Technology Development Programmes

NATMO'S Enterprise Geo-Portal & Datacentre

Initiative: Geospatial data generated in pieces over the years under several projects is now to be made available in the public domain for 24 x 7 access by the users. Keeping this objective in view NATMO has taken up the initiative to set-up its own Geo-Portal.

Achievement:

- Database preparation and web upload of Jaipur, Noida, Gurgaon, Maldah, Kalpetta, Pratapgarh (Hindi), Dibrugarh have been completed.
- State Administrative Maps of West Bengal (English & Hindi), Kerala, Chhattisgarh, Haryana, Himachal Pradesh, Punjab, Bihar Jharkhand have been uploaded in the Geo-portal.
- Infrastructure Map of Maldah district has been uploaded.
- Theme Maps of National Highway, Wild Life, Railways, National Park, India Airways have been uploaded.

- State Map of Rajasthan, Tamil Nadu, Himachal Pradesh, Punjab, Goa and Sikkim have been uploaded.
- Data base preparation of Solar Parks, CGHS Wellness Centre, Pin Code Mapping is under process.

WMS/WFS

- GMS Bela-Pratapgarh
- GMS Dibrugarh
- India Soil
- India Soil Cover
- Kedarnath Tourist Map
- India-Variation of Rainfall
- India-Annual Rainydays
- India -Small-scale Land Holding
- India -Physiography
- Web maps in pdf format of Shaktipithas in India & Adjacent Countries(1:6M), Kedarnath Tourist Map have been uploaded.
- Data Centre activities: DR (Disaster Recovery) and Back-up Solution for E office installed.

Golden Map Service (GMS):

Initiative: 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.

Objective: 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 landuse. 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;

- 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.
- Secondary: To provide route maps between two points in the country.

- Tertiary: To provide a basis for a variety of social, economic, administrative operations related to elections, crime, rural marketing, relief and supply etc.

Achievement: Cities like Noida (Uttar Pradesh), Gurgaon (Haryana), Maldah (West Bengal), Kalpetta (Kerala) are currently under process. Jaipur (Rajasthan) is completed and awaiting printing. Pratapgarh (Uttar Pradesh) in Hindi also completed and awaiting printing.

District Planning Map Series (DPMS)

Initiative: 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.

Objective: 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.

Achievement: NATMO has already published 280 districts maps for the users. Digital version of the maps are also in the final stage. However, revision and updation work on account of formation of new districts, are in progress.

This year NATMO has completed ten (10) district maps and the same are awaiting for printing.

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.

Thematic map on India Shaktipith, Airways, National Highway, has now been completed and published by NATMO. India Administrative Map (Reprinted) and West Bengal State Administrative Map have also been published during the FY.

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; however, it is now under scrutiny level.

ii) **Commemorative Atlas:** NATMO has taken up this task with fourteen different themes of contemporary importance. The atlas has been completed and it is under scrutiny before final submission

National Atlas of India

Initiative:

In the year 1956, the then Prime Minister of India, Pundit Jawaharlal Nehru 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, 'भारतीय 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.

Objectives:

- To have India's National Atlas like the other countries of the world.
- To depict the country in respect of its geology, geography, geomorphology, demography, culture, administration, etc. in thematic map form.

Achievement:

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.

Atlas For Visually Impaired (BRAILLE)

Initiative: 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.

Objective: 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.

Achievement: NATMO has started preparing Braille atlas in different regional languages due to demand from different states schools and accordingly Atlas of Telengana, Assam and Jammu & Kashmir is completed and will be published soon in hard copy form. Telengana

atlas is being prepared in Telugu Braille Script. Regional languages chosen for preparing Braille atlas are- Assamese, Bengali, Oriya, Telugu, Tamil and Malayalam.

Monographs:

Monographs are published by NATMO on specific topics. NATMO's monographs on Geomorphology, Lakshadweep, are popular among the series.

Achievement : This year NATMO has completed one monograph on 'Shaktipiths', the same will be published very soon.

Shaktipiths of India, another monograph on the historical review of the *Shaktipiths* that elaborates the historical events connected to Hindu religion through various thematic maps.

Other Services

» **Exhibitions and Fairs :** NATMO participated in 20 exhibitions and fairs all over the country. Through sales of the publications, NATMO earned Rs 526155/- during this year.

» **Important other programs convened during the year:** NATMO participated in first Scientific Hindi Workshop at Hyderabad during 21st and 22nd March, 2024. NATMO was awarded the 2nd prize by DST for '**डीएसटी उत्कृष्ट कार्यान्वयन प्रोत्साहन योजना' 2023-24**'

Conclusion: NATMO as a pioneer mapping organisation has been playing a substantial role in contributing to nation development. NATMO's achievements are just the open proof of its integrity and commitment to the societal needs. The successful set-up of data centre in NATMO is going to be a paradigm shift in the activities and deliverables from this organisation in providing more and better map services in the coming years.

CHAPTER 9

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.

9.1 General Administration

During the financial year 2023-24, the Department has saved nearly Rs.75 lakhs in electricity consumption by taking the measures installation of Roof Top Solar Power Plants, Reduction in Demand load @200 KVA per month and improvement of Power Factors. This Department has earned a revenue approximately of Rs.1.40 Crores by way of collecting License Fees from Commercial Organizations like Bank, Post office and by way of reimbursements of Service Charge, Electricity & Delhi Jal Board consumption charges from the Govt organizations housed in Technology Bhavan.

Special Campaign 3.0 for Institutionalizing Swachhata and minimizing Pendency in Government offices was organized during October 02-31, 2023. Some of the activities organized under special campaign were:

- Distribution of metallic water bottles among the students of MCD Primary schools and advised all the students not to use plastic water bottles.
- Distribution of jute bags among the families of nearby slum area and educated them regarding environment hazards of single used plastic.

Organising of Ayurveda Day on 31st October, 2023 in the Department. During the occasion Director General, Central Council for Research in Ayurveda Science (CCRAS) delivered the lecture on ***'Ayurveda for Everyone on Everyday'.***

Special Plantation Drive was carried out by plantation in Technology Bhawan.

Celebration of Constitution Day: To Commemorate the adoption of the Constitution of India by the Constituent Assembly on 26th November, 1949, the Department of Science & Technology organized a pledge ceremony for celebration of the Constitution Day at Technology Bhawan. All the Scientists, officers and staff of DST, DSIR and PAO participated in the reading of preamble to the Constitution of India. The Constitution Day was also celebrated in subordinate offices and Autonomous Institutes/ Statuary Bodies under the administrative control of DST.

9.2 Staff Position

Group A							
Category	Gen.	SC	ST	OBC	EWS	PH	Total
Scientific	75	8	4	12	0	2	**99**
Non-Scientific	33	9	1	9	0	1	**52**
Group B							
Scientific	8	0	0	1	0	1	**9**
Non-Scientific	72	8	5	24	0	6	**109**
Group C							
Scientific	0	0	0	0	0	0	**0**
Non-Scientific	45	46	6	35	7	7	**139**

9.3 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 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.

The information regarding Grants-in-aid ranging from Rs.10 lakh to Rs. 50 lakh, both recurring & non-recurring, released to private institutions/ voluntary organizations during the year 2023-24 for inclusion in the Annual Report may be treated as 'NIL'.

9.4 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.), Assistant 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 in 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 2023-24. 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 work in Hindi.

34th meeting of Joint Hindi Advisory Committee meeting was organised on 15th December, 2023 under the chairmanship of Dr. Jitendra Singh, Minister of Science and Technology and Earth Sciences at Aryabhatt Hall, Department of Science and Technology.

Celebration of Hindi Pakhwara: Various Hindi competitions were organized during the Hindi Pakhwara of the Department, from 14 to 28 September, 2023 and successful participants were given monetary awards and certificates. The closing ceremony of Hindi Pakhwada was organized in Aryabhatt Hall, Department of Science and Technology on 8th November, 2023.

9.5 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 2023 to 31st March 2024, 1326 RTI applications and 65 First Appeals were received by the Department out of which 1324 RTI applications and 61 Appeals have been disposed of as per the provisions of the RTI Act, 2005.

9.6 Public Grievance

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.

2559 public grievances were received by the Department during the period from 1st January, 2023 to 31st March, 2024. In addition to this, there was a backlog of 184 grievances. Out of these 2743 grievances (2559+184), a total of 2674 grievances have been disposed of by 31st March, 2024.

Further, 245 appeals were received in respect of public grievances during the period from 1st January 2023 to 31st March 2024. Out of these, 216 appeals have been disposed of by 31st March, 2024.

9.7 Special Campaign 3.0

The Department of Science & Technology (DST), its subordinate offices and Autonomous Institutions vigorously participated in the Swachhata campaign. The Achievements/ Outcomes of DST including its subordinate offices and Autonomous Institutions during the Special Campaign 3.0 are as under:-

- DST, along with its subordinate and Autonomous Institutions carried out swachhata drives at 320 sites.
- A total of 8,214 files were reviewed and out of them 3,066 files have been identified for weeding out. All 3,066 files identified for weeding have been weeded out during the Implementation phase of Special Campaign 3.0.
- A total of 130 e-files have been closed after a review of 140 e-files.
- All six pending VIP references identified during the preparatory phase were disposed of.
- Out of 55 Public Grievances which were identified during the preparatory phase 44 were disposed of during the implementation phase.
- Out of 20 Public Grievance Appeals identified during the preparatory phase 16 were disposed of.
- A total of Rs. 8,33,784/- has been generated as revenue by DST, its Subordinate, and Autonomous Institutions by way of disposal of scrap, and 37,270 sq feet of space has been freed.

DST, its Subordinate and Autonomous Institutions have issued more than 70 tweets by using the Special Campaign #3.0. Moreover, two press releases about the best practices being followed in the Department of Science and Technology have been issued.

9.8 Vigilance

- The Vigilance Unit of the Department of Science & Technology (DST) is headed by a Chief Vigilance Officer (CVO), who is an Additional Secretary of the Department. He is supported by an Under Secretary, a Section Officer and other Secretarial Staff.
- Apart from handling vigilance related cases of the Department, its subordinate offices and aided 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.
- During 2023 (as on 31.12.2023), Vigilance Unit dealt with the following number of complaints:

Source	Opening Balance	Recd. During the year	Total	Disposed	Balance
CVC	1	20	21	21	0
Others	17	59	76	76	0

- The Vigilance unit also consolidates reports/returns received from the subordinate offices and aided 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.
- Besides this, the CVO closely liaises with all attached and subordinate offices to monitor and ensure the timely disposal of various vigilance cases.
- This year, a Vigilance Clearance Portal has been created to provide online Vigilance Clearance.
- Vigilance Awareness Week was observed in DST and DSIR from October 30 to November 5, 2023, promoting transparency and accountability. Activities included an Integrity Pledge, essay writing, turncoat debates, slogan writing, drawing, poster making, and story weaving competitions for employees and their children.

Fig.: Integrity Pledge administered in DST on Vigilance Awareness Week 2023

Fig.: Drawings made by the Children of DST/DSIR employees

- To prevent occurrence/reoccurrence of vigilance cases, the Unit emphasized preventive vigilance by systematically seeking presentations from organizations under the Department's administrative control to identify and address potential loopholes.

9.9 Status note on compliance of cyber security

Following activities/measures were undertaken towards strict compliance of cyber security guidelines during the said period-

- The guidelines of CERT-In have been circulated to all Divisions of DST and the ABs/ Attached & Subordinate Offices for strict compliance.
- CERT-DST has been constituted by DST vide order dated 06.03.2023. Regular meetings of CERT-DST are conducted for monitoring the compliances of the CERT-In guidelines.
- A new IT Cell has been set up in the Department vide order dated 21.12.2023. This cell will, inter-alia, function as Cyber Cell under the charge of CISO, DST.
- Exercise to remove administrative privileges from all Users' PCs have been completed.
- New PCs with Windows 11 have been procured to replace all PCs with Windows 7/8/8.1.
- MAC binding implemented on all ports.
- Replaced Obsolete L2 switches and upgraded to the latest OS.
- All L2/L3 switches and router are under AMC.
- EDR was installed in all Desktops.
- One training session was also conducted by DST training section on Cyber Security Awareness.
- Wi fi was deactivated for all MTS.
- All OTT platforms has been removed from browsing in Technology Bhawan NIC Network.
- All obsolete machines were detached from DST LAN.
- Implemented network segmentation in Technology Bhawan LAN.
- Security audit for various websites of DST has been done.
- EDR and UEMs were installed in Technology Bhawan. All the Cyber Security related activities are coordinated by NIC unit along with CISO, DST.

9.10 Data & Strategy Unit

A Data & Strategy Unit under the Department of Science and Technology was established with reference to the D.O. letter from Sh. Bhaskar Khulbe, Advisor to Hon'ble PM dated 02nd February 2021. The key roles of the DST-DSU include breaking silos within the Department to enable the creation of well-integrated monitoring and data systems while ensuring adequate

focus on data quality and security. It also encompasses creating mechanisms for regular data analysis within Department to inform policy decisions.

Coordinating with scheme divisions within the Ministry/Department as well as with required external partners such as States, other Ministries/Departments, research organizations, leading private players, and academic institutions for taking necessary steps in the direction is also one of their key responsibilities along with an in-depth review of the Data Governance Quality Index (DGQI) action plan developed by the Department under the guidance of the NITI Aayog.

As a newly established mechanism, DST-DSU has been actively engaged in numerous initiatives throughout the year:

- The Data & Strategy Unit (DSU)-DST secured the **1st rank in DGQI** among Scientific Ministries/Departments and achieved an impressive **8th rank out of 66 Ministries/ Departments** with a score of 4.67/5.00.
- Established a shared space within the Department for open discussions on data and its importance.
- Initiated a **"Lecture Series"** for Department employees, featuring interactive sessions with speakers from various fields and institutions, including Dr. Akhilesh Gupta (DST Senior Adviser), Dr. Debapriya Dutta (Head SEED), Dr. Sanjeev K. Varshney (Head ICD), Sh. Pardeep Singh (Deputy Surveyor General), Sh. Anupam Raj (ACGA, PFMS Division, Ministry of Finance, Government of India), and Prof. Suhel Parvez (Jamia Hamdard).
- Published an **"Annual Project Report"** for FY 2022-23, providing a visual summary of funding distribution across states, institutions, and gender categories.
- Since the establishment of the Data Strategy Unit (DSU), it has created **dashboards for all DST schemes** from **2017-18** onwards. Additionally, the DSU is developing individual dashboards for each program to facilitate monitoring, evaluation, and research.
- The Unit promotes DST scheme awareness with **weekly thematic posters and data infographics** at Technology Bhawan and collaborates with DST Data Officers to streamline data collection mechanisms.
- DSU runs an **Internship Programme**, encouraging interns from various academic institutions to contribute fresh and innovative ideas to meet the Unit's objectives.

Scan for DSU Dashboards

TABLEAU PUBLIC
DATA AND STRATEGY UNIT

DSU21-DST@GOV.IN | @dsu_dst | Data and Strategy Unit, DST

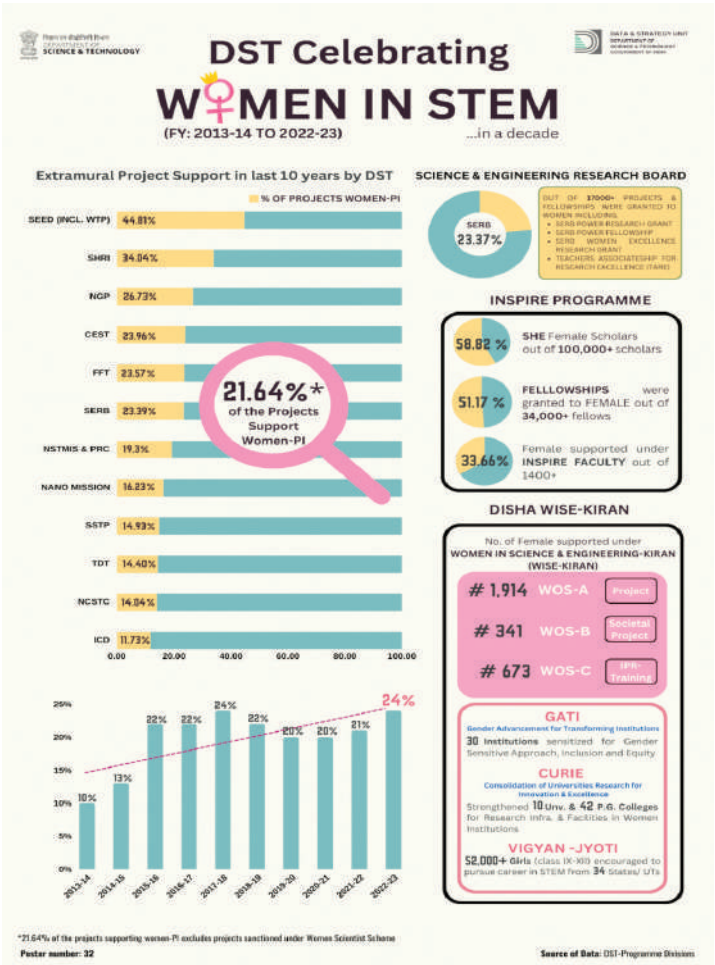


Fig.: Data-driven report on a decade of support for women in STEM.

CHAPTER 10

AUDIT OBSERVATION

Annexure-I

Position as on 31.03.2024

Detailed position of Action Taken Notes (ATNs) to be included in the Annual Report for the year 2023-24 as per the table 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 31.03.2024

Summary of important Audit Observations pertaining to DST: **NIL**

CHAPTER 11

BUDGET

FINANCIAL STATEMENT

Summary of Financial Requirements					
Sl No.	**Head of Development Projects/ Programme/ Scheme**	**(₹ in crore)**			
		Actual 2022-2023	**BE 2023-2024**	**RE 2023-2024**	**BE 2024-2025**
1	Secretariat	94.31	114.00	115.14	122.61
2	Survey of India	475.72	530.70	457.47	533.64
3	National Atlas and Thematic Mapping Organisation (NATMO)	28.29	36.05	34.27	31.19
4	Science Counsellors Abroad	21.12	11.50	10.00	8.50
5	Science and Technology Institutional and Human Capacity Building	769.88	1068.40	500.00	900.00
6	Research and Development	245.04	592.00	200.00	391.00
7	Innovation, Technology Development and Deployment	476.33	536.60	200.00	536.61
8	National Mission on Inter disciplinary Cyber Physical System	299.40	580.00	435.00	564.46
9	National Quantum Mission	0.00	0.00	5.00	427.00
10	Science and Engineering Research Board (SERB)	803.00	803.00	1004.50	803.00
11	Technology Development Board (TDB)	100.00	100.00	54.70	100.00
12	Autonomous Institutions and Professional Bodies	1246.90	1560.00	1618.30	1612.20
13	National Research Foundation	0.00	2000.00	258.60	2000.00
Total- DST		**4559.99**	**7932.25**	**4892.98**	**8030.21**

Note: BE = Budget Estimates, RE = Revised Estimates

Annexure

Ministry of Science and Technology
Department of Science and Technology

Statement showing Grant-in-aid exceeding Rs. 10 lakh to Rs. 50 lakh (both recurring & non-recurring) sanctioned to private institutions/ Voluntary organizations during the year 2023-24

S. No.	Name of the Institution/ Organization/ Individual	Ministry / Department giving grant	Recurring (In thousand rupees)	Non-recurring (In thousand rupees)	Purpose of the grant
1	Department of Chemical Engineering, BITS Pilani Hyderabad Campus, Hyderabad, Telangana	DST	2000	11500	Fund for Improvement of S&T Infrastructure
2	Department of Civil Engineering, Thapar Institute of Engineering and Technology, Patiala, Punjab	-do-	1900	16000	Fund for Improvement of S&T Infrastructure
3	Department of Environmental and Water Resources Engineering,VIT Vellore, Vellore, Tamil Nadu	-do-	1400	8000	Fund for Improvement of S&T Infrastructure
4	SRM Institute of Science and Technology (Formerly SRM University), Chennai, Kanchipuram, Tamil Nadu	-do-	1650	15050	Fund for Improvement of S&T Infrastructure
5	Ahmedabad University, Ahmedabad, Gujarat	-do-	2400	21500	Fund for Improvement of S&T Infrastructure
6	Chaitanya Bharathi Institute of Technology, Hyderabad Telangana	-do-	700	5000	Fund for Improvement of S&T Infrastructure
7	Joseph's College of Engg,Chennai	-do-	800	6300	Fund for Improvement of S&T Infrastructure
8	Information Technology, Rajagiri School of Engineering and Technology, Rajagiri, Ernakulam, Kerala	-do-	500	3500	Fund for Improvement of S&T Infrastructure
9	Computer Science and Engineering, Mar Epharem College of Engineering and Technology, Marthandam, Kanyakumari, Tamil Nadu	-do-	1000	8000	Fund for Improvement of S&T Infrastructure
10	Botany, Vivekanandha College of Arts and Sciences For Women (Autonomous), Elayampalayam, Tiruchengode, Tamil Nadu	-do-	700	5000	Fund for Improvement of S&T Infrastructure
11	Mechanical Engineering, Sri Eshwar College of Engineering, Coimbatore, Tamil Nadu	-do-	700	5200	Fund for Improvement of S&T Infrastructure
12	Department of Electronics and Communication Engineering, Birla Institute of Technology, Mesra, Ranchi, Jharkhand	-do-	300	17500	Fund for Improvement of S&T Infrastructure
13	Jb Institute of Engineering and Technology, Moinabad, Ranga Reddy, Telangana	-do-	600	4000	Fund for Improvement of S&T Infrastructure
14	Bajaj College of Science, Wardha, Bajaj College of Science, Wardha, Maharashtra	-do-	700	5000	Fund for Improvement of S&T Infrastructure
15	Civil and Environmental Engineering, Birla Institute of Technology, Mesra, Ranchi, Jharkhand, Ranchi, Jharkhand	-do-	1400	8000	Fund for Improvement of S&T Infrastructure
16	Department of Mechanical Engineering, BITS Pilani Hyderabad Campus, Telangana	-do-	1400	8500	Fund for Improvement of S&T Infrastructure
17	Electronics and Communication Engineering, Chennai Institute of Technology, Kundrathur, Kanchipuram, Tamil Nadu	-do-	600	3500	Fund for Improvement of S&T Infrastructure
18	Department of Pharmaceutical Chemistry, Shree Dhanvantary Pharmacy College Kim Surat, Gujarat	-do-	700	5000	Fund for Improvement of S&T Infrastructure
19	Department of Chemistry, Pandit Deendayal Energy University, Gandhinagar, Gujarat	-do-	300	35500	Fund for Improvement of S&T Infrastructure
20	Department of Remote Sensing, BIT Mesra, Ranchi, Jharkhand	-do-	2000	19500	Fund for Improvement of S&T Infrastructure
21	Manipal University Jaipur, Dehmi Kalan, Ajmer Expressway, Jaipur, Rajasthan	-do-	28407.6	70000	Promotion of University Research and Scientific Excellence
22	Sri Ramakrishna College of Arts and Science, Coimbatore, Tamil Nadu	-do-	500	3620	Fund for Improvement of S&T Infrastructure
23	Department of Chemistry, Banasthali Vidyapith, Rajashtan	-do-	1900	17900	Fund for Improvement of S&T Infrastructure

24	Department of Computer Science and Engineering, Vellore Institute of Technology Chennai, Tamil Nadu	-do-	1100	6400	Fund for Improvement of S&T Infrastructure
25	Department of Obstetrics and Gynaecology, Trichy SRM Medical College Hospital and Research Centre, Tiruchirappalli, Tamil Nadu	-do-	1000	8000	Fund for Improvement of S&T Infrastructure
26	Department of Civil Engineering, Shiv Nadar University, Gautam Buddha Nagar, Uttar Pradesh	-do-	1400	8400	Fund for Improvement of S&T Infrastructure
27	School of Civil Engineering, Sastra University, Thanjavur, Tamil Nadu	-do-	2000	12000	Fund for Improvement of S&T Infrastructure
28	Department of Chemistry, Biochemistry and Forensic Sciences, Amity University Haryana, Gurgaon, Haryana	-do-	2000	17850	Fund for Improvement of S&T Infrastructure
29	Department of Chemical Engineering, Shiv Nadar University, Gautam Buddha Nagar, Uttar Pradesh	-do-	1600	9500	Fund fo Improvement of S&T Infrastructure
30	Centre For Innovative Manufacturing Research, VIT University, Vellore, Tamil Nadu	-do-	200	9000	Fund for Improvement of S&T Infrastructure
31	Centre For Nanotechnology Research, VIT University, Vellore, Tamil Nadu	-do-	1500	8500	Fund for Improvement of S&T Infrastructure
32	Department of Chitkara University Research and Innovation Networ, Chitkara University, Patiala, Punjab	-do-	1000	5500	Fund for Improvement of S&T Infrastructure
33	Vellore Institute of Technology Chennai, Tamil Nadu	-do-	200	9000	Fund for Improvement of S&T Infrastructure
34	Department of Aiccrs, Amity Institute of Click Chemistry Research and Studies, Gautam Buddha Nagar, Uttar Pradesh	-do-	1500	22000	Fund for Improvement of S&T Infrastructure
35	Guru Nanak College, Chennai, Tamil Nadu	-do-	800	6600	Fund for Improvement of S&T Infrastructure
36	BMS College of Engineering, Bengaluru Urban, Karnataka	-do-	1000	8500	Fund for Improvement of S&T Infrastructure
37	Fatima College(Autonomous), Madurai, Tamil Nadu	-do-	900	7100	Fund for Improvement of S&T Infrastructure
38	G H Raisoni College of Engineering and Management, Wagholi, Pune, Maharashtra	-do-	1100	9000	Fund for Improvement of S&T Infrastructure
39	Rungta College of Engineering and Technology Bhilai, Durg, Chhattisgarh	-do-	525	3900	Fund for Improvement of S&T Infrastructure
40	International Institute of Information Technology Hyderabad, Telangana	-do-	45762	69254	Promotion of University Research and Scientific Excellence
41	Shoolini University, Solan, Himachal Pradesh	-do-	25583	63000	Promotion of University Research and Scientific Excellence
42	Manipal University off Jaipur-Ajmer Expressway, Jaipur, Rajasthan	-do-	28408	70000	Promotion of University Research and Scientific Excellence
43	Symbiosis Institute of Technology, Lavale, Pune, Maharashtra	-do-	14869	36500	Promotion of University Research and Scientific Excellence
44	Koneru Lakshmaiah Education Foundation, Vaddeswaram, Krishna, Andhra Pradesh	-do-	19950	48500	Promotion of University Research and Scientific Excellence
45	Thapar Institute of Engineering and Technology, Patiala, Punjab	-do-	59715	150500	Promotion of University Research and Scientific Excellence
46	Gandhi Institute of Technology and Management, Visakhapatnam, Andhra Pradesh	-do-	39765	94600	Promotion of University Research and Scientific Excellence
47	SASTRA Deemed University, Thanjavur, Tamil Nadu	-do-	28333	71800	Promotion of University Research and Scientific Excellence
48	KIIT Deemed to be University, Bhubaneswar, Orissa	-do-	19050	45000	Promotion of University Research and Scientific Excellence
49	Charotar University of Science and Technology, Changa, Anand, Gujarat	-do-	23719	59000	Promotion of University Research and Scientific Excellence
50	Birla Institute of Technology, Ranchi, Jharkhand	-do-	24971	59500	Promotion of University Research and Scientific Excellence
51	VIKSAT, Nehru Foundation for Development, Ahmadabad	-do-	2000	0	Core Support Project

52	Foundation for Environment & Economic Development Services (FEEDS), Kangpokpi, Manipur	-do-	4000	0	Core Support Project
53	Himalayan Research Group, Shimla, Himachal Pradesh	-do-	3000	0	Core Support Project
54	Himalayan Environmental Studies and Conservation Organization (HESCO), Dehradun, Uttarakhand	-do-	3085	0	Core Support Project
55	Vigyan Ashram- Indian Institute Of Education, Pune	-do-	3900	1463	Livelihood generation for rural youth through innovation, training and entrepreneurship promotion
56	NBIRT, Tripura	-do-	2400	0	Ensuring Energy security and green livelihood of rural communities using affordable Solar Energy and local resources
57	Society For Development Alternatives, Delhi	-do-	3000	0	Core Support Project
58	People's Science Institute, Dehradun	-do-	0	3698	Strengthening the local innovation systems through SampT interventions for enhancing livelihood system efficiency of EWS in villages of Haridwar district, Uttarakhand
59	Gorakhpur Environmental Action Group, Gorakhpur	-do-	3380	0	"Strengthening resource efficiency in small farm-based livelihood through biologically integrated farming systems in flood prone areas of eastern Uttar Pradesh and North Bihar"
60	Malabar Social Service Society, Kannur, Pallikkunnu, Kerala	-do-	1273	0	Rural Women Technology Park in ten villages of Parappa block of Kasaragod district of Kerala
61	Madhya Pradesh Vigyan Sabha, Gyan Vigyan Parisar	-do-	1352	0	To Establish Women Technology Park for demonstrative model of technologies for livelihood enhancement of tribal women in Narharpur Block, Kanker (C.G.)
62	Amrita Vishwa Vidyapeetham, Ettimadai, Coimbatore, Tamil Nadu	-do-	2308	113	3D printed biochips for early monitoring of thyroid dysfunction
63	Easwari Engineering College Chennai	-do-	2743	1755	Biocompatible Conductive Inks for Cost-Effective Fabrication of Microfluidic Wearable Sensors for Analyzing Glucose Level from Sweat
64	Vignan Foundation for Science Technology and Research University, Vadlamudi, Guntur, Andhra Pradesh	-do-	2706	1920	Processing and preservation of non-timber forest products (resins and flowers)
65	Stanley College of Engineering and Technology for Women (Autonomous)	-do-	2843	1031	IoT Based Landslide and Slope Monitoring system using TDR and Shape Accel Array for Mines
66	Dr. Vishwanath Karad Mit World Peace University, Pune, Maharashtra	-do-	1763	1005	Developing NADES based green technology for extraction of value-added products from marigold flowers
67	Vellore Institute of Technology, Vandalur, Kelambakkam Road, Chennai	-do-	2207	0	Aedes Aegypti mosquito (Dengue) breeding surveillance using drones in flooded regions of Chennai
68	Birla Institute of Technology and Science-Pilani	-do-	0	0	Designing Near-Infrared Fluorescent Probes for Detection of Mycotoxins in Agricultural Crops and Food Items
69	V.G. Vaze College of Art, Science and Commerce, Mulund, Mumbai	-do-	1417	565	Induction of Vitamin D in Chlorella Through photo chemical effect of UV light
70	Aarupadai Veedu Medical College, Pondicherry	-do-	729	274	Dissecting the Role of Megsin in Diagnosis and Prognosis of Alcoholic Liver Cirrhosis
71	Himalayan Organisation for Protecting Environment (HOPE), Uttarakhand	-do-	1016	0	River Rejuvenation and Development of Sustainable Employment Opportunity.
72	Sophitorium Engineering Collage, Odisha	-do-	5000	0	Science Technology and Innovation STI Hub In Koraput Amp Khurda Block, STI HUB KORAPUT Amp STI HUB KHURDA District, Odisha State
73	Centre In Science and Technology Customization for Tribal Development, Odisha	-do-	4800	0	Science Technology and Innovation Hub In Balangir Block, Balangir District, Odisha State

74	Vidya Jyothi Institute of Technology, Telangana	-do-	1812	0	Design And Development of Internet Of Things Based Grain Storage And Grain Monitoring System For Social And Economic Empowerment Of Scheduled Caste Communities In Moinabad Mandal, Rangareddy District, Telangana State
75	Vivekananda Institute of Biotechnology, West Bengal	-do-	0	3455	Science Technology and Innovation Hub In Sunderban, Joynagar II Block, South 24 Parganas District, West Bengal State
76	Cooch Behar Himalayan Nature Development Society, West Bengal	-do-	1105	0	Exploring The Challenges and Opportunity Of Creative Craft Industry A Case Of Rural Rajbanshi Community Of North Bengal
77	AMC Engineering College, Karnataka	-do-	3580	0	Promoting The Hase Chitra Art To Enhance The Livelihood Of Hasala's, SC Community In Karnataka HASE "Hase-Chitra's Amelioration Sustainbly And Extrapolation.
78	Chandigarh Engineering College, Punjab	-do-	1000	0	To promote and disseminate environment friendly technologies to generate sustainable employment opportunities for SC community
79	P.S.R Engineering College, Tamilnadu	-do-	0	1335	The Livelihood Enhancement of Sangupatti Village SC Community People Engaged In Firecracker Factories And Agro Farm Lands By IOT Enabled Life Standard
80	Aditya Engineering College, Andhra Pradesh	-do-	3930	0	Science Technology and Innovation Hub For Development Of Scheduled Caste Communities In Amalapuram Mandal, Dr B R Ambedkar Konaseema District, Andhra Pradesh State
81	Ramakrishna Mission Vivekananda Educational and Research Institute, West Bengal	-do-	1948	1300	Establishment Of Indigenous Fish and Ornamentals Hub In Sonarpur Block, South 24 Parganas District In Wetlands Region Of West Bengal For Sustainable Livelihood Development Of Local SC/ST Fisher Folks
82	Himalayan Environmental Studies and Conservation Organisation (HESCO), Uttarakhand	-do-	1000	0	Science Technology and Innovation Hub In North India Uttar Pradesh, Uttarakhand And Himachal Pradesh
83	S.A. Engineering College, Tamilnadu	-do-	0	1113	Science Technology And Innovation Hub For Enhancing Employbility Amp Livelihood Of SC Community Population Through Technolgy Development Of Coir Based Products For Appliucation In Construction Amp Manufacturig Sector In S.A. Engineering College,Tiruvallur District, Tamilnadu State
84	Centre For Research and Social Development, Rajasthan	-do-	1600	1900	Improvement Of Livelihood of SC Community Through Horticultural And Agricultural Interventions
85	Kalasalingam Academy of Research and Education, Tamilnadu	-do-	3000	0	Establishment Of STI Hub for Production Of Eco-Friendly And Economical Products To Improve The Socio-Economic Status Of SC/ST Population In Srivilliputhur Block
86	Koneru Lakshmaiah Education Foundation, Andhra Pradesh	-do-	1823	0	Precision Farming and The Value Addition For Scheduled Caste Population In Piduguralla Mandal, Guntur District, Andhra Pradesh
87	Sathyabama Institute of Science and Technology, Tamilnadu	-do-	3300	0	Science Technology And Innovation Hub In Kattumannar Koil, C,D Block, Cuddalore District, Tamilnadu State
88	K R Mangalam University, Haryana	-do-	0	2981	KRMU-KEIC STI Hub, Sohna Block, Gurugram, Haryana
89	Madhya Pradesh Vigyan Sabha, Madhya Pradesh	-do-	3100	0	Science Technology and Innovation Hub In Gyaraspur Block Vidisha District (M.P).
90	BVC Engineering College, Andhra Pradesh	-do-	1317	0	Science And Technology Intervention To Make Low-Cost Fish Dryer To Enhance Socio-Economic Status Of ST Fishing Community Of Konaseema Region

91	Centre In Science and Technology Customization for Tribal Development, Odisha	-do-	1000	0	Capacity Building By S T Intervention In Patachitra And Glass Painting To The Tribals Of Odisha
92	The Energy and Resources Institute (TERI), South Delhi, Delhi	-do-	3168	0	Science, Technology and Innovation Hub In Mokhada Block, Palghar District, Maharashtra For Creating Livelihood Opportunities And Addressing Malnutrition For The Scheduled Tribe ST Communities
93	Pangchen Lakhar Community Conserved Area Management Committee, Arunachal Pradesh	-do-	1562	0	Natural Resource Management and Livelihood Augmentation Through Appropriate Technological Intervention In Pangchenlakhar Community Conserved Area (PALCCA), Zemithang, Arunachal Pradesh
94	Amrita Vishwa Vidyapeetham Amritapuri Campus, Kerala	-do-	0	1346	STI Hub Improving Tribal Livelihoods, Education Sustainability Sti-Itlives
95	Xavier Institute for Tribal Education (XITE), Jharkhand	-do-	1008	0	Science Technology and Innovation Hub In Village Gamharia, Saraikela Kharsawan Block, West Singhbhum District, Jharkhand State
96	KG Reddy College of Engineering and Technology, Telangana	-do-	2213	0	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
97	Agrawal P G College, Rajasthan	-do-	3237	0	Establishment Of Solar Appliances Fabrication Hub 'SAFH' For Livelihood Generation In Tribal Villages Of Udaipur, Rajasthan Science Technology And Innovation Hub In 11Villages, Sarada Amp Jaisamand Block, Udaipur District, Rajasthan State
98	University Of Petroleum and Energy Studies, Uttarakhand	-do-	1207	0	A Novel Artificial Intelligence-Based Smart Snake Trapping Device for Improving The Socio-Economic Status Of Scheduled Tribes Sts In India
99	Gandhi Institute of Technology And Management (GITAM), Andhra Pradesh	-do-	1338	3374	Tribal Women Empowerment Through Provision Of Livelihood Opportunities At V. Madugula Mandal Tribal Hamlets, Anakapalli District, Andhra Pradesh
100	Manthan Educational Programme Society, Gujarat	-do-	2600	0	Science Technology and Innovation Hub At Manthan Narmada Lok-Vigyan Kendra, Dediapada Block, Narmada District, Gujarat State
101	River Research Centre, Kerala	-do-	1082	0	Enhancing Forest-Based Livelihood Opportunities Among Indigenous Tribes In The Western Ghats Of Kerala
102	Research in Environment, Education and Development Society (REEDS), Maharashtra	-do-	1721	2099	Science Technology and Innovation Hub In Akkalkuwa, Akrani Block, Nandurbar District, Maharashtra State
103	KLE Academy of Higher Education and Research, Karnataka	-do-	3783	2724	Feasibility And Impact Of A Tribal Interactive Health, Behavioural And Demography Surveillance System In Belagavi,Karnataka
104	Sri Krishna College of Engineering and Technology, Tamilnadu	-do-	1200	0	Food Fortification Technology To Combat Primary Health Care Deficiencies And Economic Empowerment Of Dwellers In Forest Fringe Villages
105	Society For Peoples Action in Rural Service and Health, Maharashtra	-do-	1578	0	Technological Intervention in Promoting Composting and Kitchen Gardening For Safe And Sustainable Food Production In Tribal Villages Of Aspiration Gadchiroli District, Maharashtra
106	The Energy and Resources Institute, New Delhi	-do-	1800	0	Long-term Development and Maintenance of NSTMIS website including the Digital Repository for S&T Publications and Preparation of Online Directory of R&D institutions

107	Vardhaman College of Engineering, Hyderabad, Telangana	-do-	1300	0	Charaterizing the scope, opportunities, challenges & future trends in technology entrepreneurship education in India
108	CMR Technical Campus, Hyderabad, Telangana	-do-	2500	0	Study of Stimulating Research in Indian Universities for Socio-economic Development of India
109	CMR Technical Campus, Hyderabad, Telangana	-do-	1110	0	Assessment of R&D impact on socio-economic status of rural India
110	Yenepoya (deemed to be University), Mangalore, Karnataka	-do-	1627	NA	WOS-A
111	REVA University, Bangalore, Karnataka	-do-	1907	NA	WOS-A
112	M. S. Swaminathan Research Foundation, Chennai, Tamil Nadu	-do-	1183	NA	WOS-A
113	M. G. Science Institute, Ahmedabad, Gujarat	-do-	1033	NA	WOS-A
114	TERI School of Advanced Studies, New Delhi, Delhi	-do-	1138	NA	WSE-PDF
115	Vellore Institute of Technology, Vridhachalam, Tamil Nadu	-do-	1138	NA	WSE-PDF
116	Kanya Maha Vidyalaya, Jalandhar, Punjab	-do-	1078	NA	WSE-PDF
117	Jamia Hamdard, New Delhi, Delhi	-do-	0	2499	CSRI
118	Birla Institute of Technology, Mesra, Noida Campus, Uttar Pradesh	-do-	2039	0	CSRI
119	International Institute of Information Technology, Hyderabad, Telangana	-do-	1750	1323	CSRI
120	LV Prasad Eye Institute, Hyderabad, Telangana	-do-	1298	0	CSRI
121	Amrita School of Engineering, Coimbatore, Tamil Nadu	-do-	NA	1000	CSRI
122	Mitaly Bansal (Borlaug Institute for South Asia, Ludhiana, Punjab)	-do-	2248	NA	Faculty Fellowship
123	Mayuri Rege (Ramnarain Ruia Autonomous College Mumbai)	-do-	1627	NA	Faculty Fellowship
124	Raja Lakshmi S (Institute of Bioinformatics and Applied Biotechnology)	-do-	2246	NA	Faculty Fellowship
125	SRM Institute of Science and Technology, Chennai	-do-	1000	0	Design and development of sensor for detection pf pharmaceutical compounds present in water and wastewater
126	CEPT University, Gujrat	-do-	3167	0	Water4Change Integrative and fir-for- purpose water sensitive design framework for fast growing liveable cities
127	Manav Rachna International University. Faridabad, Haryana	-do-	4132	0	Co-solving water logging and groundwater depletion issue in parts of Faridabad Smart City using Underground Taming of Flood water for Aquifer Storage and Recovery
128	REVA University, Bengaluru, Karnataka	-do-	1290	1198	R&D
129	Birla Institute of Technology and Science, Hyderabad, Telangana	-do-	1294	1685	R&D
130	Vellore Institute of Technology, Vellore, TamilNadu	-do-	835	1097	R&D
131	BITS Pilani, Goa	-do-	312	645	
132	Institute of Advanced Research, Koba Institutional Area, Gandhinagar, Gujarat	-do-	1258	2006	R&D
133	Jain University, Karnataka	-do-	1332	1067	R&D
134	Jain University, Karnataka	-do-	2310	2900	R&D
135	Plaksha University, Mohali, Punjab	-do-	2007	1968	R&D
136	Vidyavardhaka College of Engineering, Mysuru, Karnataka	-do-	824	0	
137	Customized Energy Solutions (CES)	-do-	1000	0	India Energy Storage Week (IESW) 2023.
138	Customized Energy Solutions (CES- IESA)	-do-	2310	0	Industry Research & Development Fellowship Programme (IRDFP)" jointly with India Storage Energy Alliance (IESA)

139	Graphic Era University, Uttarakhand	-do-	1246	0	R&D
140	Chennai Institute of Technology, Tamil Nadu	-do-	3105	0	R&D
141	Chitkara University, Punjab	-do-	0	2225	R&D
142	Thapar Institute of Engg. & Tech, Punjab	-do-	1124	5584	R&D
143	Sri Ramakrishna Engg. College, Tamil Nadu	-do-	1224	1769	R&D
144	VIT University, Tamil Nadu	-do-	1678	1650	R&D
145	Chebrolu Engineering College, Andhra Pradesh	-do-	1574	0	R&D
146	RVR & JC College of Engineering, Andhra Pradesh	-do-	1427	0	R&D
147	SIBAR Guntur, Andhra Pradesh	-do-	1008	0	R&D
148	BITS, Pilani, Hyderabad Campus, Telangana	-do-	1164	2000	R&D
149	Manipal Institute of Technology, Karnataka	-do-	0	3396	R&D
150	Mepco Schlenk Engineering College,Mepco Schlenk Engineering College, Tamilnadu	-do-	0	1011	R&D Project
151	Pankajakasthuri Ayurvedic Medical College, Thiruvananthapuram, Kerala	-do-	2729	5626	R&D Project
152	Saintgits College of Engineering, Kottayam, Kerala	-do-	1027	0	R&D Project
153	International Institute of Information Technology, Hyderabad, Telangana	-do-	1544	0	R&D Project
154	Saveetha Dental College and Hospitals, Saveetha University, Chennai	-do-	1004	0	R&D Project
155	Karpagam Academy of Higher Education, Coimbatore Tamilnadu & Tocklai Tea Research Institute Jorhat, Assam	-do-	3374	1666	R&D Project
156	Thapar Institute of Engineering and Technology University, Punjab	-do-	1860	2326	R&D Project
157	Velammal College of Engineering and Technology, Madurai, Tamilnadu	-do-	1142	0	R&D Project
158	SRM Institute of Science and Technology Kanchipuram, Tamilnadu	-do-	1449	2027	R&D Project
159	SRM University-AP, Amaravati, Andhra Pradesh	-do-	1648	2200	R&D Project
160	Pandit Deendayal Energy University, Gandhinagar, Gujarat	-do-	2159	0	R&D Project
161	UPES, Dehradun	-do-	0	4550	DST-iTBI (Private institute)
162	CVRU I-TBI FOUNDATION, at Dr. C. V. Raman University – Chhattisgarh, Bilaspur.	-do-	1800	0	To implement the various activities of iTBI related to innovation and entrepreneurship.
163	Electronics and Software promotion Export Promotion Council (ECS)	-do-	1150	0	INDIASOFT 2023
164	Indian STEP & Business Incubator Association	-do-	1387	0	DST Startup Utsav 2022
165	Dayananda Saga rEntrepreneurship Research and Business Incubation Foundation	-do-	1082	0	Technology Business Incubator (TBI)
166	JSSATE- Science and technology Entrepreneurship Park, Noida	-do-	2140	0	Participation of DST supported Women Entrepreneurs in GiTEX 2023
167	International Institute of Information Technology Hyderabad Hyderabad Telangana	-do-	1000	0	Project on IoT Enabled Smart Cities Pollution Health and Governance
168	Mr. Geospatial Media and Communicatins Pvt. Ltd. Geospatial Media Communications Noida Gautam Buddha Nagar. Uttar Pradesh	-do-	2000	0	Participation in GeoSmart India 15-17 November 2022 Hyderabad
169	Bharati Vidyapeeth Deemed University Institute of Environment Education and Research Pune Maharashtra	-do-	3791	0	PMU for Catalysing Geospatial Capacity Building Post National Geospatial Policy 2022
170	Mr. Geospatial Media and Communicatins Pvt. Ltd. Geospatial Media Communications Noida Gautam Buddha Nagar. Uttar Pradesh	-do-	1200	0	Becoming Knowledge Partner and participation in exhibition in geo-smart India 2023 scheduled to be held on 17th-19th October 2023 at Hydrabad International Convention Centre
171	Anusandhan National Research Foundation (ANRF)	-do-	9422	2410	To promote R&D activities in the Country
172	Chitkara University, Pinjore	-do-	1435	0	R & D under SHRI

173	Rajalakshmi School of Architecture Thandalam, Chennai, Tamilnadu	-do-	2866	0	R & D under SHRI
174	Search and research development society Bhopal, Madhya Pradesh	-do-	1500	0	R & D under SHRI
175	Vellore Institute of Technology Chennai, School of Mechanical Engineering (SMEC)	-do-	0	1183	R & D under SHRI
176	Pankajakasthuri Herbal Research Foundation, Thiruvananthapuram, Kerala	-do-	3500		R & D under SHRI
177	School of Electrical Engineering Kalinga Institute of Industrial Technology, Bhubaneswar, Orissa	-do-	1200	0	R & D under SHRI
178	Velammal College of Engineering and Technology, Madurai, Tamilnadu	-do-	1253		R & D under SHRI
179	Department of ECE, REVA University, Bangalore, Karnataka	-do-	1626	1376	R & D under SHRI
180	Sophitorium Institute of Technology Life skills, khordha Orissa	-do-	2387	2665	R & D under SHRI
181	Malla Reddy, Engineering College (Autonomous), Hyderabad, Medchal Malkajgiri, Telangana	-do-	0	1058	R & D under SHRI
182	Nehru Arts and Science college, Coimbatore, Tamilnadu	-do-	1778	0	R & D under SHRI
183	Pankajakasthuri Ayurveda Medical College and PG CentreKattakada, Thiruvananthapuram, Kerala	-do-	6396	1628	R & D under SHRI
184	Pasumpon Muthuramalinga Thevar Memosrial, College, Kottaimedu Post, Kamuthi Taluk, Ramanathapuram District, Tamil Nadu	-do-	3500	0	R & D under SHRI
185	Pankajakasthuri Ayurveda Medical College & P.G. Centre, Thiruvananthapuram, Kerala	-do-	1843	2403	R & D Millet Program
186	Vigyan Vani Kendra Education and Activity Society, Itarsi, Madhya Pradesh	-do-	1199	0	R & D Millet Program
187	The IIS University Gurukul Marg, Mansarovar, Jaipur, Rajasthan	-do-	833	281	R & D Millet Program
188	Search and Research Development Society, Bhopal, Madhya Pradesh	-do-	1233	0	R & D Millet Program
189	Amal Jyothi College of Engineering Kottayam, Kerala	-do-	1750	0	Science Ride
190	Carvan Sanskritik Evam Vikas Manch GopalGanj, Bihar	-do-	1870	0	Science and Tech Awareness Exhibition
191	SHK Trust Sangli, Maharashtra	-do-	1800	0	India's First Astrnomical Dark Sky Reserve-Phase 1
192	Ramanujan Society of Mathematics and Mathematical Sciences Jaunpur, Uttar Pradesh	-do-	1400	0	Advancement Quality Education and Inspiring School Students in Mathematics and Science through Fair, Exhibition, Quiz and Documentary
193	Shree Bhardwaj Cramodyog Seva Sansthan Maharajganj, Uttar Pradesh	-do-	1800	0	Motivation and Innovative Programs for Science Students of Maharajganj and Siddarthnagar District of Uttar Pradesh
194	Grassroots Foundation Mumbai, Maharashtra	-do-	1500	0	Scientific Litercy and ST communication promotion across the country through Science Media Communication Research, Applications Field Capacity development. To benefit people from sci-media, especially community science media, science through ICT/Digital/A-V applications Virtual Exhibitions, etc. Innovating, augmenting, synergizing and harnessing Science Communication/ Science Media with emerging trends, applications, research Communication, Science Risk Communication, Nature Science Communication
195	Shri Satpuda Sanjivani Seva Sansthan Khargone West Nimar, Madhya Pradesh	-do-	1800	0	Promoting Scientific Temper in Tribal Population of three targeted blocks for Health & Education Challenges

196	Sankalp Samajik Avam Paryawaran Vikas Sansthan Haridwar, Uttarakhand	-do-	1800	0	Vigyan evam Prodhogiki Media ke madhyam se plastic pradushan or swashchta par vigyan prodhogiki jagrukta
197	Shri Ganga Sewa Samiti Almora, Uttarakhand	-do-	1900	0	Pahadi shetr ghaat va narayan bagadh blockon men shikshakon ka jokhim taiyari pashikshan or jokhim vigyan sanchaar
198	Choupal Samudayik Vikas Samiti Almora, Uttarakhand	-do-	1900	0	Pithoragarh Zile ke 2 Vikaskhandon mai Vigyan Jagrukta abhiyano ke dwara vigyan lokpriykaran
199	Kadam Jan Vikas Sanstha Gwalior Gwalior, Madhya Pradesh	-do-	2500	0	Jan Jatiy Mahila swayn shayta samuh or vigyan media vigyan media srahna ke saath shamta nirmaan
200	Aadarsh Human Rural Development Society Tikamgarh, Madhya Pradesh	-do-	1800	0	Swasth evam poshan vigyan suraksha hetu vigyan chetna
201	Shri Heeralal Mahore Shiksha Prasar Samiti Gwalior, Madhya Pradesh	-do-	1800	0	Schoolon mai vigyan media ke paramprik or ubharte anuprayog ke liye vigyan kathakron or vigyan animetron ka vikas
202	Vaibhav Laxmi Lok Samvridhi Sanstha Nainital, Uttarakhand	-do-	2000	0	Mahilaon ki vyavsaayik suraksa or satt aajivika ke liye vigyan or prodhogiki ko lokpriy bnana
203	Chandpara Scheduled Caste Tribal Welfare Association North Parganas, West Bengal	-do-	2000	0	Health Risk & Sanitation Science Communication Campaign for SC Communities in Gaighata block, District- North 24 West Parganas West Bengal
204	Kadam Samiti Nainital, Uttarakhand	-do-	1800	0	Training Teachers with “Do it Yourself” applications for Promoting Scientific Innocation Mindset of Students
205	Gramin Vikas Sanstha Chicholi Betul, Madhya Pradesh	-do-	1800	0	Vigyan evam Prodhogiki Sanchar ke lok madhymon ka upyog karte huye aadiwasi mahila swasthy ke shetr men vigyan evam prodhogiki ka upyog
206	Indian Resource and Development Association Kurukshetra, Haryana	-do-	2400	0	Science on Sheel (STEM BIKE)
207	All India Samaj Sewa Kendra Yamuna Nagar, Haryana	-do-	1850	0	STEM Demonstration Dissemination Popularization
208	Shri R.S. Educational Society Jabalpur, Madhya Pradesh	-do-	1300	0	Science awareness and exhibition campaign
209	Shristi Jan Kalyan Samiti Yamuna Nagar, Haryana	-do-	1800	0	Science Awareness Exhibition (STEM Demonstration Dissemination Popularization)
210	Laxmi Samajeek Vikas Avm Swasthya Samiti Almora, Uttarakhand	-do-	2000	0	Vigyan Evam Prodhoyogi Media Aadharit Handson prashikshan vigyan sanchar
211	Ek Ummeed Shaikshanik Evam Samajik Kalyan Evam Vikas Samiti Indore, Madhya Pradesh	-do-	1573	0	Creating Women and Students Sentinels and Disaster Literate Society through Creative Science and Technology Communication
212	Uttranchal Javik Utpadak Avem Prodhoyogiki Vikas Swayatt Sahkarita Almora, Uttarakhand	-do-	2500	0	Jaiv vaividhata suraksha, manav va jangali jiv dwandh ke ghataav ke liye jokhim v vigyan jagrukta
213	Shram Shakti Mahila Seva Sansthan Sagar, Madhya Pradesh	-do-	1544	0	Schoolon mai katha vachan (vigyan fikshan) koshal vikas ke madhyam se vigyan ka lokpriykaran
214	Shree Mateshwari Vikas Sewa Samiti Udaipur, Rajasthan	-do-	2500	0	Vigyan Media or aadivasi mahilaye: satt vaigyanik krishi vigyan va taknikon ki or unnmukh kar vaigyanik jagrukta ko badhawa dena
215	Science Centre Gwalior Bhopal, Madhya Pradesh	-do-	2500	0	Prakrati Media Shala: A Virtual Exploratory of Nature for Children, Teachers, Youth & Common Mass Based on Science Media Application, Gamification and Do It Yourself Method
216	Rural and Urban Development through Right Awareness Society (RUDRA) Karauli, Rajasthan	-do-	1800	0	Hands on science and science media for energy awareness of students
217	Sandhan Sansthan Udaipur, Rajasthan	-do-	1700	0	Developing Risk Science Communicators from Tribal Women SHG Leaders
218	Akanksha Seva Samiti Karauli, Rajasthan	-do-	1800	0	Science and Health Awarness of farmers through risk and science communication

219	Aagaj Samaj Sevi Sanstha Gwalior, Madhya Pradesh	-do-	2000	0	Swachta, Swasthya or poshan vigyan jagrukta
220	Ek Ummeed Shaikshanik Evam Samajik Kalyan Evam Vikas Samiti Indore, Madhya Pradesh	-do-	2000	0	Teachers workshops for Digital Science Communication on Environmental and Climate Change Risks
221	Rishiraj Samajik Avam Shashnic Sanstha	-do-	2300	0	To promote the use of renewable energy by motivating and
222	Indore, Madhya Pradesh	-do-	0	0	creating awarness among school students through Sampt communication and science media
223	Minerva Skills Society for Education and Vocational Training Samiti Indore, Madhya Pradesh	-do-	2000	0	S T Media for Waste Management and Science Awareness for pollution free landscape
224	Prakalp Sansthan Udaipur, Rajasthan	-do-	2000	0	Development of Scientific Thinking of Organic Farming Innovation with Women Farmers
225	Lok Vikas Samiti Udaipur, Rajasthan	-do-	2350	0	Folk Media for scientific awareness of Health, Natutral Resources in Chotti Sadari and Shariyawad blocks of Pratapgrah district
226	Samvedana Jan Sewa Avm Samajothan Samiti Almora, Uttarakhand	-do-	1700	0	Prakarti Vigyan Jagrukta evam prakratik tanaav ke liye grahiniyon men bahuyaami drishtikon v vaigyanik abhiruchi viksit karna
227	Samvedana Jan Sewa Avm Samajothan Samiti Almora, Uttarakhand	-do-	2500	0	Vigyan Subharti-Bhartiy Vigyan Media Sanjaal dwara vaigyanik swabhaav pritsaahan
228	NGO Anand Hoyti Shimla, Himachal Pradesh	-do-	2000	0	Satt Bagwani shamta vikas ke liye sthaniy bhasha men saamudayik vigyan media abhiyaan
229	Ashoka Taqniki Evam Vyvasayik Prashikshan Sansthan, Baran, Rajasthan	-do-	2000	0	Natural resource conservation and science awareness
230	Rishiraj Samajik Avam Shashnic Sanstha Indore, Madhya Pradesh	-do-	1800	0	Achieving Healthy Ageing through scientific evidence based Physical Exercises and activities in Older-aged people
231	Devbhoomi Geet Evam Natya Sanskritik Samiti Nainital, Uttarakhand	-do-	2000	0	Science media assisted capacity building of science narrators and animators and campaign for disaster and health risk reduction
232	ECO Roots Foundation East Delhi, Delhi	-do-	1500	0	A model for creating Cyber-physical learning spaces of Interactive Fun with Science in District Level Clusters of Rural & Peri-urban Schools catalysed by thematic nodalised science communication and a portable Imaginarium of Universe- the Virtual Exploratory
233	Girijan Swaichchhik Sansthan Jaipur, Rajasthan	-do-	2000	0	Health and Health Risk Science Communication and Public Dialogues
234	Girijan Swaichchhik Sansthan Jaipur, Rajasthan	-do-	2389	0	To promote S&T solutions and scientific outlook for Natural Resource Conservation and Livelihoods & Science Awareness in Kota District
235	Himalyan Eco Future Sanstha Almora, Uttarakhand	-do-	2500	0	Kaafligair Chetr men prakrati vigyan evam harit media dwara jokhim sanchar or vaigyanik jagrukta
236	Utkarsh Nav Chetena Va Utthan Sanstha Haridwar, Uttarakhand	-do-	2000	0	Mitti or pani ki gunvatta ki suraksha ke liye vigyan sanchaar
237	Apeksha Mahila Evam Bal Vikas Samiti Kanpur Nagar, Uttar Pradesh	-do-	2000	0	Mahilaon ke liye vigyan or prodhogiki media abhiyan dwara prakratik sansaadhan or aajivika sanrakshan
238	Mahaveer Sewa Sansthan Chitrakoot, Uttar Pradesh	-do-	1800	0	Samaaj ke vanchit vargaron men andh vishwash or mithakon ka mukabla karne ke liye vaigyanik suchna or sanchar ke madhyam se vaigyanik jagrukta ka sarveshan or sarvadhan
239	Green Tomorrow Society Jaipur, Rajasthan	-do-	2500	0	Environmental- Digital Learning (Learning Module and Green Media Toolkit ICT Infotainment Application) for Future Generation of Environmental halth risk & Science
240		-do-	0	0	Awareness

241	Green Tomorrow Society Jaipur, Rajasthan	-do-	2000	0	Nature Science Literacy and Environmental Science Life Campaign through Science Communication
242	Gla University Mathura, Uttar Pradesh	-do-	1500	0	Inculcating Scientific Temper and Socio-Scientific Work Ethics in Next Generation Busines amp Knowledge Workers
243	Dalit Shikharvasi Vikas Samiti Almora, Uttarakhand	-do-	1500	0	Mahila Swasthy Va aajivika ke liye jokhim jagrukta evamvaigyanik swabhaav protsaahan
244	Himproductive Society of Social Welfare Sirmaur, Himachal Pradesh	-do-	1800	0	Maan or Bacche ki suraksha ke liye vigyan: Vaigyanik jeevan shaili vikalpon ke liye jaagrukta abhiyaan or vaigyanik soch paida karna
245	Gramin Mahila Uthan Samiti Almora, Uttarakhand	-do-	1623	0	Mahila aajivija evam udhmita ke vaigyanik utryan ke liye vigyan media karyshala
246	Sahbhagi Vikas Sanstha Udaipur, Rajasthan	-do-	2000	0	Satt krishi or vikas sambandhit samajh badhane ke liye aadivasi yuvaon hetu vigyan evam takniki jagrukta shivir
247	Golden New Era Educational and Social Society Almora, Uttarakhand	-do-	2400	0	Krishi prayavarniy jokhim sanchar ko badhava dene ke liye shikshkon ki multi media or vigyan media aadharit shamta nirman
248	Got Succeed Social Welfare Society Burhanpur, Madhya Pradesh	-do-	1800	0	Risk Communication Skills Trainings for Teachers and Community Science Educators
249	Global Hydrogeological Solutions West Delhi, Delhi	-do-	1600	0	Strengthening and capacity building for ST communication among stakeholders in three Industrial hubs in Himachal Pradesh and Rajasthan for sustainability of natural resources and environment
250	Shiv Shakti Mahila Mandal Guna, Madhya Pradesh	-do-	2300	0	To spread scientific consciousness by connecting the folk arts of tribal area with new medium-sceince communication through digital medium
251	Community Development Centre Vizianagaram, Andhra Pradesh	-do-	2400	0	Using Low Cost Teaching Aids for improving Science Teaching methods
252	Samanta Chandrashekhar Vigyan Club Balsore, Orissa	-do-	2800	0	Training of Teachers Through Low-Cost hands on innovative methods of science teaching in physics to promote innovation amongst students of Odhisa
253	NISHTHA East Delhi, Delhi	-do-	1241	0	Science Behind Miracles & Supersition
254	Aadhar Nirman Foundation South West Delhi, Delhi	-do-	1700	0	Promotion of Scientific Literacy & Scientific Temper for Rural Students through Science Media, Hands on Science Demonstrations and Interactive Motivational Lecture- Demonstrations
255	Jidnyasa Trust Thane Thane, Maharashtra	-do-	1800	0	Accessible Mathematics for all- Content for Special Education
256	Search and Research Development Society Bhopal, Madhya Pradesh	-do-	2000	0	Science and Technology Communication and Grass-Root Level Model for Inspiring Innovational Mindset and Scientific Temper in Tribal Students
257	Vaigyanik Drishtikon Society Jaipur, Rajasthan	-do-	2869	0	Vigyan Ke Sath Kadamtaal
258	Universal Communication Media Center Lucknow, Uttar Pradesh	-do-	1800	0	Digital Sansadhano/media ke madhyam se gramin shetr ki janta ko anuvanshik vigyan or urja shakshrta ke sandarbh mai vaigyanik rup se shashkt bnane ka ek rachnaatmak
259		-do-	0	0	prayas
260	Public Welfare Association Indore, Madhya Pradesh	-do-	1600	0	Development of Scientific attitude of 10th and 12th class students for nature conservation by use of ICT and Digital Media
261	Gargi Sai Sanskar Shiksha Samiti East Nimar, Madhya Pradesh	-do-	1800	0	Training Community Science Educators with Hands on Science Lecture- Demonstrations
262	Nivodh Paryavaran Sodh Avam Samajik Sewa Sanstha Prayagraj, Uttar Pradesh	-do-	2500	0	School men Vigyan Sanchar ke Madhyam se swasthy va vigyan shakshrta
263	Ved Mata Gayatari Jan Kalyan Samiti Shimla, Himachal Pradesh	-do-	2000	0	Science awareness on environmental and health issues by Jan Vigyan Media Chapal Abhiyan
264	Madurai Kamaraj University Madurai, Tamil Nadu	-do-	2000	0	ECO Digital Media Literacy and Communicating Sustainability Sciences through Developing Educators

265	Sarva Hitkari Siksha Prasar samiti Mathura, Uttar Pradesh	-do-	2300	0	Hands-on Activity on Physics and Science with Visual Aids
266	Kundan Welfare Society Gurgaon, Haryana	-do-	2100	0	Scientific Awareness among community through exhibitions
267	Andaman Nature Club Port Blair, Andaman and Nicobar	-do-	2400	0	Use of Folk Media as a tool of development communication among the school teachers of A&N Islands
268	Manav Swasthya Seva Sansthan Mathura, Uttar Pradesh	-do-	2100	0	Awareness Workshops for School Teachers by using Low Cost Teaching Aids in Mathura, Uttar Pradesh
269	Society for Humanitarian Advancement with Key Technological Initiative (SHAKTI) Balasore, Orissa	-do-	2400	0	Project proposal to exploring the science among tribal people to stop withch craft, Black Magic, Fire Burn Treatment of new born babies and sorcery practice through folk media drama and pala among tribals of Harichandanpur and Champua Blocks of Keonjhar District of Odisa
270	Grassroot Awareness and Technical Institute for Society (GATI) Dehradun, Uttarakhand	-do-	1760	0	Workshops on Low Cost Teaching Aids
271	Vardhaman College of Engineering Hyderabad, Telangana	-do-	1740	0	Shodhana STEM Demonstration of Practices in Science and Technology in the region of Rangareddy District, Telangana
272	Rural Development Foundation Anand, Gujarat	-do-	1300	0	Awareness Generation through Folk Media towards Climate Change and its impacts among People
273	Society for Innovation and Sustainable Development Saharanpur, Uttar Pradesh	-do-	2608	0	Folk Media Campaign for Science Popularisation in Saharanpur district, Uttar Pradesh
274	Prasansa Foundation Panchmahals, Gujarat	-do-	2000	0	Hands on Science activities by using Low Cost Teaching Aids (Physics) in Vadodara, Surat Districts of Gujarat and Silvasa of (DNH) District
275	Janni Sanrakshan Avom Vikas Samiti Ludhiana, Punjab	-do-	2300	0	Industrial Tour in Punjab
276	Kamaraj College of Engineering and Technology Madurai, Tamil Nadu	-do-	1200	0	Awareness Programme on Various Emerging Technologies for the school children
277	Kainat Educational and Welfare Society Hardoi, Uttar Pradesh	-do-	2500	0	Workshop on Low-cost teaching aids and outreach programme
278	Andalu Society	-do-	2250	0	Improvement of teaching skills with low cost teaching
279	Ranga Reddy, Telangana	-do-	0	0	techniques in school teachers ny Master Science Communicator in Karnataka State
280	Shri Girraj Education and Social Welfare Society West Delhi, Delhi	-do-	1900	0	Science Expo of Himachal Pradesh
281	Shwetambar Shodh Evam Shekshnik Sansthan Samiti Ujjain, Madhya Pradesh	-do-	1800	0	Science Popularization programme through Malvi Folk Media Maach
282	Pioneer Educational and Research Foundation Hyderabad, Telangana	-do-	2500	0	Innovative training by Master Communicator for Teachers with Low Cost Teaching Aids Techniques in Telangana State
283	Jeevan Jyoti Samaj Sewa Sansthan Lucknow, Uttar Pradesh	-do-	1600	0	Development of Resource Person on Geometry with Hands- on Activity
284	Society for Innovation and Incubation Development Kadapa, Andhra Pradesh	-do-	1400	0	A Science Expo to Create Scientific Temper and promote benefits of Science and Technology among school children
285	Abha Vikas Sansthan Basti, Uttar Pradesh	-do-	2000	0	Organization of science fair and exhibition mela for popularization and creating awareness on science and technology
286	ESWAR Odisha, Orissa	-do-	2600	0	project proposal for organization science drama festival to campaign for water conservation and rain water harvesting through folk media among the tribal & rural mass in the aspirational district as kalahandi in odhisa
287	KC Reddy Sarojamma Welfare Foundation Begaluru, Karnataka	-do-	2300	0	Awareness workshops to school teachers for improving science teaching using low cost teaching aids

288	Haryana Welfare society for persons with speech and hearing impairment Panchkula, Haryana	-do-	2388	0	Mission Accessible Stem learning" ISL enabled empirial engagement fo deaf and hard of hearing students
289	Society for Rural Development and Educational Services Mungala, Telangana	-do-	2100	0	Industrial technology popularization through teaching learning science expos, prototype development 3D printing and competativeness, for ITI trainees"
290	Sangharsotthann Main Puri, Uttar Pradesh	-do-	2160	0	Public awareness campaign cum training program for folk science writing in local language
291	Shresth Prachin maa vaishno manav utthan seva samiti Bhind, Madhya Pradesh	-do-	1683	0	Science Awareness Mela in rural area of bhind M.P
292	Progressive Rural Active Youths Action for Society Howrah, West Bengal	-do-	1624	0	learning geometry with demonstration and hands on activity
293	Surya Kiran Welfare Society Wrangal Urban, Telangana	-do-	2196	0	Awareness workshops pn education teachers on innovative teaching aids to science teaching"
294	Sevak Society for empowerment through voluntary action in Karnataka Belagavi, Karnataka	-do-	2771	0	popularization Science by Training in Digital Communication through Social Media
295	JSPM's Rajarshi Shahu College of engineering Tathawade Pune Pune, Maharashtra	-do-	1300	0	Propogation through hnads on learning for secondary shool teachers and students in the area of science
296	Star club social welfare society poonch, Jammu& Kashmir	-do-	2388	0	Awareness workshops for school teachers using low cost teaching aids to improve science teaching
297	Unique welfare foundation Pratapgarha, Uttar Pradesh	-do-	1430	0	Exploration of scientific approach through Industrial tour
298	Gyaneshwar Aryawart Shiksha Evam Jan Kalyan Bhopal, Madhya Pradesh	-do-	2300	0	Teaching- Training programme through low cost teaching aid models in educational institutions
299	Satya Educational Welfare Society Champaran, Bihar	-do-	2200	0	Hand on Science activities by using low cost teaching AIDS (physics) in eastern Uttar Pradesh
300	Indian Science Communication Society Lucknow, Uttar Pradesh	-do-	2200	0	Risk Communication for awareness creation among students teachers and general public for prevention and control of vector-borne diseases through traditional and folk media and outreach programmes
301	Vikasan Kendra Belagavi, Karnataka	-do-	2861	0	Innovative Science Communication for Teachers through low cost teaching aids
302	Jeet Educational and welfare Society Kullu, Himachal Pradesh	-do-	2000	0	Science and Technology awareness cum exhibition and popularization
303	Vardhaman College of Engineering Hyderabad, Telangana	-do-	1900	0	Imparting Scientific Konwledge using Economical aids to train science and mathematics teachers in the region of Ranga Reddy District Telangana
304	Karol Educational and Welfare Society Gorakhpur, Uttar Pradesh	-do-	2060	0	Science awareness campaign in the schools of amethi district of uttar pradesh
305	Sahyog Social and Cultural Development Society Delhi, New Delhi	-do-	1500	0	Teachers Training using Low Cost Teaching Aids for Teaching Science
306	Institute of Engineering Technology Sitapur, Uttar Pradesh	-do-	2100	0	Disseminating Miracles of Digital Technology, Artificial Intelligence, Data Science among students of Sitapur, Lakhimpur & Shajahapur districts through outreach programmes
307	Chebrolu Engineering college Guntar, Andhra Pradesh	-do-	1745	0	Awareness camp for STEMM for students and teachers fo rural area of 7ndhra Pradesh State
308	New Rise Welfare Society North west Delgi, Delhi	-do-	2100	0	Industrial Tour in Himanchal Pradesh for the Practical Experience for Students of Industries
309	Somvansh Research Foundation, Varanasi, Uttar Pradesh	-do-	1700	0	Promotion of Student's SampT Exposure through Institutional amp industrial tour
310	Tejaswi Seva Sansthan Basti, Uttar Pradesh	-do-	2200	0	Scientific and Technological tour & Industrial Visit
311	National Institute of Advanced studies Bengaluru, Karnataka	-do-	1805	0	Student-scientist network monitoring the impact of climate change and communicating risk of natural disasters on the coasts of kerala and karnataka

312	Kalasalingam academy of Research and Education Virudhanagar, Tamil Nadu	-do-	2100	0	Hands-on-activities by using low cost teaching aid in science and mathematics at rural schools in Virudhnagar district, Tamilnadu
313	Sathyabama Institute of science and technology Chennai, Tamil Nadu	-do-	1600	0	creating awareness on extended technologies artificial intelligence augumented reality amp virtual reality school children
314	Pahel Viklang Punarwas Kendra Samity Gandhinagar, Gujarat	-do-	2200	0	Awareness about the communicable disease through science outreach and science exhibition in the government schools of kanpur
315	V Sivaram Research Foundation Bengaluru, Karnataka	-do-	1310	0	Industrial visit of secondary school to biotech electronic and software companies in bangalore and kolar karnataka to study and develop special interest in science & Technology entrepreneurship development
316	Socio Cultural Development Centre	-do-	1983	0	science awareness programmes for social issues eradication
317	Jagatsinghapur, Orissa	-do-	0	0	through folk media in aspirational and underdeveloped district odisa
318	Kanya Mahavidyalaya Jalandhar, Punjab	-do-	1600	0	Developing low-cost teaching aids and promoting sustainable waste management swacch bharat paradigms
319	Agriculture and graduates association Pune, Maharashtra	-do-	1100	0	Krishi Vidnyan Sapth- Better Farming by Every Farmer through modern agri technologies demonstration and application
320	Sarv Nari Kalyan Samiti North west delhi, Delhi	-do-	2500	0	creative science learning through low cost teaching aids for rural school teachers of haryana state
321	Kalasalingam academy of Research and Education Virudhanagar, Tamil Nadu	-do-	2000	0	Gearing Up for the Future- Awareness and Hands-on Learning Experience for the School Children in the Area of IoT and its associated Open-Source Software using Ardunio Kits for the Region of Madurai and Theni Districts of Tamilnadu
322	Aarupadai Veedu Institute of Technology Chennai, Tamil Nadu	-do-	2500	0	Empowering Rural Students for the Future, with AI Essentials
323	Vardhaman College of Engineering Hyderabad, Telangana	-do-	2200	0	Creation of Scientic Awareness for the School Children about Artificial Intelligence and Cyber security for the region of Shamshabad Mandal, Rangareddy Districty, Telangana
324	Parmar Seva Sansthan Lucknow, Uttar Pradesh	-do-	1800	0	Science Mela & Exhibition
325	Kartvaya Foundation Kushinagar, Uttar Pradesh	-do-	1800	0	Industrial Tour on Science & Technology
326	centre for science technology and environmental studies New Delhi, Delhi	-do-	2100	0	30 years of national children science congress: a composite assessment, analysis and future directions"
327	Premier Educational Foundation East Delhi, Delhi	-do-	1800	0	Science Mela in Uttrakhand
328	JECRC University Jaipur, Rajasthan	-do-	1750	0	Up skilling and Awareness program on Artificial Intelligence and Machine Learning for the school children of Jaipur District of Rajasthan State
329	Rashtriya Jan Kalyan Samiti East Delhi, Delhi	-do-	3000	0	mobile science exhibition in uttar pradesh
330	Kundan Welfare Society Gurgaon, Haryana	-do-	2600	0	Science Awareness drive among people through means of traditional and novel modes of folk media
331	Indian Resource and Development Association Kurukshetra, Haryana	-do-	2300	0	Savera science communication through folk media
332	Sanjeevani Prayagraj, Uttar Pradesh	-do-	2188	0	industrial tour for students and teachers of kaushambi district of UP for scientific temperament targeting socio economics upliftment
333	Science Society and public Trust South Extension, South Delhi	-do-	2100	0	outreach activities on depiction of health & Science communication in india

334	Bhartiya Mahila Gramodyog Santhan Prayagraj, Uttar Pradesh	-do-	1134	0	Creating Practical Awareness Among Students By Providing Science Technological Exposure to Industries and Institution
335	Kabir Sewa Sansthan Basti, Uttar Pradesh	-do-	1800	0	Science Exhibition
336	Network of Organization for Science and Technology Communication Pandav Nagar, Delhi	-do-	3500	0	Celebration of National Science Day 2024
337	Maa Durga Siksha Sewa Sansthan Lucknow, Uttar Pradesh	-do-	3300	0	Mobile Science Exploratory on wheels Santakabir Nagar Ambedkar Nagar Gorakh pur Maharaj gunj Ayodhya of Uttar pradesh
338	Science Communication Forum Kolkatta, West Bengal	-do-	1420	0	Organization of Districts and State Level Children Science Congress 2023 in West Bengal
339	Indian Science Communication Society Lucknow, Uttar Pradesh	-do-	2390	0	Scientific outreach activities for tribal children in Pachperwa and Gaisari Blocks of district Balrampur (U.P.)
340	Centre for Research and Social Development Jaipur, Rajasthan	-do-	2212	0	Teacher's training using DIYdo it yourself Activities for Improving quality Science of teaching
341	Socio Cultural Development Centre Jagatsinghapur, Orissa	-do-	2420	0	"Industrial Tour- A Recognition to Science and Technology for Students of under develop District (Angul, Mayurbhanj, Malkangiri, Gajapati, Rayagada & Kalahandi) of Odisha"
342	Takshashila Gyan Vigyan Samiti Hoshangabad, Madhya Pradesh	-do-	2464	0	Training Cum Demonstration for Developing Scientific Temperament in Tribal Area Through Street Theatre (Folk Media)
343	Institute for Environmental and Social Affairs Jaipur, Rajasthan	-do-	2400	0	Training of Teachers on Visual Explanation of Geometrical Theorems/Principals
344	Akshara Science Society Hyderabad, Telangana	-do-	1800	0	Science Awareness Fair in Rural Areas of Karnataka State
345	Breeze Women Welfare Association Dimapur, Nagaland	-do-	2100	0	Training cum workshop on Low Cost Teaching Aid for the GTT Science in "Dimapur, Kohima, Chumukedima and Niuland" Districts of Nagaland
346	State Resource Centre Jaipur, Rajasthan	-do-	2200	0	Improving teaching of science subjects in schools through (low-cost aids) workshop training of teachers
347	The Rural Development Association Thoubal, Manipur	-do-	1170	0	Science Awareness Creation and Exhibition among Rural SC/ST School Students and Youth of Manipur
348	Krishna Institute for Research and Public Affairs Jaipur, Rajasthan	-do-	2200	0	Promoting creative science teaching in schools of Rajasthan by giving teachers low cost teaching aids training
349	Society for Poor(SP) Chittoor, Andhra Pradesh	-do-	2200	0	Science Communication Yatra ThroughFolk Media awareness Campain With Low Cost Teaching Aids for Science popularization in Annamayya Aspirational District of Andhra Pradesh
350	Bihang Welfare Association Kalahandi, Orissa	-do-	2450	0	Project proposal for organizing folk media based science drama festivals to campaign against major tribal health issues as malaria, TB and Malnutrition among the tribal population of Naupada, As Aspirational District in Odhisa
351	Maa Sarva Vidhya Shikshan Evam Kalyan Samiti Rajgarh, Madhya Pradesh	-do-	1550	0	Science Awareness mela in aspirational district rajgarh in madhya pradesh
352	Shrushti Seva Samiti Udaipur, Rajasthan	-do-	2218	0	Science Camps for school children of a tribal region in Udaipur on the Role of Science & Technology in the field of conservation of natural Resources and Climate Resillience
353	Institute of Management and Advanced Studies Lucknow, Uttar Pradesh	-do-	2576	0	Empowering Tribal Children in Science and Technology for Innovation leading to Entrepreneurship in District Shravasti, Uttar Pradesh
354	Yapri Kta Academy North Tripura, Tripura	-do-	1600	0	Outreach Activities to promote scientific Temper regarding sustainable development among school students of Schedule Tribe Community in hilly areas at Ananda Bazar in North Tripura sistrict in Tripura

355	Amchai Welfare Society Gomati, Tripura	-do-	1450	0	Science Awareness Creation and Exhibition Among Schedule Tribe School Students, Teachers Common people in rural and Hilly areas at Gomati and Dhalai Districts in Tripura
356	Raman Science Research Foundation bhind, Madhya Pradesh	-do-	1940	0	science awareness mela on the Rote of science and technology in our society
357	Bharat Jan Vigyan Jatha Guwahati, Assam	-do-	3700	0	Science Exhibition on Wheels for Scheduled Tribes
358	Gyan Jyoti Foundation Kamrup, Assam	-do-	1517	0	Science Awareness Mela
359	Shri Girraj Education and Social Welfare Society West Delhi, Delhi	-do-	2100	0	Organization of Science popularization through outreach programs in Chamba (Aspirational) district of Himachal Pradesh with focus on SC/ST
360	All India Sarnath Educational Rural Advancement Cultural Society Bhind, Madhya Pradesh	-do-	2153	0	Workshop on Igniting the scientific temper through science outreach & Science Exhibition among the SC/ST students of aspirational districts of Chhatarpur and Damoh in Madhya Pradesh
361	Institute of Management and Advanced Studies Lucknow, Uttar Pradesh	-do-	2300	0	Science and Technology Communication for Rural Development through Folk Media and Village Outreach Programmes
362	Baba Balak Nath Welfare and Cultural Society East Delhi, Delhi	-do-	2193	0	Industrial tour on Science and Technology
363	Human Development Agency Imphal West, Manipur	-do-	2128	0	Science Awareness among Local Masses with School Student
364	J.P.S. Foundation Lucknow, Uttar Pradesh	-do-	1900	0	Scienctific and Technologial Tour Camp Industrial Visit of Students for Understanding the Science Technology
365	Jai Maa Abarmata Shiksha Evam Jankalyan Sewa Samiti Chhatarpur, Madhya Pradesh	-do-	2000	0	Industrial Tour on Science and Technology
366	Vinayak Online Shiksha Social Foundation Chhatarpur, Madhya Pradesh	-do-	2050	0	Industrial visit for school student in Madhya Pradesh
367	Aastha Sewa Samiti Lucknow, Uttar Pradesh	-do-	1800	0	Science Awareness through Exhibition Fair
368	Samagra Vikas Sansthan Lucknow, Uttar Pradesh	-do-	2141	0	Workshop for Teacher on Low Cost Science Teachning Aids
369	Maa Vidyawati Devi Seva Sansthan Kushinagar, Uttar Pradesh	-do-	2400	0	Campaign For Developing Scientific Temperament in Tribals Area through Folk Media Puppetry
370	Yuva Vigyan Parishad Gwalior, Madhya Pradesh	-do-	2400	0	Awareness Campaign for Inculcating Scientific Temperament among Masses of Tribal Areas through Folk- Vigyan Jatha
371	Swastik Gramudhyog Sasthan Pauri Garhwal, Uttarakhand	-do-	2446	0	Hand on Science Activities Training Workshops for School Teachers at 4 Blocks in 2 Districts of Uttarakhand
372	Pragati Vigyan Sanstha Meerut, Uttar Pradesh	-do-	2000	0	Workshops on Hands on activities at 05 Blocks in Meerut District
373	Center for UBIQUTIOUS Social welfare and development Hyderabad, Telangana	-do-	2100	0	scienetific industrial tour for school students in telangana state focused on tribal areas,
374	Gudlavalleru Engineering College Gudlavalleru, Andhra Pradesh	-do-	1465	0	velugu bata towards light" enhancing stem skills in rural gudlavalleru mandal
375	IT and T Educational Trust Kanchipuram, Tamil Nadu	-do-	1600	0	Hands on Workshops for School Teachers- To Improve Science Teaching
376	Lokashrya West Delhi, Delhi	-do-	1900	0	science mela in uttrakhand
377	Pathik Society Alwar, Rajasthan	-do-	2000	0	Industrial Visit of Students in Rajasthan
378	Matra Shakti Shiksha Prasar Samiti Morena, Madhya Pradesh	-do-	2100	0	Science Awarness Mela and Exhibition in Tribal Area of Khargone M.P
379	Raj Science Evam Social Welfare Foundation Gwalior, Madhya Pradesh	-do-	2000	0	Science Awarness Mela in the SC Populated area of Gwalior district
380	JC Bose Science and Research Foundation Gwalior, Madhya Pradesh	-do-	2100	0	Awareness of Modern Science through Science Mela and Exhibition amongst ST Populated Area of Shivpuri MP

381	Development Action Society Foundation Balia, Orissa	-do-	2000	0	Science Awareness cum advocacy campaign among students and SC/ST community in scheduled areas for recent advancement in science technology
382	Janardan Prasad Memorial Multipurpose Social Service Society Gorakhpur, Uttar Pradesh	-do-	2385	0	Creating Climate change awareness amongst rural children through ST intervention at district Maharajganj, Uttar Pradesh
383	SocietyfortheAdvancementofEnvironmentalScience Lucknow, Uttar Pradesh	-do-	2641	0	To motivate SC/ST and marginalized school students of sonbhadra disrtict for building a career in science through Vigyan Mela with special focus on AI
384	Little Drops Ramgarh, Jharkhand	-do-	1992	0	creating science and public Awareness through Science Mela among the students, tribal, SC & rural community in Jharkhand
385	Nagrik Shiksha samiti New Delhi, Delhi	-do-	2000	0	industrial Visit of students for understanding the science and technology in Haryana
386	Centre of Technology and entrepreneurship Development Amethi, Uttar Pradesh	-do-	2825	0	Scientific Communication for Awareness among the school students on water conservation and sanitation
387	Shraddha Foundation Anand, Gujarat	-do-	2348	0	Awareness and capacity building on climate change among SC/ST students, Teachers and members of panchayati raj institution
388	Samarpan for education and welfare society New Delhi, Delhi	-do-	2032	0	Science awareness and communication through science mela for tribal people of Ambikapur Chhattisgarh
389	Induction educational and welfare society Jaipur, Rajasthan	-do-	1900	0	science popularization programme in rural/ urban slum area of jaipur rajasthan
390	Vigyan Sahyog Foundation Morena, Madhya Pradesh	-do-	2200	0	Science awareness and exhibition mela in SC populated area of morena rural amdhya pradesh
391	Parmatma Servarth Group Ashok Nagar, Madhya Pradesh	-do-	2100	0	district level science mela and exhibition in four tribal blocks of dhar mp
392	Akarshan Utthan Samiti Chhatarpur, Madhya Pradesh	-do-	3540	0	Science on Wheels for School Students amp Gen. Public in MP.
393	Vaagdhara Banswara, Rajasthan	-do-	1900	0	Industrial Exposure Visit on Science and Technology
394	Sarojamma Welfare Society Begaluru, Karnataka	-do-	2800	0	Virtual Science & Technology Industry tour for SC, ST Students
395	Voluntary Institute for community Applied Science Prayagraj, Uttar Pradesh	-do-	2000	0	District and state level children science congress 2023 for UP East
396	Deendayal Petroleum University, Gandhinagar, Gujarat	-do-	1059	Nil	Implementation of Indo-Korean Joint Research Project
397	Amrita Vishwa Vidyapeetham Amritapuri Campus	-do-	2438	Nil	Implementation of Indo-Italian Network of Excellence
398	Global Innovation and Technology Alliance (GITA), Gurugram	-do-	6041	Nil	Implementation of India-Taiwan joint Programme CFP 2018
399	Global Innovation and Technology Alliance (GITA), Gurugram	-do-	8966	Nil	Implementation of India-Taiwan joint Programme CFP 2019
400	Global Innovation and Technology Alliance (GITA), Gurugram	-do-	21116	Nil	Implementation of India-Korea Applied R&D Programme CFP 2019
401	Birla Institute of Technology and Science	-do-	1290	Nil	Project work
402	International Institute of Information Technology	-do-	2471	Nil	Project work
403	Global Innovation and Technology Alliance (GITA)	-do-	7552	Nil	Meetings and any other
404	NITTE University Centre for Science Education and Research	-do-	1018	Nil	Projects
405	Amrita Vishwa Vidyapeetham, Kochi	-do-	1113	Nil	Final installment for settlement and closure of project

ABBREVIATION

ANRF	Anusandhan National Research Foundation
ASEAN	Africa, Association of Southeast Asian Nations
CCUS	Carbon Capture Utilisation and Storage
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
CURIE	Consolidation of University Research for Innovation & Excellence
ECU	Electronic Control Unit
FAIR	Facility for Antiproton and Ion Research (FAIR) in Germany
FICCI	Federation of Indian Chambers of Commerce & Industry
FIST	Fund for Improvement of S & T Infrastructure in Universities and Higher Educational Institutions
GERD	Gross Expenditure on R&D
GLP	Good Laboratory Practice
HGCAL	High Granular Calorimeter
INSPIRE	Innovation in Science Pursuit for Inspired Research
INSPIRE -MANAK	Million Minds Augmenting National Aspiration and Knowledge
JSPS	Japan Society for the Promotion of Science
WISE-KIRAN	Knowledge Involvement in Research Advancement through Nurturing) Scheme as Women in Science and Engineering
WISE-PDF	WISE Post-Doctoral Fellowship
MRI	Magnetic Resonance Imaging
MCTT	Manual Cognitive Training kit
NATMO	National Atlas & Thematic Mapping Organisation
NCG	National Centre for Geodesy
NCSTC	National Council for Science and Technology Communication
NGP	National Geospatial Programme
NIDHI	National Initiative for Developing and Harnessing Innovations
NLEPC	National Level Exhibition and Project Competition
NMR	Nuclear Magnetic Resonance
NMSHE	National Mission for Sustaining the Himalayan Ecosystem
NMSKCC	National Mission on Strategic Knowledge for Climate Change
NSDI	National Spatial Data Infrastructure

NSM	National Supercomputing Mission
NSTMIS	National Science &Technology Management Information System
PPP	Public Private Partnership
PURSE	Promotion of University Research and Scientific Excellence
SAIF	Sophisticated Analytical Instrument Facilities
SATHI	Sophisticated Analytical & Technical Help Institutes
SATYAM	Science and Technology for Yoga and Meditation
SCSP	Scheduled Caste Sub Plan
SERB	Science and Engineering Research Board
SHE	Scholarship for Higher Education
SHRI	Science and Heritage Research Initiative
SoI	Survey of India
SSTP	State Science and Technology Programme
SUPREME	Support for Upgradation Preventive Repair and Maintenance of Equipment
STEM	Science Technology Engineering and Mathematics
STUTI	Synergistic Training program Utilizing the Scientific and Technological Infrastructure
STI	Science Technology and Innovation
TDB	Technology Development Board
TIFAC	Technology Information Forecasting & Assessment Council
TIHs	Technology Innovation Hubs
TMT	Thirty Meter Telescope
TRC	Technical Research Centres
TSP	Tribal Sub Plan
VAIBHAV	Vaishvik Bharatiya Vaigyanik
WISE-KIRAN	Women in Science and Engineering-KIRAN
WISE-SCOPE	Women In Science and Engineering -Societal Challenges with Opportunities
WLCG	Worldwide Large Hadron Collider Computing Grid

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