सत्यमेव जयते

Department of Scientific and Industrial Research
Ministry of Science and Technology
Government of India

ANNUAL REPORT
2023-24

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DSIR

Annual Report

2023-24

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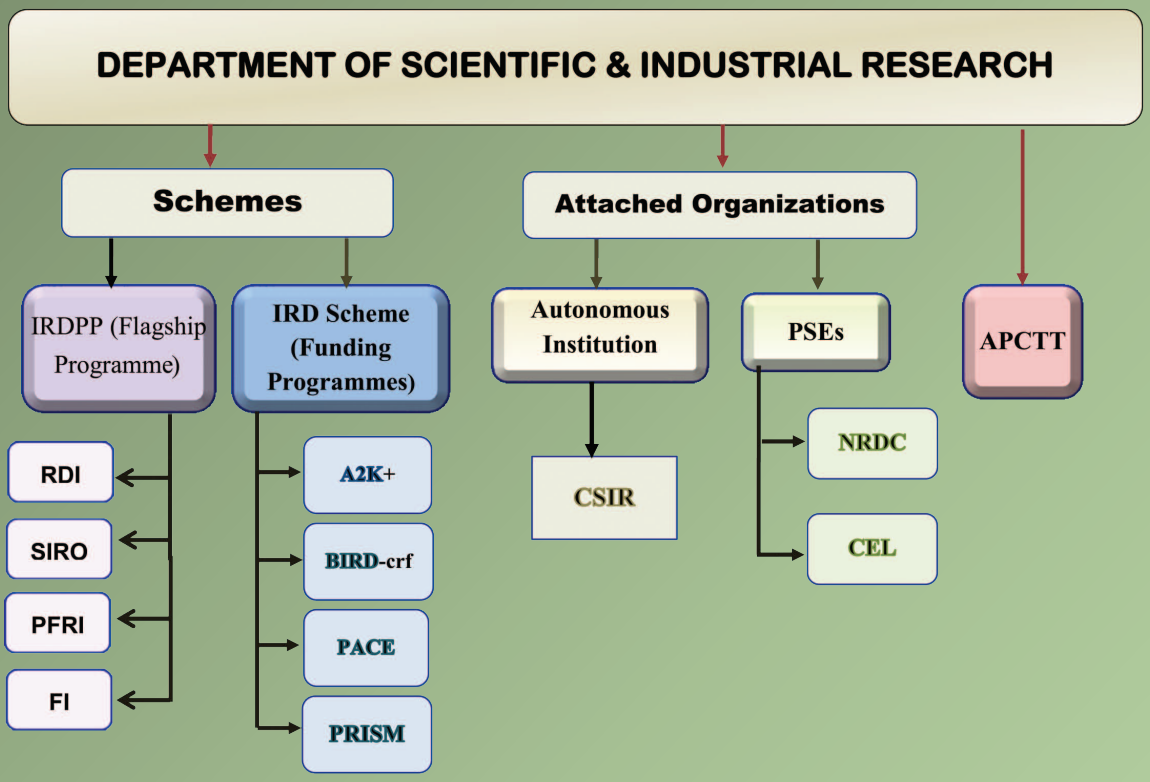
FUNCTIONAL STRUCTURE



IRDPP	Industrial Research and Development Promotion Programme
RDI	Recognition of In-house R&D units
SIRO	Scientific & Industrial Research Organizations
PFRI	Public Funded Research Institutions
FI	Fiscal Incentives
IRD	Industrial Research & Development Programme
BIRD-crf	Building Industrial Research & Development and Common Research Facility
PACE	Patent Acquisition and Collaborative Research and Technology Development
A2K+	Access To Knowledge for Technology Development and Dissemination
PRISM	Promoting Innovation in Individual, Start-ups and MSMEs
CSIR	Council of Scientific and Industrial Research
PSEs	Public Sector Enterprises
NRDC	National Research Development Corporation
CEL	Central Electronics Limited
APCTT	Asian & Pacific Centre for Transfer of Technology

HIGHLIGHTS OF ANNUAL REPORT 2023-24

(i) DSIR is the nodal department for granting recognition/ registration certificates to the In-house R&D centres of industry. As on 31.03.2024, there are 2655 In-house R&D centres of industry with DSIR recognition.

(ii) 141 In-house R&D centres were accorded fresh recognition and renewal of recognition was accorded to 508 R&D centres of industry.

(iii) Of the total industries recognized and registered with DSIR, 34 companies incurred an annual R&D expenditure of over Rs. 5000.0 lakhs each, 144 companies incurred an annual R&D expenditure in the range of Rs. 500.0 lakhs to Rs. 5000.0 lakhs and 97 companies incurred an annual R&D expenditure in the range of Rs. 200.0 lakhs to Rs. 500.0 lakhs.

(iv) During the period under report, 73 SIROs were accorded fresh recognition. These include 32 cases in the Natural and Applied Sciences, 01 case in the area of Agricultural Sciences and 05 cases in the area of Social Sciences and 35 cases in the area of Medical Sciences.

(v) DSIR is the nodal Department for registration of public funded research institutions (PFRI), Universities, IITs, IISc Bangalore and NITs for availing concessional custom duty exemption on import of equipment, spares, accessories and consumables for research purposes. During the period under report, 15 institutions were accorded fresh registration with DSIR and 61 institutions were granted renewal of registration.

(vi) Fresh approvals in Form 3CM were accorded to 27 companies u/s 35(2AB) of the IT Act, 1961, wherein the companies become eligible to claim weighted tax deduction. Reports valued at Rs. 17,666.41 Crores in Form 3CL have been certified during the period under report and forwarded to Chief Commissioner of Income Tax (Exemptions) CCIT (E) as required under the IT Act, 1961.

(vii) Financial support was extended to 28 (twenty eight) new innovative projects of individual innovators during the period under report for PRISM scheme. The department rendered financial support to 30 (thirty) on-going projects and 25 (twenty five) PRISM projects have been successfully completed during the tenure.

(viii) DSIR has organized two days DSIR-CRTDH Conclave 2023 on 6th & 7th November 2023 at Indian Institute of Technology, Gandhinagar wherein all the supported CRTDHs through BIRDcrf scheme had participated and showcased their achievements.

(ix) Five Chintan Shivirs were conducted between July 27th and October 13th 2023, at IIT Kharagpur, CSIR-IITR Lucknow, CSIR-CMERI Durgapur, CSIR-IMMT Bhubaneshwar, and DPSRU New Delhi. Each 'Chintan Shivir' commenced with a tour of the CRTDH facility, followed by an inauguration, thematic session and 'Samvad.'

(x) The Department of Scientific and Industrial Research (DSIR) is the focal point in India for matters related to APCTT (Asian and Pacific Centre for Transfer of Technology), a regional institution of the United Nations Economic and Social Commission for Asia and the Pacific (ESCAP). In 2023, APCTT conducted various joint activities with Department of Scientific and Industrial Research viz: (i) Nineteenth session of the Governing Council of Asian and Pacific Centre for Transfer of Technology, 6-7

December 2023, Tashkent, Uzbekistan (ii) International conference on green technologies for climate action and resilience, 5 December 2023, Tashkent, Uzbekistan in hybrid mode (iii) Study tour on Innovative Technologies and Good Practices for Air Pollution Control for City Officials of the Republic of Korea, 18-21 September 2023 (iv) International Conference on scaling up and adoption of fourth industrial revolution technologies for climate resilience, 15 September 2023, Guangzhou, China (v) The KECF Air Pollution Control: A Multi-stakeholder Consultation Workshop, 26 October 2023, Bangkok, Thailand

(xi) DSIR received 217 RTI Applications during 01/01/2023 to 31/03/2024. 212 RTI requests were disposed off and 05 are under process on RTI Request & Appeal Management Information System

(xii) Department has successfully developed a New CMS based website available at URL https://www.dsir.gov.in (English) and https://www.dsir.gov.in/hi.(Hindi). Website is hosted at NIC data centre and is envisaged to meet the requirements of ISO/IEC 23026 and national requirements (NIC guidelines) including W3C/WAI e-Accessibility guidelines for level A.

(xiii) As a part of the celebrations of Aazadi Ka Amrit Mahotsav (AKAM), DSIR along with Department for Promotion of Industry and Internal Trade (DPIIT) launched the "Rashtriya Boudhik Sampada Mahotsav" (RBSM)/" National Intellectual Property Festival" during the month of July 2023. The objective of the campaign was to spread awareness about generation and protection of Intellectual Property Rights (IPR) such as patents, copyrights, trademarks, geographical indications, designs, semi-conductor layout designs and plant varieties across the country. The partners on the RBSM were the Council of Scientific & Industrial Research (CSIR), Office of Controller General of Patents, Designs & Trade Marks (CGPDTM), Protection of Plant Varieties and Farmers' Rights Authority (PPVFRA), National Research Development Corporation (NRDC). NRDC, a PSE with DSIR conducted five workshops Pan-India on "Intellectual property Rights" in the month of July 2023. A total of 189 events were organized by CSIR, an autonomous organization with DSIR during the campaign. Interactions were held with the participants, stakeholders and valuable suggestions/inputs were received for effective implementation of IPR

(xiv) Three Chintan Shivir's / Stakeholder & Brainstorming meetings were conducted by the Fiscal Incentives (FI) programme division of DSIR for sectors in Pharmaceutical industry Agriculture/ Agro - Chemicals/ Biotechnology industry & Engineering & Automotive Sector. The interactions provided insights and outlined the mechanism for greater private sector participation in R&D through industry-centric motivational measures and incentives.

(xv) CSIR-NML has commissioned the first Battery Recycling Pilot Facility of the CSIR at Jamshedpur to extract critical metals such as Lithium, Nickel, Manganese and Cobalt. It encompasses 01 Ton per day (TPD) battery dismantling and cathode material separation setup, apart from the integrated large-scale hydrometallurgical facility for extraction and separation of the critical metals.

(xvi) CSIR-NIIST has developed a dual disinfection-solidification system that can spontaneously disinfect and immobilize pathogenic biomedical waste such as blood, urine, sputum, body parts, etc. and convert them into value-added soil additives within minutes. Laboratory disposables, plastics, glass, etc. are disinfected and prepared for direct recycling. An automated equipment

has been developed that ensures minimal human intervention in handling biomedical waste.

(xvii) CSIR-NCL is developing critical Nuclear Magnetic Resonance (NMR)-based profiling methodologies and data analytics for a variety of unifloral and multifloral Indian honey. These techniques not only allow for identification of premium quality honey that is suitable for exports but also enables quantification of adulteration in commercial honey.

(xviii) CSIR-CIMAP has successfully lowered nicotine content in the Petit Havana Tobacco plant variety by using a genome editing tool and reduced 60-70 per cent nicotine in it compared to nicotine content in wild-type plants. CSIR-CIMAP further plans to lower nicotine in commercial varieties to help people quit the habit by working on tobacco plant varieties used in cigarettes, cigars, beedi.

(xix) CSIR-NIO has for the first time recorded the captivating sounds of marine life with the help of Artificial Intelligence. Recent passive acoustic recordings by the CSIR-NIO have uncovered a veritable "symphony" of sounds produced by fish, shedding light on their complex underwater communication.

(xx) CSIR-AMPRI has developed a knowhow of manufacturing environmental friendly multifunctional “Bamboo Composites for Modern Housing and Structures”. This patented Knowhow Technology is transferred to two Industries- M/s Permali Wallace Pvt. Limited, Bhopal and M/s Ecological Fibre Pvt Ltd., Jabalpur. Bamboo composites have been commercialized and on industrial level these bamboo composites can be converted into panel boards, beams, pillars, truss, partitions, doors, window frames, roof, floorings etc. used mainly in the housing sectors & construction industries

(xxi) National Research Development Corporation, PSE with DSIR signed 22 MoU’s with new organizations, assigned 40 technologies and Licensed 20 innovative technologies to start-ups / entrepreneurs.

(xxii) Central Electronics Limited, PSE with DSIR incurred the highest ever net worth of Rs. 133.27 Crore as on 31.03.2023.

(xxiii) Rs. 6162.44 crore was the actual expenditure incurred by DSIR (including autonomous organization and PSEs) upto 31.03.2024.

(xxiv) Department of Scientific and Industrial Research (DSIR) successfully conducted Special Campaign 3.0 from 2nd October, 2023 to 31st October, 2023. The Campaign was started by the Hon’ble Minister of Science and Technology (I/c) Dr Jitendra Singh with 'Shramdaan' on 2nd October, 2023 at CSIR Headquarters, Anusandhan Bhavan, New Delhi. 'Shramdaan' was also organized on 2nd October, 2023 at DSIR, Technology Bhavan, New Delhi and the CPSEs i.e. Central Electronics Limited (CEL), National Research Development Corporation (NRDC) and all across the 37 labs of Council of Scientific & Industrial Research (CSIR).

(xxv) “Recycling on Wheels Smart-ER Project” was flagged off during the Special campaign 3.0. The project is a novel initiative to collect and recycle electronic waste using smart vehicles.

(xxvi) “Hindi Pakhwada” (Fortnight) was organized at DSIR from 14/09/2023 to 29/09/2023 to observe the occasion of Hindi Day on 14/09/2023. Seven Hindi competitions were organized at DSIR during the “Hindi Pakhwada” and the successful participants were felicitated with cash prizes and certificates.

(xxvii) DSIR received the Standardisation Testing and Quality Certification (STQC) from the Standardisation Testing and Quality Certification (STQC) Directorate, an attached office of the Ministry of Electronics and Information Technology, Government of India for the new CMS website of DSIR which is valid from 06th April 2023 to 26th April 2026.

An Overview

An Overview

1.0 INTRODUCTION

The Department of Scientific and Industrial Research (DSIR) under the aegis of the Ministry of Science and Technology, GoI was set up through a Presidential Notification, Dated 4th January, 1985 (74/2/1/8 Cab). The mandate of DSIR is to promote industrial research for indigenous technology development, promotion, utilization and transfer.

The Allocation of Business for the Department is as follows:

i. All matters concerning the Council of Scientific and Industrial Research (CSIR).

ii. All matters relating to National Research Development Corporation (NRDC).

iii. All matters relating to Central Electronics Limited (CEL).

iv. Registration and Recognition of R&D Units.

v. Technical matters relating to UNCTAD and WIPO.

vi. National register for foreign collaborations.

vii. Matters relating to creation of a pool for temporary placement of Indian Scientists and Technologists.

DSIR undertakes programmes to facilitate R&D in the industry and supports industrial units develop state-of-the-art technologies; provides an enabling frame work for commercialization of laboratory-scale R&D; augments technology transfer capabilities; enhances the share of technology intensive exports in overall exports of the country and strengthen industrial consultancy; establishes a user-friendly information network to facilitate scientific and industrial research in the industry, science research foundations and public funded research organizations/ institutes. DSIR has one autonomous organization, Council for Scientific and Industrial Research (CSIR) and two public sector enterprises, National Research Development Corporation (NRDC) and Central Electronics Ltd. (CEL). DSIR also provides host facilities and assistance to a regional institution of the United Nations Economic and Social Commission for Asia and Pacific (UN-ESCAP) i.e Asian and Pacific Centre for Transfer of Technology (APCTT).

2.0 DSIR PROGRAMMES

The Department of Scientific & Industrial Research (DSIR) operates a Central Sector Umbrella Scheme – Industrial Research & Development which comprises of the following four sub - schemes:

(i) Promoting Innovations in Individuals, Start-ups and MSMEs (PRISM) – focuses on supporting individual innovators, start-ups and MSMEs for converting innovative ideas into demonstrable working models / prototypes / processes and assist them to become techno-preneurs

(ii) Patent Acquisition and Collaborative Research & Technology Development (PACE) – Scheme focusses on technology acquisition and its development, demonstration for commercialization.

(iii) Building Industrial Research & Development and Common Research Facility (BIRD-crf) – Scheme focuses on creation of common research and technology development hubs (CRTDHs) for micro, small and medium enterprises.

The other components of BIRD-crf sub-scheme were Industrial Research & Development Promotion Program, Information Technology and e-Governance and Asian and Pacific Centre for Transfer of

Technology(APCTT) which operated during the 12th Plan. All these three components of the BIRD-crf scheme - Industrial Research & Development Promotion Program, Information Technology and e-Governance and Asian and Pacific Centre for Transfer of Technology (APCTT) have been de-linked beyond 31.03.2017 effective from the FY 2017-18 and now operates outside this sub-scheme.

(iv) Access to Knowledge for Technology Development and Dissemination (A2K+)

The sub-scheme has three components which are as follows :-

(a) Technology Development and Utilization Programme for Women (TDUPW) which promotes adoption of new technologies by women for greater operational efficiency and reduction of drudgery

(b) Support to Studies which undertakes studies related to analysis of latest developments in the emerging technology areas including those related to preparation of status reports on technologies from public funded institutions ready for commercialization and documents the findings, leanings and outcomes for wider dissemination and

(c) Support to Events like seminars, workshops, conferences, exhibitions, Hackathons, virtual events etc. Scheme provides a platform for exchange of views leading to useful insights and policies on issues relating to industrial research and technological innovation besides recommending collaborative projects between industry, institutions and academia.

These sub schemes have been continued beyond 31st March, 2020, for a further period of 5 years till the end of Fifteenth Finance Commission, i.e. 31st March, 2025 (Fifteenth Finance Commission duration is 2021-2026).

3.0 ACHIEVEMENTS OF DSIR SCHEMES & PROGRAMMES

The major achievements of the various schemes & programmes of the Department during the period under report are the following :

3.1 Industrial R&D Promotion Programme

3.1.1 In-house R&D Recognition

DSIR is the nodal Department for granting recognition/ registration to the In-house Research and Development (R&D) centres established by Industry in the country. There are currently 2101 companies having 2655 In-house R&D centres in the country with DSIR recognition. Of the total 2101 companies recognized by DSIR, 137 companies having 141 In-house R&D centres in the country were granted fresh recognition during the period from 01st January, 2023 to 31st March, 2024.

508 companies were granted renewal of recognition during the period under report from 01st January, 2023 to 31st March, 2024 and 34 companies incurred an annual R&D expenditure of over Rs. 5000 lakhs each, 144 companies incurred an annual R&D expenditure in the range of Rs. 500 lakhs to Rs. 5000 lakhs and 97 companies incurred an annual R&D expenditure in the range of Rs. 200 lakhs to Rs. 500 lakhs (Annexure 3, 4 & 5) .

3.1.2 Recognition of Scientific & Industrial Research Organisation (SIROs)

Scientific Research Foundations in the areas of medical, agriculture, natural and applied sciences and social sciences seek DSIR recognition and registration as Scientific and Industrial Research Organisations (SIROs). The recognized and registered SIROs are eligible for availing Customs Duty exemption on imports required for R&D activities. With SIRO recognition, institutions become eligible for extramural funding from various Government agencies. The exemption under the concessional GST notifications has been rescinded

through the notification no. 11/2022-integrated tax (rate) dated 13.07.2022 with effect from 18.07.2022. At present there are 891 SIROs duly recognized by DSIR. During the period under report from 01st January, 2023 to 31st March, 2024, 73 SIROs have been accorded fresh recognition. These include 32 cases in the Natural and Applied Sciences, 01 case in the area of Agricultural Sciences and 05 cases in the area of Social Sciences and 35 cases in the area of Medical Sciences.

3.1.3 Registration of Public Funded Research Institutions (PFRI)

DSIR is the nodal Department for registration of Public Funded Research Institutions (PFRI) or a University or an Indian Institute of Technology or Indian Institute of Science, Bangalore or a Regional Engg. College other than a Hospital for purposes of availing Customs Duty exemptions in term of Notification. No. 51/96-Customs Dt. 23.07.1996, amended by Notification 43/2017 dated. 30.06.2017 further amended by Notification No. 42/2022-Customs dated 13.07.2022 as amended from time to time. During the period under report, from 01st January, 2023 to 31st March, 2024, fresh registrations were issued to 15 institutions and 104 institutions were due for renewal of registration as on 31-08-2023. The department received 74 renewal applications from various institutions and 61 Renewal of registration certificates were issued.

3.1.4 Fiscal Incentive

Secretary, DSIR is the Prescribed Authority under section 35 (2AB) of Income Tax Act, 1961. During the period from 01st January, 2023 to 31st March, 2024, fresh approvals in Form 3CM were accorded to 27 companies and extension of approvals in Form 3CM were accorded to 191 companies. Agreements of co-operation for R&D were also signed with these companies. The Department reported R&D expenditure of Rs.17,666.41 Crores in 3CL Report to Chief Commissioner of Income Tax (Exemption), as required under the IT Act, 1961.

3.2 Industrial Research & Development Scheme

3.2.1 Promoting Innovations in Individuals, Start-ups and MSMEs (PRISM)

Promoting Innovations in Individuals, Start-ups and MSMEs (PRISM) scheme aims to support individual innovators which will enable to achieve the agenda of inclusive development – one of the thrust areas of 12th Five Year Plan (2012-17). The scheme is continuing with its objectives of supporting innovation for inclusive development. It would also provide support to autonomous institutions or organizations or to society registered under the Societies Registration Act, 1860 or Indian Trusts Act, 1882 or other statues leading to development of state-of-art new technology solutions aimed at helping MSME cluster units. The scheme has been extended till 31.03.2026 as a component scheme of Industrial Research and Development (IRD) Programme of DSIR.

The Proposals shall preferably be considered in the following focus sectors: Green technology, Clean energy, Industrially utilizable smart materials, Waste to Wealth, Affordable Healthcare, Water & Sewage Management and any other technology or knowledge intensive area.

The financial assistance under the programme may vary from Rs. 2.00 lakh to Rs. 50.00 lakh. The department has successfully completed 25 (twenty five) PRISM projects supported during the period under report i.e. from 01.01.2023 to 31.03.2024. Some of the successfully completed projects are Development of Half- face piece Air Purifier & Air Mask, Designing of Self retaining Vascular Forceps, An Automated Panipuri Vending Machine, A low cost Cervical spine offloader & postural corrector column-an innovative prosthesis for leg spondylitis, AMBU (Aqua Management Binary Unit), Infusion Flow Monitoring Device, Casil-O-Scope- The affordable & portable eye examining device, Building Zinc Gel Battery for e-Rickshaw (electric three wheelers), Power Appliance for Toilet cleaning,

Use of waste biomass for the development of edible coating, Braille Slate for Maths Learning, Compact societal composter, Development of Ergonomically designed working model of Fruit Plucking Device, Design and Development of Reducing Atmosphere (Redox) Fabric Indigo Dyeing Machine, Energy Efficient Smart Transformer.

The financial support was extended to 28 (twenty eight) new innovative projects of individual innovators during the period 01.01.2023 to 31.03.2024. The department also rendered financial support to 30 (thirty) ongoing projects during the period under report.

During the period under report, DSIR has also initiated a study to understand the impact of the PRISM scheme on innovations in Science & Technology, its achievements, challenges, and outcome for the period 2015-2020. The report on "Publication of Achievements/impact of PRISM Scheme for the last five years", has been executed by TePP Outreach cum Cluster Centre (TOCIC), Sri Padmavati Mahila Vishvavidayalam (SPMVV), Tirupati. The report covers success and failure of projects supported under "Promoting Innovations in Individuals, Start-ups and MSMEs (PRISM) Scheme of DSIR. The number of startups emerged from the study are impressive despite the regional variations. The increase in funding for innovators under Phase II would lead to more start-ups thus contributing to employment generation, regional growth and stronger economy of the country. The recommendations of the report include that women innovators need special assistance to establish start-ups, the TOCICs should have an interface with industry to motivate innovators for commercialization, TOCIC may organize workshops on digital marketing and emphasis on business strategies that will equip the innovators to move towards commercialisation.

3.2.2 Common Research and Technology Development Hubs (CRTDHs)

DSIR operates BIRD-crf scheme as a sub-scheme under the Umbrella Scheme – 'Industrial Research & Development'. This scheme focuses on creation of Common Research facilities for micro and small enterprises i.e. CRTDH (Common Research and Technology Development Hubs) with an aim to enhance translational research and foster industry institution interaction targeted towards innovative product development. DSIR extends grants to institutions for setting up of these hubs/centres, which include R&D facilities/infrastructure, analytical test facilities, design centres, pilot plant production facility, demonstration units, product display and centre information etc. The facilities at CRTDHs are used by the Micro, Small and Medium Enterprises (MSMEs), Innovators and start-ups. The CRTDHs evolve a business model for self-sustainability. CRTDH program started during the year 2014-15. The achievements of the some of the ongoing CRTDHs are **(**i) The CRTDH established at CSIR- CEERI, Pilani is dedicated to Electronics/ Renewable energy sector. The centre has been instrumental to MSMEs/ Start-ups in assisting them to conduct their research and development activities including testing of innovative products and technologies in Advanced Electronic Systems, Power electronics and Renewable energy. (ii) CRTDH at IIT Roorkee, Uttarakhand. The objective of the CRTDH at IIT Roorkee is to setup the state of art facilities for characterization of microwave materials with Radar Cross Section and EM wave radiation measurements for benefit of MSMEs with R&D intervention and to develop and characterize the cost effective advanced materials and techniques that can be used for shielding the microwave radiation and stealth applications like camouflage net and radar cross section reduction. (iii) The CRTDH established at Indian Institute of Technology Gandhinagar achieved success in dye production using a Micro-reactor, enhancing the yield of acid Yellow 23 dye. (iv) CRTDH-IIT Kharagpur is involved in the affordable healthcare sector. The hub's objectives is to develop innovative portable devices - rural health kiosks- that can be used in rural healthcare facilities to provide fast, accurate, and reasonably priced diagnosis; to move products from the bench to the bedside; and to offer

MSMEs training and consulting services to help them advance their technical knowledge and skill sets. (v) CRTDH at CSIR - Indian Institute of Toxicology Research (IITR), Lucknow has facilitated in the development of technologies for Water Treatment Sector, Effluent Treatment Sector, Air Pollution Abatement, Skill Development and Training & Air Pollution Monitoring and Management.

DSIR has organized two days DSIR-CRTDH Conclave 2023 on 6th & 7th November 2023 at Indian Institute of Technology, Gandhinagar wherein all the supported CRTDHs had participated and showcased their achievements.

CRTDH program is going to complete ten years since its operationalization, hence the Department of Scientific and Industrial Research (DSIR) conducted five CHINTAN SHIVIRS between July 27th and October 13th 2023, at IIT Kharagpur, CSIR-IITR Lucknow, CSIR-CMERI Durgapur, CSIR-IMMT Bhubaneshwar, and DPSRU New Delhi. Each 'Chintan Shivir' commenced with a tour of the CRTDH facility, followed by an inauguration, thematic session and 'Samvad.' The sessions focused on the challenges encountered by MSMEs, start-ups, and innovators, exploring potential solutions in collaboration with CRTDH co-ordinators.

3.2.3 Patent Acquisition and Collaborative Research and Technology Development (PACE)

DSIR through the PACE scheme provides catalytic support to industries and institutions for development and demonstration of innovative product and process technologies, traversing the journey from proof of concept or laboratory stage to pilot stage so that they can be launched for commercialization. The scheme supports ingenious work and assists in development of new technologies or creative/ innovative application of the existing technologies to solve unmet needs of industry. The scheme also strengthens the interface between industry, R&D establishments and academic institutions by supporting collaborative proposals. During the period under report, the following ongoing technology development and demonstration project was monitored for assessing the technical and financial progress in the project:

"Development and standardization of manufacturing processes for large scale production of valuable secondary metabolites from callus-derived cells of vascular cambial explants of selected woody plant species" by M/s Sami-Sabinsa Group Limited (formerly Sami Labs Limited), Bangalore. Arjunolic acid metabolite from *Terminalia arjuna*, Salacinol from Salacia sp and oroxylin -A from *Oroxylum indicum* from the 20L bioreactor has been successfully produced under the project. The standardization for remaining explants is underway.

A meeting of Technical Advisory Committee (TAC) of PACE scheme was held on 12th December 2023 and the committee recommended the following proposals for consideration:

Name of Applicant / Company	**Title of Project**
M/s Devashish Polymers Private Ltd., Mumbai	Development of high performance synthetic Elastomeric compounds for use in LPG and allied industry
M/s GPS Renewables Pvt Ltd., Bangalore in collaboration with Maharashtra Association for the Cultivation of Science (MACS)-Agharkar Research Institute (ARI), Pune	Unlocking Sustainable Energy: Scaling up and Pilot Trial of Enhanced Microbial Methane Production from Agricultural residue using anaerobic fungi

3.2.4 Access to Knowledge for Technology Development and Dissemination (A2K+)

3.2.4.1 A2K+ Studies program aims to support studies in emerging areas of technology and document the findings for wider dissemination and preparation of status reports. Department has supported 10 (Ten) new and 22 (Twenty Two) ongoing study projects during the period under report. The department has successfully completed 02 (Two) A2K+ studies during the period under report.

During the period under report, a fresh call for proposals was advertised on following five study topics well-aligned with current societal challenges, research priorities, and national visions. 76 (Seventy Six) new applications were received by the Programme Division for financial support under A2K+ (Studies) programme of DSIR under fresh call for proposal.

Theme I: Affordable and Clean Energy (Ensure access to affordable, reliable, sustainable and modern energy) – Research & Development support and mobilization of public and private capital for innovation in clean and renewable energy.

Theme II: India's technological import liabilities and the development of frameworks and methodologies for S&T interventions on import substitution.

Theme III: Women and Technology: STI Investments and Policy Foresights for Economic and Social Empowerment of women.

Theme IV: Funding mechanisms for strengthening Industrial R&D and Innovation landscape in India.

Theme V: Scope of artificial intelligence based technologies in sectors such as healthcare, education, agriculture, smart cities and infrastructure and smart mobility and transportation.

3.2.4.2 A2K+Events programme provides a platform for exchange of views among industry, consultancy organizations, academic and research institutions that would lead to useful insights on issues relating to industrial research and technological innovation and help in evolving tools and techniques to remain competitive in today's business climate. The objective of A2K+ Events program is to support the organization of workshops, interactions, training programmes, exhibitions and other events for identification of collaborative projects between academia, institutions and industry participating in the events. Total 28 events were successfully organized by different organizations during the reported period. Each event has fruitful outcome which is beneficial to the organizers as well as participants. One of the events i.e. National Symposium on Crosstalk Between Animal Research & Alternatives" NSARA 2023 & One day Training cum Workshop on Laboratory Animal Science & Alternative Tools organized by CSIR-North East Institute of Science and Technology (CSIR-NEIST) Pulibor, Jorhat was attended by more than 273 participants. The scope of the symposium and training cum workshop had set a platform for the first time in North East India to share the knowledge and expertise of distinguished speakers and resource persons in the areas of biomedical research involving animals as tools & available alternative methods for in-silico computational modeling and simulations to rationalize the animal usage in research. The National Symposium saw a significant contribution to the advancement of knowledge, collaboration, and growth in various fields.

3.2.4.3 TDUPW program promotes adoption of new technologies by women/women SHGs/ entrepreneurs for greater operational efficiency, Product value addition, enhanced/alternate sources of income and reduction of drudgery. The Department supported and initiated five new projects towards women empowerment through technological capacity building under the TDUPW program. 3025 women were trained for technological capacity building under various ongoing projects and one project was successfully completed during the period under report. Outreach webinars and stakeholder interaction meets were organized under scheme for program awareness, popularization & promotion.

On March 7, 2023, Department organized an event called "DigitAll: Innovation and Technology for Gender Equality" in honor of International Women's Day. The event brought together key stakeholders of TDUPW programme of DSIR including Principal Investigators of ongoing projects, Implementing Agencies, representatives from food processing organizations, micro- finance-rural banking, online marketing experts and women self help groups (SHGs). The participants were motivated during the event and success stories of DSIR-TDUPW

scheme were shared in empowering women for technological capacity building.

TDUPW Program division celebrated International Women's Day on 8th March 2024 on the theme "Invest in Women: Accelerate Progress" in collaboration with PSGR Krishnammal College for Women, at Coimbatore. Various women entrepreneurs, Social organizations, Incubators, academic & Research Institutions participated in the event and shared the challenges faced by women owned enterprises and role of S&T in women empowerment. A stakeholder interaction meet was also organized during the event that marked participation of officer's form Food Safety organization, Technology Incubation parks, a women CEO, and a young women entrepreneurs and start-ups. The progamme also marked inauguration of TDUPW- Skill Satellite Centre at PSGR Krishnammal College for Women Coimbatore District, Tamil Nadu supported under TDUPW/A2K+ scheme of DSIR. This center will provide the technological intervention and capacity building to women on food processing, fortification and value addition utilizing raw material from local rural areas and also financial literacy and enterprise development training. This centre is expected to help the local women uplift their socioeconomic status significantly.

4.0 ASIAN PACIFIC CENTRE FOR TRANSFER OF TECHNOLOGY (APCTT)

The Department of Scientific and Industrial Research (DSIR), Ministry of Science and Technology (MoST), Government of India is the national focal point for Asian and Pacific Centre for Transfer of Technology (APCTT) in India since its inception in 1977. The Asian and Pacific Centre for Transfer of Technology (APCTT) is a regional institution of the United Nations Economic and Social Commission for Asia and the Pacific (ESCAP) servicing the Asia-Pacific region. APCTT promotes an enabling environment for innovation, transfer and commercialization of technologies in 53 member states and 9 associate members of ESCAP.

During the reporting period, APCTT delivered and actively contributed to 19 demand-driven activities (hosted by Bangladesh, China, India, Thailand and Uzbekistan) in co-operation with 71 partner institutions. The activities included regional consultation meetings, expert group meetings, international conferences, capacity building workshops, national stakeholder consultations, and knowledge products including periodicals and analytical reports.

During 2023, APCTT's primary focus areas were: (a) Strengthening regional technology co-operation, transfer and strategic partnerships for advancing climate mitigation and adaptation and air pollution control technologies; (b) Capacity building and enhanced knowledge on innovative technologies for climate resilience, disaster risk reduction, control of air pollution, and technology co-operation with focus on green innovations and fourth industrial revolution technologies and (c) Enhancing technology intelligence through production and dissemination of knowledge products on new and innovative technologies for climate change and sustainable development.

APCTT's demand driven activities benefitted nearly 1000 participants comprising representatives from governments, technology promotion agencies, technology transfer intermediaries, academia, research and development institutions, city authorities, industrial enterprises, technology-based start-ups and financial institutions.

5.0 Information Technology and e-Governance (ITeG)

Information Technology and e-Governance (IT-eG) group was formed during the mid of the 10th Plan period in order to create an IT enabled work environment in the Department through accelerated usage of various Information Technology opportunities. Aim of ITeG was to convert the existing procedures and processes into citizen centric. IT-eG division implements e-Governance in the Department progressively that needs to be in

conformance to the National e-Governance Action Plan. IT-eG Division operates on a separate IT Budget Head under Secretariat Economic Services 2023-2024 for the implementation of activities carried out by the division.

Department has successfully developed new Content Management System (CMS) website for DSIR in (Bilingual). The website has been made compliant to the Guidelines for Indian Government of Websites (GIGW). During the period under report, DSIR received Standardisation Testing and Quality Certification (STQC) which is valid from 06th April 2023 to 26th April 2026. DSIR has integrated the website of DSIR with Google Analytics since May 2023 and is being tracked regularly. The website is regularly updated and has been visited more than 2.08 Lakhs times since 6th May 2023. Development of e-file submission and process flow is also developed for applications submitted at Service Plus portal for SIRO, PFRI, A2K+ schemes.

6.0 RTI ACT 2005

The Right to Information Act 2005 enacted on 15th June 2005, has been implemented successfully in the Department. As per the provisions of the Act, Nodal Officer, Appellate Authority, Transparency Officer, Central Public Information Officer and Central Assistant Public Information Officer are designated.

The proactive disclosures under Section 4 (1) (b) of the RTI Act 2005 enacted on June 15, 2005 are regularly updated [Last Updated on 25.07.2023] and available on the DSIR Website at https://www.dsir.gov.in. DSIR has complied with the directives received from Central Information Commission. RTI Requests and First Appeals received and their responses are available on DSIR Website. DSIR has received 217 Applications during 01/01/2023 to 31/03/2024 and all the applications were registered and out of them 212 were disposed off and 05 are under process on RTI Request & Appeal Management Information System at https://rtinonline.gov.in/RTIMIS. During 01/01/2023 to 31/03/2024, 04 applications were registered and disposed off at first appeal.

7.0 AUTONOMOUS INSTITUTION

Council of Scientific and Industrial Research (CSIR)

(i) The Council of Scientific & Industrial Research (CSIR) was established as an autonomous body in September 1942 to address the needs of industrial research in the country. Further, evolving the scope and range of activities in several domains, CSIR is today known for its excellence in R&D and S&T innovations. CSIR has Pan India presence through its network of 37 National Laboratories which undertakes focused basic and applied research in diverse fields of S&T. CSIR has established 39 outreach centres, one innovation complex and three units. CSIR's R&D expertise and experience is embodied in about 3476 scientists supported by about 4000 technical and support personnel.

(ii) CSIR has been playing a significant role in mentoring the scientific and technological advancement in the country. CSIR addresses national needs through its innovative research, strong fundamental science, industry partnerships, entrepreneurship, translation research, capacity building, and policy making. Through its technological interventions, CSIR has provided solutions and innovations for the industry and has also proved to be a catalyst in improving the quality of life of millions of people across the country.

(iii) Various S&T domains in which CSIR has focused its R&D activities over the years include oceanography, earth sciences, geophysics, chemicals, drugs, genomics, biotechnology and nanotechnology to mining, aeronautics, instrumentation, environmental engineering and information technology. It provides significant

technological intervention in many areas with regard to societal efforts which include environment, health, drinking water, food, housing, energy, leather, farm and non-farm sectors.

(iv) CSIR is the Nation's custodian for Measurement Standards of Mass, Distance, Time, Temperature, Current etc. CSIR has created and is the custodian of Traditional Knowledge Digital Library (TKDL) which is a tool to address unethical commercial exploitation of Indian Traditional Knowledge. CSIR also maintains Microbial Type Culture Collection (MTCC) and Gene Bank.

(v) Pioneer of India's intellectual property movement, CSIR today is strengthening its patent portfolio to carve out global niches for the country in select technology domains. CSIR has pursued cutting edge science and advanced knowledge frontiers. It has published around 5846 papers in SCI Journals with an average impact factor of 4.9.

(vi) CSIR through its various constituent laboratories is also placing major focus upon creating incubation facilities for spin off and start-ups. CSIR hand holds these companies so as to create a new segment of knowledge enterprises.

(vii) CSIR has been focusing in a significant manner on the development of S&T Human Resource and has been providing yeoman service through various fellowships. It has been imparting skills in diverse S&T areas so as to empower youth for better career and employment opportunities. CSIR has forged linkage with Ministry of Skill Development and Entrepreneurship to enhance and widen its contributions for Skill Development in the country.

7.1 Significant Events

(i) CSIR participates in 108th Indian Science Congress (ISC) – 2023

CSIR and its laboratories participated in the 'Pride of India Mega Expo' in 108th Indian Science Congress – 2023 organised at RTMNU, Nagpur, Maharashtra, during 3-7January 2023. The Expo was inaugurated by the Hon'ble Minister of State (Independent Charge) Science & Technology, Dr Jitendra Singh, along with Deputy CM, Maharashtra, Shri Devender Fadnavis.

The Secretary DSIR & DG, CSIR, Dr N Kalaiselvi, visited CSIR Pavilion at the 'Pride of India Mega Expo' and interacted with delegates, students, Start-ups and beneficiaries. CSIR bagged the 'Best Exhibitor of the Year' Award at ISC 2023.

(ii) One Week One Lab campaign of CSIR

The 'One Week One Lab' campaign of CSIR was launched to focus on the utmost need of the present day for establishing a resourceful connect of stakeholders (scientists/ entrepreneurs/ students/ industries/ start-ups/ society) for the advancement of the technologies and the progress of the society. The objective of the campaign is to showcase the diverse legacies, exclusive innovations and technological breakthroughs of the network of 37 CSIR labs situated across the nation working in diversified domains of S&T.

Highlighting the global excellence in technology, innovation and start-ups of the Nation, the 'One Week One Lab' campaign of CSIR was launched by the Hon'ble Minister of State (I/C) S&T, Dr. Jitendra Singh, on 6th January 2023. Dr N Kalaiselvi, Secretary, DSIR & DG, CSIR, called the campaign, a celebration of Science & Technologies for CSIR labs and new initiative in the *AmritKaal*, to leverage the technologies of CSIR.

The Hon'ble Minister of S&T (I/c), Dr. Jitendra Singh, on 6thJanuary 2023 also inaugurated the workshop and exhibition on "Innovation and Sustainable Construction Materials & Technologies" with an aim of moving towards Net Zero Emission and Zero Waste. The CSIR-CBRI was the first lab to organise the 'One Week One Lab' (OWOL) campaign. Almost every week after

that, the campaign was organised by other CSIR laboratories and was concluded with CSIR-NAL. The OWOL Campaign of CSIR was culminated on 26th September 2023 during the Foundation Day Celebrations of CSIR.

(iii) CSIR commemorates the International Year of Millets

CSIR-CFTRI organized the event on, "CSIR innovations on Millets" commemorating the International Year of Millets on 10th January, 2023. The event was inaugurated by the Hon'ble Minister of State (I/C) S&T, Dr. Jitendra Singh. The United Nations declared 2023 as the "International Year of Millets" and the cause was backed by 72 other countries. An exhibition on millet products and a Desktop Calendar 2023 on millets was released as part of the celebrations of "International Year of Millets-2023". The Exhibition had a display of products and technologies developed in CSIR-CFTRI, Mysuru, CSIR-NIIST, Thiruvananthapurm and CSIR-IHBT, Palampur and showcased the capabilities of CSIR laboratories in Millets R&D and reach to various stakeholders.

(iv) CSIR participates in India International Science Festival (IISF) 2023

CSIR and its laboratories participated in the 'Mega Science & Technology Expo' of India International Science Festival (IISF) 2023, held at Maulana Azad National Institute of Technology (MANIT), Bhopal, Madhya Pradesh during 21-24 January 2023. The aim of the 'Mega Science & Technology Expo' of IISF 2023 was to showcase India's prideful achievements, advancements, and success stories in the field of Science, Technology, Engineering, and Mathematics.

The Mega S&T Expo was inaugurated by the Hon'ble Minister of State (I/C) S&T, Dr Jitendra Singh, along with the Hon'ble CM of Madhya Pradesh Shri Shivraj Singh Chouhan and the Hon'ble Minister S&T of Madhya Pradesh, Shri Om Prakash Saklecha. The Hon'ble Ministers along with Dr N. Kalaiselvi, Secretary, DSIR & DG, CSIR visited CSIR Pavilion at the 'Mega S&T Expo'. CSIR Pavilion won the 'Best Pavilion in the Expo' Award at the Mega S&T Expo of IISF 2023. Other programs organised by CSIR Labs during IISF 2023 were "Vigyanika - Science Literature Festival" by CSIR-NIScPR, "Artisan's Technology Village-Vocal for Local" by CSIR-AMPRI and "Science through the Games and Toys" by CSIR–4PI.

(v) Kisan Mela organized in Lucknow

CSIR-CIMAP, as a part of One Week One Lab campaign, organized a Kisan Mela during 31st January 2023 till 4th February 2023. Shri Surya Pratap Shahi, Cabinet Minister, Govt. of UP inaugurated the CIMAP Kisan Mela and addressed the farmers, entrepreneurs and staff of the institute. More than 3000 farmers and entrepreneurs participated in the Mela. During the Kisan Mela "Aus Gyanya", UV protection herbal product 'CIM-Kayakawach', handbook of alternative cultivation of mentha and QR-code for information on MAPs varieties were released. The farmers interacted with scientists and industry, wherein they were also distributed planting materials. A farmers meet and awareness programme was also conducted at CSIR-CIMAP Research Centres in Bengaluru and Hyderabad on 2nd February 2023.

(vi) CSIR organise G20 RIIG Conference on Materials for Sustainable Energy in Ranchi during March 2nd - 3rd, 2023

CSIR organized the Research and Innovation Initiative Gathering (RIIG) Conference on "Materials for Sustainable Energy" during 2nd-3rd March , 2023 at Ranchi under India's G20 Presidency. Various facets of 'Materials for Sustainable Energy' were discussed under three sessions, viz. (i) 21st Century Challenges Related to Energy Materials & Devices, (ii) Solar Energy Utilisation and Photovoltaic Technology, and (iii) Materials and Processes for Green Energy. Leading experts were drawn from institutions such as IITs, IISERs, CSIR Labs, industries, think tanks including NITI Aayog and Indian Energy Storage Alliance.

Twenty foreign delegates from ten G20 member countries, six invited guest countries and an international organization joined the two-day conference. From India, 38 delegates and special invitees from scientific departments, research and academic institutions and industry participated in the RIIG Conference.

(vii) **MoU signing between CSIR, India and AMEXCID, Mexico on research, technology and innovation collaborations**

In a landmark milestone in S&T Cooperation between India and Mexico, an MoU on Research, Technology & Innovation cooperation was signed between CSIR, India and the Mexican Agency for International Development Cooperation (AMEXCID) of the Ministry of Foreign Affairs of the United Mexican States on 4thMarch 2023.

The MoU shall facilitate co-operation in the areas of research, technological development/ deployment, innovation and capacity building with an objective to expand knowledge and strengthen Intuitional capacities in both the countries. The collaboration would focus in the areas of Aerospace, Electronics Instrumentation & Strategic Sectors; Civil, Infrastructure & Engineering; Ecology, Environment, Earth, Ocean Sciences & Water; Mining, Minerals, Metals & Materials; Chemicals & Petrochemicals; Energy & Energy Devices; Agriculture, Nutrition & Biotechnology; and Healthcare. Special focus on technology and industry collaboration has been structured in the MoU (supporting Start-up ecosystem and existing industry through technology partnerships, tailor-making each other's technologies/products and demonstration/deployment, establishing joint outreach centres and capacity building centres).

(viii) **International Women's Day celebration at CSIR**

The CSIR family celebrated International Women's Day on 9th March 2023 to honour the Pride of Women in CSIR contributing directly or indirectly in the progress of science & society. The celebration had Mrs Manju Singh, an educationist and Dr Jitendra Singh, Hon'ble Minister of State (I/C) S&T gracing the occasion as the Chief Guests. Ms Nivruti Rai, VP- Intel Foundry Services, Intel Corporation & Country Head, Intel India, joined the celebration as the Guest of Honour and addressed the audience by delivering special talk on "Breaking Barrier: Advancing Women in Science & Technology".

The celebration was also graced by the presence of the Principal Scientific Advisor (PSA) to the Govt. of India, Prof A. K. Sood and Dr M. Ravichandran, Secretary, MoES & Dr Rajesh Gokhale, Secretary, DBT. Directors of CSIR laboratories and Heads of CSIR Headquarter Directorates along with their spouses also participated in the event with other CSIR staff joining physically/ online for the celebration. A segment on Spouse Forum Meet was organised as an interactive session with the special invited guests along with their families.

(ix) **CSIR participated in the National Technology Week 2023 celebrations**

Hon'ble PM, Shri Narendra Modi on 11th May 2023 inaugurated the five-day National Technology Week celebrations jointly observed by all the Scientific Ministries and Departments in New Delhi. CSIR showcased its technologies and innovations in the exhibition. Expert talks by CSIR leaders were also organised during the event.

(x) **Rastriya Baudhik Sampada Mahotsav**

Under the aegis of Azadi Ka Amrit Mahotsav (AKAM), Department of Scientific and Industrial Research (DSIR) & Department for Promotion of Industry and Internal Trade (DPIIT) along with the partners Council of Scientific and Industrial Research (CSIR), O/o Controller General of Patents, Designs, and Trade Marks (CGPDTM), Protection of Plant Variety and Farmers' Rights Authority (PPVFRA), National Research Development Corporation (NRDC) and Sanrachna Foundation launched a month-long celebrations of Rashtriya Boudhik Sampada Mahotshav (RBSM) - National Intellectual Property Festival from 1stJuly 2023 to 31stJuly 2023.

The campaign was launched by Dr .Jitendra Singh, Hon'ble Minister of State (I/C), S&T and Chairman, National Implementation Committee (NIC) at CSIR-NPL, New Delhi on 30th June 2023. CSIR through its 37 constituent laboratories conducted 184 events all across the country with more than 1,25,000 participants during the campaign. CSIR-IMMT, Bhubaneshwar and CSIR-CECRI, Karaikudi flagged off "CSIR- IP Rath" for disseminating IP knowledge to greater masses.

(xi) **Lavender Festival in Bhaderwah, Jammu & Kashmir**

Hon'ble Minister of State (I/C) S&T, Dr. Jitendra Singh on 4th June 2023 inaugurated the two-day Lavender festival organized at Bhaderwah in Jammu as a part of One Week One Lab campaign of CSIR-IIIM, Jammu. The Lavender festival involved hundreds of farmers, agri-industrialists, entrepreneurs etc. The farmer -industry meet, Agri-startup expo and cultural programme were the significant highlights of the festival.

(xii) **Pushp Krishi Mela organised under CSIR Floriculture Mission II**

CSIR-IHBT organised "Pushp Krishi Mela" under CSIR Floriculture Mission II on 10th August, 2023 at DIHAR, DRDO, Leh. It was inaugurated by Hon'ble Lt. Governor Brig. (Dr.) B. D. Mishra (Retd.). Chief Executive Councillor, LAHDC, Leh, Advocate Tashi Gyalson, Member of Parliament, Ladakh, Shri Jamyang Tsering Namgyal, Shri Ravinder Kumar (IAS), Secretary Agriculture/ Horticulture UT Ladakh and Dr. O.P Chaurasia, Director, DIHAR, DRDO, Leh, Ladakh were present as Guest of Honour.

(xiii) **Installation of 10 Ton per day Biogas plant at Bowenapally Vegetable Market, Hyderabad, Telangana**

CSIR-IICT, Hyderabad has installed and operated a 10 ton per day biogas plant at Dr. B.R Ambedkar Vegetable Market in Bowenpally where 10 tons of waste is converted to 500 - 600 m^3/day of biogas everyday along with liquid digest that can be used as organic fertilizer. The biogas is used to replace grid power (approx. 400 kWh/day) and LPG consumption (28 – 30 kg/day). Department of Biotechnology (DBT) has provided financial support for the project.

(xiv) **CSIR-NBRI Launches Improved Variety Lotus**

CSIR-NBRI launched an improved variety of the national flower Lotus with 108 petals called 'Namoh 108' on 14th August 2023 during the inaugural of the One Week One Lab campaign of CSIR-NBRI. The Lotus variety is more weather resilient and can flower from March to December. This lotus was brought by NBRI scientists from Manipur to conduct research on it. This is the first Lotus variety whose genome is completely sequenced. This plant will never be extinct or endangered like many other flowers and plants have become. CSIR-NBRI also released apparels made from lotus fibre and perfume 'Frotus' developed from Lotus plants in collaboration with FFDC, Kannauj.

'Namoh 108'

(xv) **Launch of CSIR's Indigenous E-Tractor, CSIR Prima ET11**

The Hon'ble Minister of State (I/C) S&T, Dr. Jitendra Singh, on August 21st, 2023, launched the compact E-Tractor CSIR PRIMA ET11 which was indigenously designed and developed by CSIR-CMERI to cater to small and marginal farmers of India.

(xvi) **CSIR-NAL Launches Q Plane and JALDOST airboat**

In a significant step towards advancing the capabilities of unmanned aerial vehicles (UAVs) in India, the CSIR-NAL unveiled the Q Plane – a lightweight all-electric hybrid UAV with vertical-take-off-and-landing capability during the curtain raiser of One Week One Lab, on 2nd August 2023. Designed for autonomous flight, the UAV has a range of 30 kilometres and endurance of up to 70 minutes.

CSIR-NAL developed JALDOST which is an airboat that operates on water and removes excess aquatic weed & floating waste from water bodies. The JALDOST has a closed airtight pontoon type hull to make it inherently unsinkable. It has a hybrid propulsion system, comprising air propulsion and paddle wheel propulsion. CSIR-NAL has developed two versions of the airboat — JALDOST Mark-1 and an upgraded version JALDOST Mark-2. The JALDOST Mark-2 has been designed on the specifications given by BBMP and can be used to clean lakes in Bengaluru. It was launched on 2nd August 2023, during the curtain raiser of One Week One Lab of CSIR-NAL.

(xvii) **Shanti Swarup Bhatnagar National Awards**

The Hon'ble Minister S&T, Dr Jitendra Singh on 26th September 2023, presented the Shanti Swarup Bhatnagar National Awards to eminent Scientists below the age of 45 at a largely attended 82nd Foundation Day Celebration Function of CSIR at Bharat Mandapam in New Delhi. Hon'ble Prime Minister Shri Narendra Modi has in a written message extended his heartiest congratulations to all the winners of Shanti Swarup Bhatnagar Prize and extended his greetings and best wishes to everyone associated with CSIR for the success of the 82nd CSIR Foundation Day. The Prime Minister's message hailed CSIR for playing a prominent part in serving society, industry and the nation. The message mentioned the Aroma Mission, strides in floriculture, the Purple Revolution through Lavender cultivation in Jammu and Kashmir, laying of Steel Slag roads along the border areas of the country as some instances of CSIR's contribution in meeting national aspirations.

(xviii) **Exhibition on CSIR Decadal Achievements**

On the occasion of the 82nd Foundation Day of CSIR, a two-day event to showcase the decadal (2014-2023) achievements of CSIR was organized at Pragati Maidan, New Delhi, on 26th & 27th September 2023. The exhibition was inaugurated by Hon'ble Minister S&T, Dr. Jitendra Singh. All 37 CSIR laboratories participated in the exhibition and displayed their achievements through posters, exhibits, products, prototypes, etc. At the event's backdrop, a CSIR-Industry Meet was organized and attended by the industry partners of various laboratories of CSIR.

(xix) **Flag Off of "Recycling on Wheels Smart-ER" to Promote Cleanliness and Environmental Responsibility under Swachhata Hi Seva (SHS) campaign from CSIR Headquarters**

In alignment with the Swachhata Hi Seva (SHS)

campaign, celebrated from 15th September to 2nd October 2023, Hon'ble Minister S&T, Dr Jitendra Singh inaugurated the "Recycling on Wheels Smart-ER" at CSIR Headquarters in New Delhi on 2nd October 2023. Dr Kalaiselvi, DG, CSIR and Secretary, DSIR, addressed during the inauguration of the Special Campaign 3.0 for institutionalizing *Swachhata* and said that all the 37 CSIR labs across the country are engaged with both physical cleaning and e-cleaning that is processing and weeding out of obsolete files.

(xx) **Director General, WIPO visits CSIR-Traditional Knowledge Digital Library**

Mr. Daren Tang, Director General, World Intellectual Property Organization (WIPO) and other distinguished delegates from the WIPO visited the CSIR-Traditional Knowledge Digital Library (TKDL) facility on 12th October 2023 and participated in discussions on the CSIR Innovation System, TKDL CSIR Technologies and CSIR's Current IP Strength & Strategy. The CSIR team was led by Dr. N. Kalaiselvi, Secretary, DSIR and Director General, CSIR. The distinguished guests included Prof. Unnat P. Pandit, Controller General of Patents, Designs & Trade Marks (CGPDTM), and representatives from the Department for Promotion of Industry and Internal Trade (DPIIT), the office of the CGPDTM, and Ministry of AYUSH.

(xxi) **Exchange of CSIR-DAAD Agreement of Co-operation**

A German delegation headed by Dr. Michael Harms, Deputy Secretary General, German Academic Exchange Service (DAAD), Federal Republic of Germany visited CSIR for exchange of CSIR-DAAD Agreement of Co-operation as for exploring collaboration discussions with AcSIR.

(xxii) **CSIR Innovation showcase in World Food India 2023**

The World Food India 2023 event was organised by the Ministry of Food Processing Industry at Pragati Maidan, New Delhi from 3-5 November, 2023. Event was inaugurated by Hon'ble Prime Minister Narendra Modi. The CSIR pavilion at World Food India-2023 expo was inaugurated by Dr. N. Kalaiselvi, the Director General, CSIR, and Secretary, DSIR in the presence of three CSIR constituent laboratories Directors - Dr. Sridevi Annapurna Singh, Director, CSIR-CFTRI, Mysuru; Dr. Sudesh Kumar Yadav, Director, CSIR-IHBT, Palampur (HP) and Dr. C. Anandha Ramakrishnan, Director, CSIR-NIIST, Thiruvananthapuram. The CSIR labs CFTRI, IHBT and NIIST participated in the World Food India event and showcased their scientific innovations in food sector.

(xxiii) **CSIR signs MoU with HQIDS**

A MoU between the Headquarters, Integrated Defence Staff (HQIDS) and the Council of Scientific and Industrial Research (CSIR) was signed on 23rdNovember 2023 for technical collaboration and joint research and development in the field of Defence Technology. The MoU aims to provide an umbrella framework for initiating collaborative interaction between CSIR Labs, HQ IDS and Armed Forces, namely Indian Army, Indian Navy and Indian Air Force for enhancing scientific understanding of technologies related to defense and undertaking joint research and development in dual use technologies.

(xxiv) **CSIR-AMPRI Awarded with CII 3R Awards 2023**

The CSIR-AMPRI won the Confederation of Indian Industry - Reduce, Reuse, Recycle (CII 3R) Awards 2023. The Award has been conferred for the institute's excellence in managing wastes through innovative solutions/technologies.

(xxv) **CSIR Director's Conference**

The annual CSIR Director's Conference was held on 1-2 December 2023. CSIR-IMMT, Bhubaneswar hosted the two-day conference. Several policy related matters, CSIR projects and plans were brainstormed during the conference. A demonstration garden under the CSIR Floriculture Mission was inaugurated by the DG, CSIR in Puri. The DG, CSIR also inaugurated the Srikhetra Herbals Manufacturing

Unit and distributed planting materials to the farmers. The manufacturing unit for the extraction of Tulsi oil and manufacture of aromatic products was setup using CSIR technologies under the CSIR Aroma Mission.

(xxvi) **CSIR participates in Global Bio-India 2023**

CSIR laboratories participated in the Global Bio-India 2023 organised by the Department of Biotechnology (DBT) in collaboration with Biotechnology Industry Research Assistance Council (BIRAC), during 4-6 December 2023 at Pragati Maidan, New Delhi and showcased their innovations and developments in the fields of bio-technologies and biosciences.

7.2 S&T Achievements

(i) **CSIR's first battery recycling pilot facility commissioned in Jamshedpur**

CSIR-NML has commissioned the first Battery Recycling Pilot Facility of the CSIR at Jamshedpur to extract critical metals such as Lithium, Nickel, Manganese and Cobalt. It encompasses 1 Ton per day (TPD) battery dismantling and cathode material separation setup, apart from the integrated large-scale hydrometallurgical facility for extraction and separation of those critical metals.

(ii) **Clinical Trials of Oral Contraceptive Pill 'Levormeloxifene' Approved**

DGCI approved the clinical trials of an oral contraceptive pill 'Levormeloxifene' jointly developed by CSIR-Central Drug Research Institute (CDRI) and the technology partner.

(iii) **Biomedical Waste to Soil Additives**

CSIR-NIIST has developed a dual disinfection-solidification system that can spontaneously disinfect and immobilize pathogenic biomedical waste such as blood, urine, sputum, body parts, etc, and convert them into value-added soil additives within minutes. Laboratory disposables, plastics, glass, etc. are disinfected and prepared for direct recycling. An automated equipment has been developed that ensures minimal human intervention in handling biomedical waste.

(iv) **Honey Profiling using NMR**

CSIR-NCL is developing critical Nuclear Magnetic Resonance (NMR)-based profiling methodologies and data analytics for a variety of unifloral and multifloral Indian honey. These techniques not only allow for identification of premium quality honey that is suitable for exports but also enables quantification of adulteration in commercial honey.

(v) **CSIR-CIMAP research lowers nicotine content in Tobacco plant**

CSIR-CIMAP has successfully lowered nicotine content in the Petit Havana Tobacco plant variety by using a genome editing tool and reduced 60-70 per cent nicotine in it, compared to nicotine content in wild-type plants. CSIR-CIMAP further plans to lower nicotine in commercial varieties to help people quit the habit by working on tobacco plant varieties used in cigarettes, cigars, beedi.

(vi) **Technology for addressing humidity issue of salt**

CSIR-CSMCRI has successfully completed a project for Tata Salt that addresses the issue of yellowing of salt.

(vii) **A new multi-component alloy-based catalyst designed for efficient production of Green Hydrogen**

Scientists from the Centre for Nano and Soft Matter Sciences (CeNS), Bangalore, and CSIR-NCL, Pune, have developed a promising catalyst for the hydrogen evolution reaction (HER), a crucial step in water electrolysis for producing hydrogen. This newly designed catalyst, a mixture of cobalt, manganese, and tin known as Co-Mn-Sn alloy, has shown better efficiency and stability in generating hydrogen as compared to the individual metals or binary (Co-Mn, Mn-Sn or Co-Sn) alloys. The presence of manganese and tin in the alloy played

a synergistic role in boosting its performance. As the Co-Mn-Sn alloy does not contain any platinum group metal it offers exciting prospects.

(viii) **Indian sign language brings hope for deaf students aspiring to learn STEM subjects**

First of its kind project in the country on 'Indian Sign Language Enabled Virtual Laboratory' (ISLEVL) has been initiated under the CSIR's 'JIGYASA' programme under which experts are creating specialised digital content to educate the deaf by Indian Sign Language (ISL) translated contents in STEM (Science, Technology, Engineering and Math). 103 new signs and 200 content videos on scientific concepts have been developed by a team led at CSIR-IMTech, with the assistance of deaf special education experts.

(ix) **Scientists tap into underwater fish chorus symphony with help of AI**

CSIR-NIO has, for the first time, recorded the captivating sounds of marine life with the help of Artificial Intelligence. Recent passive acoustic recordings by the CSIR-NIO have uncovered a veritable "symphony" of sounds produced by fish, shedding light on their complex underwater communication.

(x) **3D Printable Filament Fabrication by Melt Extrusion and Graphene coated Polymer Material**

The 3D Printable Filament Fabrication by Melt Extrusion and Graphene coated Polymer Material by Melt extrusion technique of CSIR-CECRI was utilized to develop in-house fabricated filaments of neat PLA, neat ABS and graphene-based PLA and ABS composites. The parameters for obtaining optimal filament thickness were studied. These filaments are suitable for FDM based 3D printing. The technology knowhow has been transferred to M/s. Monotech Systems Ltd., Chennai.

(xi) **High Performance Moisture Compatible Resistant Protective Coating System**

Wet surface corrosion is challenging and necessitates a distinct strategy. The use of conventional paints will not be a solution for the corrosion in the wet surface. In order to combat this CSIR-CECRI has developed a coating to shield concrete buildings that frequently come into contact with water and high relative humidity. It can be used in extreme weather environments like the C5-M and C5-I environments. Lamellar pigments in the coating serve as an inert barrier to prevent the vertical penetration of corrosive species. The unique feature of moisture-curing coating is that it can be applied using either an airless sprayer or a brush. This is mainly utilised for the protection of underwater infrastructure, sewage pipes and cooling towers. The technology has been transferred to M/s. Krishna Conchem Products Pvt Ltd., Maharashtra.

(xii) **Utilization of by-products of wheat milling industry for the development of biodegradable plates**

The current global consumption of non-decomposable plastics is over 200 million tonnes, and an estimated growth is about 5% annual. Disposable tableware made of plastics, such as styrene, and the voluminous production of waste resulting therefrom. The research by CSIR-CFTRI focused on production of edible plates as a substitute to non-biodegradable disposable plates, utilizing wheat industry by- products. The edible plates were prepared using different combinations of wheat bran and resultant atta in different ratios viz., WB, 90:10 (WR10); 80:20 (WR20),70:30 (WR30). Farinograph data showed higher the bran content higher will be the water absorption. The doughs from the blends were prepared with water at two different temperatures (100^0C & 27^0C), sheeted, moulded and baked. Plates produced from WR10,20,30 were analysed further and based on break test, leak test and sensory WR30 was chosen as the best. WR 30 was found to leak at 23.01 ±0.24 minutes with hot water and 85.42 ±0.11minutes with water at room temperature. Moisture, ash, fat, protein, and total dietary fibre content was 4.3±0.016, 4.90±0.08, 3.86±0.075, 16.06±0.082 and 26.92±0.166, respectively. Shelf-life predicted

for plate was 250-285 days based on MSI studies.

(xiii) **Development of Low Carbon MgO-C Refractory for Clean Steel production**

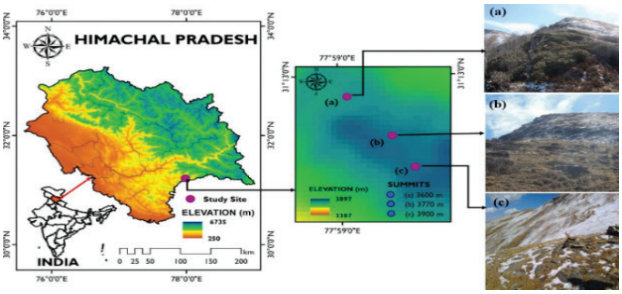
Two different nano-carbon sources coded as N22 and N33 having surface area of 106 m^2/g and 75 m^2/g have been selected for the development of MgO-C refractory with the varying nano carbon content of 0.5 to 1.5 wt% with a fixed total carbon content of 3 wt%. 02 inch MgO-C refractory blocks with varied amount of external and in-situ nano carbon were prepared and evaluated by CSIR-CGCRI. Nano carbon containing samples exhibited better strength, oxidation and thermal shock resistance and comparable corrosion resistance properties w.r.t. 10% graphite containing MgO-C samples.

(xiv) **Smac Mimetics for Treatment of Cancer**

CSIR-CDRI's discovery of novel Smac Mimetic Peptidomimeticsis useful for the treatment of cancer. It has been shown to be effective against chemotherapy resistant cancer. The novel Smac mimetics are prepared by incorporating 5-furanylprolinre, a unique amino acid that imparts exclusively trans bond geometry favourable for target protein binding. The novel Smacmimetics disclosed in the present invention binds to BIR-2 and BIR-3 domains of the IAP and exhibit highly anti-proliferative activity against variety of cancer cell lines including chemotherapy resistant cell lines. The new Smac mimetic promotes hall mark apoptotic features in cancer cells demonstrating its actual in-vitro target engagement. The most potent Smac mimetic is orally active having robust anti-tumor efficacy against multiple xenograft animal models. It is highly stable in biological system and appeared to be present in systemic circulation with significant bioavailability via Subcutaneous (56%) and Oral (55%) routes of administration. The invention shows robust in-vitro and in-vivo anti-cancer activity against chemotherapy resistant cancer.

(xv) **Compositional change in vascular plant diversity in the alpine mountainous region of Indian north-western Himalaya indicate effects of warming**

A study conducted by CSIR-IHBT in the alpine regions of the Himalaya, investigate the impact of climate warming on alpine vegetation. The study found that mean annual soil temperature had significantly increased, particularly in the upper alpine summit. There was also an increase in species richness and plant cover percentage. The changes in diversity indices suggested a homogenization of biotic communities, with thermophilization more pronounced in the lower alpine summits. This study provides important baseline data on the response of alpine communities to climate change in the region. Further research is needed in other parts of the Himalayan alpine eco-regions to better understand the implications for the conservation of vulnerable flora in the changing climate scenario.

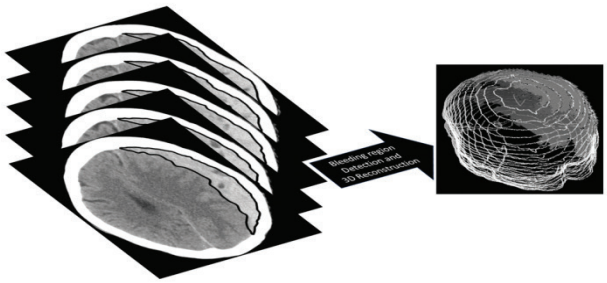


(xvi) **Detection system for Alzheimer's disease**

Combination of structural MRI (sMRI) and functional MRI (fMRI) derived image analysis may provide unique ability to capture the dynamic state of change in the degenerating brain. Hence, to capture the overall structural and functional anomalies of brain tissues caused by AD an exhaustive combinatorial system has been developed at CSIR-IICT by using structural and/or functional MRI data followed by rigorous image processing and deep learning based algorithms to diagnose AD and/or mild cognitive impairment (MCI) patients. Whole brain sMRI and fMRI slices are processed and brain pixel based intensity features are fed into a deep learning based convoluted neural network (CNN) algorithm to calculate the AD/healthy probability of each MRI slice.

(xvii) **Detection system for automatic identification and 3D-reconstruction of haemorrhagic stroke**

Rapid identification of the stroke regions in the early stages of the disease helps develop a suitable treatment guideline to assist the clinicians. A non-invasive computational tool capable of utilizing the CT images and further automatically and accurately detect the stroke regions will be of utmost importance. CSIR-IICT has developed an image processing and deep learning based system for automatic detection of haemorrhagic stroke regions and subsequently estimation of the volume and spread of the haemorrhage/bleeding regions using the brain CT images. A 3D-reconstruction of the detected haemorrhagic regions is shown.



(xviii) **SenzHb: A Rapid Haemoglobion Test Kit**

A rapid heaemoglobin test kit has been developed at CSIR-IITR in collaboration with FSSAI, New Delhi for estimation of haemoglobin in blood samples. The easy to use paper based colorimetric strip type sensor will be of immense use for point of care testing by the health-care workers, where sophisticated instruments are not available. The technology is transferred to M/s Techno Surge Industries Pvt. Ltd., Amravati, Maharashtra.

(xix) **Development of Bio fertilizers**

CSIR-NBRI has developed the following biofertilizers: "जैवआर्सेनिककवच": It is a synergistic microbial formulation with four fungal strains and two bacterial strains that combats arsenic stress and promote plant growth in paddy crops grown in arsenic contaminated fields.

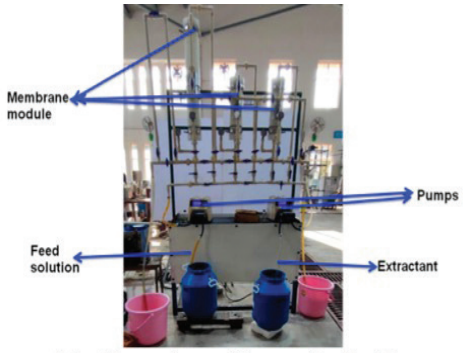
BIO PAL-12: Bio-PAL 12 is bio-fungicide formulation against Fusarium that cause yield losses ranging from 10 to100% in many cereals, vegetables and legumes. This product has ability to inhibit more than 15 phyto pathogenic fungi and can also enhance the growth of different agronomic, floriculture and vegetable crops.

BACI-GUARD: Bio-fungicide comprising of endophytic bacteria, Bacillus subtilis strain NBRI-W9 specifically developed for control of Fusarium wilt, yellows and corm rot in gladiolus. It also has bio-stimulant activity which provides drought tolerance in mustard and provides plant growth promotion in tomato and other crops.

BIOAGENT PBE8: This product is effective against 'Fusarium wilt disease' and suppress its incidence in tomato by 75-85%. It also inhibits other soil borne fungal pathogens and stimulates plant growth and yield attributes in infected plants

(xx) **Separation/Recovery of Heavy Metals from Industrial Waste Water**

To avoid the precipitation and thereby sludge formation, hollow fiber membranes are used for the extraction of chromium (Cr) from the electroplating waste water of Hindustan Aeronautics Limited, Sunabeda (Odisha). The hollow fibers are made up of micro porous polypropylene film having total effective membrane area of 16 m^2. The unit was tested by CSIR-IMMT for Cr extraction in continuous mode with a flow rate of 48L/h. The Cr extraction obtained was 89% with Alamine 336 as the extractant.



Hollow fiber membrane unit for separation of metal ions

(xxi) **In Silico Design of Catalyst for MeOH to Formaldehyde**

CSIR-NCL conducted studies to validate our DFT-based predictions suggesting a catalyst to convert MeOH to Formaldehyde at room temperature. Working conditions for the existing catalysts are too harsh. CSIR-NCL experiments that the catalyst converts MeOH to formaldehyde at ambient conditions.

(xxii) **Geothermal Ladakh**

CSIR-NGRI has completed heat flow and thermal conductance (Geothermal) modelling studies in the regions of Puga, Chumathang and Panamic regions. Magnetelluric and Geochemical studies, DRONE Electro-magnetic studies, Extensive Electircal Resistivity Tomography surveys have also been completed and technical reports for all the above are submitted to the concerned departments of Ladakh UT.

(xxiii) **NAviMet (Comprehensive Aviation Weather Monitoring)**

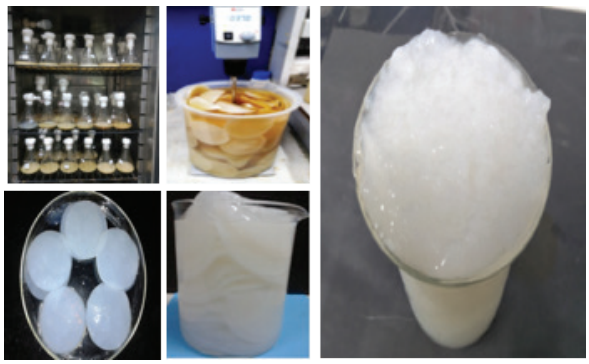
CSIR-NAL's indigenous technology – NAviMet is a first-of-its-kind innovative comprehensive weather observing system that measures & reports the complete meteorological requirements of the airport to deliver safe & smooth air operations. These weather sensors are mounted over a state-of-the-art, eco-friendly frangible mast to facilitate the precise weather condition of the airports to the meteorologists. The novel NAviMet software, in addition, provides plethora of operational demanding parameters viz., METAR, SPECI, SYNOP, METREPORT, TAF, Aerodrome Warning, Cloud, Runway selection, etc., adhering to internationally stipulated formats to aid and ease the air operations.

CSIR-NAL's NAviMet is commissioned at HAL's New Helicopter Facility, Tumakuru, Karnataka and currently functioning aiding their air operations. The New Helicopter Facility was dedicated to the nation by the Hon'ble Prime Minister.

(xxiv) **Technology on Process for Bacterial nanocellulose**

The global demands to upcycling wastes for producing value-added products become an imperative not only for the economic viewpoint, but also from the waste reduction perspective and the implementation of higher green standards. Bacterial nanocellulose (BNC) has been emerging as a biomaterial of considerable significance in a number of industrial sectors because of its remarkable physico-chemical and biological characteristics. BNC composites are expected to have valuable properties that hold potential for use in apparel and footwear products, such as its unique structure,

biodegradability, mechanical strength, and high crystallinity. CSIR-NCL has developed a patented process to produce bacterial nanocellulose from an indigenously isolated bacteria and demonstrated the production using cheap carbon source for the improved yield of BNC.



(xxv) **Detection of volcanism off the Nicobar Islands in the Andaman Sea**

Multiple high-resolution multibeam echo-sounding (MBES) surveys by CSIR-NIO along with water column imaging (WCI) onboard RV Sindhu Sadhana along the volcanic arc helped to detect water column anomalies related to volcanism. Gas flares originating from the outer flanks of cratered seamount were observed in 2018 and 2021. Geological sampling over the gas venting location revealed the presence of chemosynthetic species typically observed at methane seeps and/ or hydrothermal vent sites. These observations confirmed the volcanic activity at the cratered seamount off the Nicobar region in the Andaman Sea.

(xxvi) **Column Flotation Technology**

CSIR-NML has been in the forefront in indigenizing the 'Column Flotation Technology' for processing lean grade and fine-grained ores for more than three decades. Development of column flotation technology achieved Technology Readiness Level - 9, implying that it is ready for successful deployment at commercial scale. The USP of CSIR - NML is providing a 'One-stop solution for installation and commissioning of commercial scale flotation columns' by collaborating and partnering agencies. So far, 5 laboratory scale, 1 pilot plant scale and 8 commercial scale flotation columns were commissioned.

Column flotation is commercially used all over the world due to its salient features such as better hydrodynamic conditions and froth washing mechanisms that exist in the flotation column which enhances both recovery and grade, compared to conventional cells.

Recently, a commercial scale flotation column of 200 TPD has been installed at Bhelatand Coal Preparation Plant of M/s Tata Steel Limited.

(xxvii) **Slosh and Vibration Studies on LCH External Auxiliary Fuel Drop Tank**

Slosh and vibration studies on the external auxiliary fuel drop tank of Light Combat Helicopter (LCH) developed by Hindustan Aeronautics Limited (HAL), Bengaluru were carried out at CSIR-SERC. The required test fixtures were designed and fabricated by CSIR-SERC. The tank was filled 2/3rd of its capacity with water (140 litres) and the entire test set-up (test fixture with drop tank assembly) was subjected to slosh and vibration by means of an actuator and a mechanical shaker. A vibration excitation of 2000 cycles/minute (33 Hz) and a slosh load with ±15° at 10 cycles/minute were applied simultaneously to the drop tank for a period of 25 hours. Subsequently, only slosh load with ±15° at 10 cycles/minute was applied to the drop tank for a period of 15 hours. The fuel drop tank withstood the required slosh and vibration loadings as specified by MIL standard. The results of the studies were useful for qualification and operational clearance of the drop tank on LCH.

7.3 Scientific Excellence

CSIR has published 5846 research papers during 2022 in SCI journals of repute. The new knowledge generated from CSIR laboratories is reflected in terms of high average Impact Factor (4.9).

7.4 Excellence in Intellectual Property

During 2023-24, CSIR filed / granted the following patents:

	Abroad	India
Patents Filed	202 (125 Unique Patents)	242 Unique Patents applications
Patents Granted	89 Patents abroad (64 Unique Patents)	435 Unique Patents
Copyright Applications	55 in different categories such as literary work (18%), software (75%) and artistic work (7%)	

7.5 Value Generation through External Cash Flow (ECF)

CSIR's External Cash Flow stood at Rs. 1262.87 Crore during 2023-24, by working with various Govt./ non-Govt. Indian and foreign organisations.

ECF (Rs in crore)	
Government	520.25
PSU	496.03
Private	192.75
Foreign	53.84
Total	**1262.87**

8.0 PUBLIC SECTOR ENTERPRISES

8.1 National Research Development Corporation (NRDC)

National Research Development Corporation (NRDC) is a Government of India enterprise, under the administrative control of Department of Scientific & Industrial Research (DSIR), established in 1953 under section 25 now section 8, of the Companies Act. The main objective is to promote, develop and commercialize technologies/ know how/ inventions/ patents/ processes emanating from various national R&D institutions. The Corporation offers its services through-out the country in improving the Nation's manufacturing base with innovative technologies suitable for our entrepreneurs and conditions. It acts as an effective interface for translating R&D results into marketable products. Over the last seven decades of its existence, the NRDC has forged strong links with various R&D organizations both within the country and abroad and pursued bringing inventions and innovations to commercial fruition. The Corporation is recognized as a repository of a wide range of technologies and has licensed technologies to over 5100 entrepreneurs spread over almost all areas of industry and has provided assistance for filing of more than 2100 IP's.

During the financial year 2022-23, Revenue from operations was recorded at ₹ 649.76 lakhs compared to ₹ 1144.66 lakhs during the previous financial year in 2021-22. Surplus Before Tax and extraordinary expenses was recorded at ₹ 371.73lakhs in 2022-23 compared to ₹ 20.00 lakhs during the previous financial year in 2021-22 and Surplus After Tax and Extraordinary Expenses was recorded at ₹ 371.87 lakhs compared to ₹ 4.94 lakhs during the previous financial year.

NRDC signed 22 MoU's with new organizations, assigned 40 technologies and Licensed 20 innovative technologies to start-ups / entrepreneurs during the period under report. NRDC assisted start-up mission and evaluated 1200 number of applications received from start-ups for availing tax benefits. NRDC has also partnered with IOCL to mentor, handhold, incubate, implement, monitor and review the progress of the Start-ups supported by IOCL.

The organization has initiated TDVC for supporting technology development as well as operationalization in its incubation center set-up at Headquarters and also entered into agreement with CSIR-NAL and CSIR-IMMT for managing their incubation centers. The Corporation in its pursuit of protection of inventions and technologies developed by scientists and researchers, etc. provided financial/ technical assistance for filing of 66 IP applications received from various universities, R&D institutes, etc.

NRDC is increasing its footprints pan India by establishing outreach centres in various cities like Pune, Guwahati and strengthened its activities in Vishakhapatnam at its Mo-MSME- IPFC office. Further, an MoU with North East Centre for Technology Application and Reach (NECTAR)

has been executed. Foreign collaboration efforts are also being made and MoUs have been executed with United States Patent & Trademark Office (USPTO) and African-Asian Rural Development Organization (AARDO).

8.2 Central Electronics Limited (CEL)

Central Electronics Limited (CEL) is a profit making public sector enterprise under the Department of Scientific and Industrial Research (DSIR), Ministry of Science & Technology, Government of India. It was established in 1974 with an objective to commercially exploit indigenous technologies developed by National Laboratories and R&D Institutions in the country. CEL is one of the companies that utilized home grown technologies during all these years of its existence. The company is primarily engaged in production of strategic components for defense applications of national importance, equipment for railway safety and solar photovoltaic modules and systems. The company has developed a number of products for the first time in the country through its own R & D efforts and in close association with the premier national & international laboratories including defence laboratories. The organization had the highest ever net worth of Rs. 133.27 Crore as on 31.03.2023 with positive reserves. CEL signed MoU with DMRC for development of Broken Rail Detection / Rail Monitoring System. ToT (Transfer of technology) agreement was signed between CEL & Defence Laboratory, Jodhpur (DLJ) for "**Microwave Absorbing Nickel Spinel Ferrite (MWA-NSF) Powder**" and with CEL & ISRO- Vikram Sarabhai Space Centre (VSSC), Kerala for "**Piezoelectric Vibration Sensor**"

CHAPTER 1 INDUSTRIAL R&D PROMOTION PROGRAMME (IRDPP)

INDUSTRIAL R&D PROMOTION PROGRAMME (IRDPP)

DSIR through its flagship program i.e. "Industrial Research & Development Promotion Program (IRDPP)" has vision to promote Industrial Research in the country through Industry and Institution centric motivational measures and incentives creating an enabling environment for development & utilization of novel technologies and innovations.

1.0 Objectives

The broad objectives of the Industrial Research and Development Promotion Programme (IRDPP) are to:

I. Bring in-house R&D into sharper focus;

II. Strengthen R&D infrastructure in industry and Scientific and Industrial Research Organisations (SIROs);

III. Promote R&D initiatives of the industry and SIROs;

IV. Ensure that the contributions made by the in-house R&D centres and SIROs dovetail adequately in the overall context of technological and industrial development.

1.1 Areas of Coverage

The specific areas covered under the component scheme are:

I. In-house R&D in Industry.

II. Scientific and Industrial Research Organisations (SIROs) and

III. Fiscal Incentives for Scientific Research.

Activities and achievements in each of above areas are presented below:

1.2 In-House R&D in Industry

1.2.1 Recognition of In-house R&D Centers

A strong S&T infrastructure has been created in the country. This covers a chain of national laboratories, specialized R&D centers, various academic institutions and training centers, which continuously provide expertise, technically trained manpower and technological support to the industry. Various policy measures have been introduced from time to time, to meet the changing industrial and technological requirements of the industry. The Government has been giving special attention to promotion and support to industrial research in industry. Several financial benefits have also been provided which encourage and make it financially attractive for industrial units to establish their own in-house R&D units.

A scheme for granting recognition to in-house R&D center of the industry is operated by the DSIR. A number of incentives and support measures are made available to in-house R&D units of industry to strengthen the technological base. Ministry of Finance issued notifications amending the basic notifications under Customs and Goods & Service Tax (GST). As per the amendments, DSIR recognized & registered in-house R&D units other than hospitals can avail customs duty exemption and concessional GST on their procurements for research. However, Government of India, Ministry of Finance (Department of Revenue) has rescinded notifications related to Goods & Service Tax (GST) *w.e.f.* 18th July 2022.

The in-house R&D center qualifying for recognition are expected to be engaged in research and development activities related to the line of business of the firm such as development of new technologies, design and engineering, process/ product/design improvements, developing new methods of analysis and testing; research for increased efficiency in use of resources such as capital equipment, materials and energy; pollution control, effluent treatment and recycling of waste products.

The R&D activities are expected to be separate from routine activities of the firm, such as production and quality control. The in-house R&D units should have staff exclusively engaged in R&D and headed by a full-time R&D manager who would have direct access to the chief executive or to the board of directors depending upon the size of the unit. The in-house R&D centers are also expected to maintain separate identifiable infrastructure and R&D accounts.

Number of in-house R&D centers recognized by DSIR increased steadily from around 100 in 1973 to around 275 by 1975, to over 700 by 1980, around 925 by 1985, over 1100 in 1990, over 1200 in 1995 and thereafter hovering between 1200 to 1250; 1361 in March 2010; 1618 in December 2011;1767 in December 2012; 1797 in December 2013; 1762 in December 2014, 1800 in December 2015; 1900 in November 2016; 1997 in November 2017; 2052 in November 2018; 2238 in December 2019;2340 in November 2020; 2809 in March 2020, 2754 in March 2021, and 2655 in March, 2024; of these nearly 2161are in the private sector and the remaining units are in public/joint sector. The last 'Directory of Recognized in-house R&D Units' till 31.03.2021 was brought out and next updated directory will be brought out in March, 2024. Directory lists recognized in-house R&D units, giving registration number, name and mailing address of the company, location of the in-house R&D unit(s) and validity of DSIR recognition.

To promote entrepreneurship in biotechnology sector, the conditional three-year existence of the company was relaxed with effect from July 2015for according short term fresh recognition to Biotech Start-ups established in the Incubation Centre or Technology Parks. DSIR refers the applications received from start-up companies in the biotechnology sector to the Department of Biotechnology (DBT), being the nodal Department for promoting biotechnology in the country for their views and comments. Based on recommendations received from DBT and keeping the guideline relaxation in view, the application is considered for recognition. The relaxation of three years of existence of the companies for other sectors has been proposed for consideration.

A detailed guidelines for the Recognition of In-house R&D centre are available on Department's website. The applications received are scrutinized for their completeness in the department and are then circulated for comments to various other departments/agencies, concerned administrative ministries such as MSME, MNRE, CSIR, ICAR, ICMR, MoEF, CCRAS, AYUSH, DBT, DST, SERB, TDB, TIFAC, DC&PC, MeitY, DoP and NRDC. The applicant industries seeking recognition are pre-screened by the departmental officers and invited for online / physical presentation and discussion in DSIR and may be visited by a team of experts and DSIR representatives. The applications along with comments from outside nodal departments/ organizations, visit reports, and the Department's own evaluation are considered by an Inter-Departmental Screening Committee constituted by the Secretary, DSIR. The Committee meeting is scheduled every month / bimonthly to consider the applications and makes recommendations for recognition & registration to the Secretary, DSIR.

During the period under report, the Screening Committee met 10 times and 232 applications received/ considered for recognition alongwith the previous deferred cases. 231applications were disposed of which 141 R&D units were granted fresh recognition based on their satisfactory R&D Infrastructure& programs. A statement giving month-wise receipt, disposal etc. of applications for recognition of in-house R&D units is given at Annexure 1.

1.2.2 Renewal of Recognition

DSIR recognition to the in-house R&D centres of the industry is granted for a period ranging from two to five years based on their R&D Infrastructure& programs. The companies having the R&D units recognized by the Department are advised to apply for renewal of recognition well in advance (three months prior to the date of expiry of the recognition). The applications are examined in DSIR by the

Research and Review Group (RRG) comprising of representatives from CSIR, NRDC, DSIR and DST constituted by the Secretary DSIR. The RRG takes into account recommendation for renewal of recognition based on satisfactory R&D performance of the R&D centres of industry based on the research indicators like the R&D expenditure, R&D assets, R&D manpower, R&D achievements (new products and processes developed, technologies commercialized, patents filed, research papers published etc.) and the ongoing and future R&D programmes. Sometimes, the RRG may seek clarification/suggestions from the industry for strengthening their R&D activities. After obtaining the necessary information from the industries, the cases which have been accorded DSIR recognition are considered for renewal of recognition.

As of 1st April 2023, in-house R&D units of 544 companies were due for renewal of recognition beyond 31.03.2023. A total of 521 applications were received till 31st March, 2024 which included 481applications pertaining to renewal beyond 31.03.2023 and 40 applications pertaining to renewal beyond 31.03.2022. During the period under report, the Research Review group (RRG) met tentimes. Based on the evaluation of the performance of the R&D units, renewal of recognition was granted to 508 company's having recognized R&D units. Total of 63 companies could not be renewed so far because of the reason that their application was not received in the department. 03 companies could not be renewed beyond 31.03.2023 because of the reason that the R&D performance was not found satisfactory by the committee. A total of 13applications are being processed currently in the department. A statement showing month-wise receipt, disposal and pendency of the cases of renewal of recognition of the R&D units is given in Annexure 2.

1.2.3 R&D Expenditure

The R&D expenditure incurred by in-house R&D units in industry has steadily increased. During 1980-81, it was of the order of Rs. 300.00 crores. In 1985-86, R&D expenditure was of the order of Rs. 500.00 crores. In 2002-03, it was of the order of Rs. 2650 Crores. In 2013-14, it was of the order of Rs. 18,000 crores per annum. In 2017-18, R&D expenditures increased to Rs. 35,000 crores and in 2020-21, it was of the order of Rs. 44030 Crores. It is estimated that the present R&D expenditure of the 2655 recognized in-house R&D units is of the order of about Rs. 51,000 crores per annum. The share of public /joint sector is about 20 per cent and that of private sector about 80 per cent. The representative list of Companies spending over Rs. 5000.0 lakhs per annum on R&D, Rs. 500.0 lakhs to Rs. 5000.0 lakhs per annum on R&D and between Rs. 200.0 lakhs to Rs. 500.0 lakhs each per annum on R&D is given in Annexure 3, 4 and 5 respectively.

1.2.4 R&D Infrastructure

The in-house R&D centers have created State of art design & simulation facilities, Prototyping, Validation & Testing facilities meeting regulatory requirements and compliance with National/ International Laboratory certifications. The laboratories of In-House R&D centers are equipped with sophisticated analytical equipment, design software's, predictive testing and advanced raw material characterization facilities for carrying out their research activities.

The major equipment include : Grinding Mill, Oven 198 KW, Pole Coil Pressing Machine, Epstein Tester Conductivity Meter, Universal Testing Machine, Digital Oscilloscope, Induction Brazing Machine, Banding Machine, Sieve Shaker, Reaction vessel with stirrer, Mixer, Ball Mill, Elisa Reader Machine, Tractor, Hydraulic Test System, HPLC (High Performance Liquid Chromatography) with UV-VIS Detector, 3D Scanner with software, Hydraulic Tester MTS, Magnetic actuator test system for Auto-reclosure, Tank Weighing System, Dosing Pump, Hardness Tester, Water Bath, Hot Plate, Sieve Shaker, pH meter, Laminar Air flows, Fluid Bed Processer, UV Visible spectrophotometer, Blown Film Machine, Multipurpose relation gauge high speed floor model centrifuge, Karl Fischer, LCMS

NMR 400 MHz Gas Chromatography Instrument, HPLC-Isocratic Pump-Manual injector, Muffle Type Electric Baking Furnace, Lyophilizer, Rotary Vacuum Evaporator with Water bath, HV Insulation tester, Laser Source, CNC Vertical Machine, Viscometer, Enterprise Level CAD System, Drilling Machine, Nitrogen Generator, Spectro-Thermal Optical Emission Spectrometer, NMR equipment, LCMS – Spectroscopy Lab equipment, vision sensor with speed evolution by quad processing, Autoclave Horizontal, Autoclave Vertical, CNC 3D Coordinate Measuring Machine, Sebumeter, Tube Filling and Sealing Machine, cylindrical head pitot tube & Manometer for water flow measurement, Lathe Machine, CNC Router Machine, Single piston pump, Digital Oscilloscope with probe, Incubator, Thermocyclers with dual block, Compound Microscope, Polarimeter, Binocular Microscope, Compound Microscope, Three-phase AC dimmer stat, Digital soldering station, Step cleaner, Ion Chromatography Automated Mineralogy System, FESEM Setup, Triple quadrupole, Oxygen Analyzer, MOR Testing Machine, Bulk Density Meter, New generation bio tribometer, XRF, AAS Flame Photometer, Electrodynamic Shaker, VMC, TIG Welding- HVAC, Chest Freezer, Particle Analyzer, Lab Turbo Dispenser, Compression Machine, Liquid Chromatography-Mass spectrometer, Liquid Nitrogen trap Advance Flow reactor, Tablet compression Machine, X-ray diffraction equipment, ICPMS, Zeta-sizer advance series, Gas chromatograph, Preparative HPLC system, Malvern particle size analyser, Cascade impactor, Fluid Bed Coater, Capsule Filling Machine, Throughput HPLC System, Stability Chamber, Modified Dissolution Apparatus, Semi Micro Balance, Moisture Analyser, Digital Automatic Potentiometric Titration Apparatus, Chemistry diaphragm pump, Media preparatory model, Water purifier, etc

1.2.5 R&D Manpower

There has been a steady increase in R&D manpower employed by the in-house R&D units. By 1975-76, about 12,000 R&D personnel were employed by the recognized in- house units and by 1981-82, the figure was over 30,000. The estimated manpower for the 2655 in-house R&D units is over 1,57,000.

1.2.6 Achievements of In-house R&D Units Agricultural Sciences:

i. Development of hybrid of Cotton, Rice, Pigeon pea, Chickpea, Pearl millet, Black gram, Spinach, Fenugreek, Cowpea, Soybean, Cluster Bean, Cauliflower.

ii. Development of new products such as Micronutrient Fertilizer for export, Crop Specific nutrient formulations, Hydroponics as a technology, Organic soil conditioner in powder as well as granule form, Multi micronutrient mixture for fisheries.

iii. Development of new products such as Sudozone, Debrista, Pheromone lures for Tomato Leaf Minor and Maize Fall army worm.

iv. Development of new products such as Protein Lacto Gluconate based crop specific bio stimulants.

v. Development of hybrids of Onion, Hot Pepper, Watermelon.

vi. Development of new products such as liquid fortified with other nutrients from biological sources, micronutrients, New version granules fortified with microbial nutrients, Agglomerated Aqua Sap Powder to avoid loss by flying away, a carrageenan based room freshener gel.

vii. Development of hybrids of Maize, Paddy, Wheat, Indian Mustard, Bottle gourd, Sponge gourd, Okra, Chili, Tomato.

viii. Development of research varieties of Paddy and hybrids and conducted multi location trials of research varieties for commercialization. Hybrids of Maize and Sunflower released for commercialization. Five hybrids of Chili, two hybrids of Tomato were released, two hybrids of Okra were released for commercialization.

ix. Development of new products by regeneration and micro propagation protocols for mass multiplication of Pomegranate, Dendroclamus Asper, Bambusa Balcooa, Succulents, Teak, Lemon, Ornamental plants. The tissue culture micro propagation done through callus mediated somatic embryos on different media combination supplemented with different plant growth hormones using explants of florescence and leaf.

x. Development of new products Beejamrat, Jeevamrat, Neem Seed Extract, Rock phosphate manure.

xi. Development of Hybrid Bhindi, Hybrid Brinjal, Hybrid Bottle gourd, Hybrid Cabbage, Early Hybrid Cauliflower, Hybrid Capsicum, Hybrid Radish.

xii. Development of hybrids of Okra, Tomato, Pepper etc.

xiii. Development of New hybrid of Castor, Pearl millet.

xiv. Development of new products such as Pineapple and Thai Guava tissue culture raised plants.

xv. Screening of inbred lines and development of Hot pepper hybrids for high temperature tolerance (35°C to 400°C)

xvi. Screening of Germplasm and lines for the development of Powdery mildew resistance hybrids in Hot pepper

xvii. To develop high capsaicin and high colour value hybrid for dry segment

xviii. Developing Rice Variety in long duration with tolerance to submergence.

xix. Development of Healthy millet and pulses based baked cookies and chips.

Biological / Biomedical Sciences/ Pharmaceuticals:

i. Development of new process for growth of Hemophilic influenza type B bacteria to increase the yield of bacterial polysaccharide for manufacturing of Hemophilic influenza type B vaccine.

ii. Development of Telbivudine, Flucytosine, Melamine, Hydroxychloroquine sulfate, Ezetimibe, Acyclovir Sodium dehydrate and new processes developed for Ziprasidone, Ritonavir, Sitagliptin Phosphate Monohydrate, Val ganciclovir Hydrochloride Amorphous, Acyclovir sodium dehydrate, Loraine sulfate.

iii. Development of Metformin Hydrochloride Prolonged Release Tablets, Atorvastatin Tablets.

iv. Development of Vildagliptin Tablets, Citalopram Tabs, Olme+Amlo+Hctz Tablets, Ticagrelor Tablets, Apixaban Tablets, Eslicarbazepine Tablets, Esomeprazole Granules.

v. Development of Fluconazole, Alpha lipoid acid, Tri-methyl sulfoxonium Iodide, N, N, N-tris-p-Toluene SulphonylDiethylene thiamine.

vi. Development of Doxylamine Succinate tablets, Sugammadex Sodium, SitagliptinHCl, Sitagliptin Phosphate, AmiodaroneHCl, Metformin PR Tablets, Albendazole Tablets, Alogliptin and Metformin XR tablets, Atorvastatin, Folic Acid, Methyl cobalamin, Pyridoxine Tablets.

vii. Development of new products such as Vicks ImmunoCold, QuilNatura Gummies, Cosome AR Tablets, Cosome MSR Tablets.

viii. Development of new products such as Anti-infective camelid antibody drug conjugates (Abide) for bacterial and yeast infections, Broad spectrum as well as narrow spectrum

Abide developed for various applications, Chemi resistive biosensor for detection of pathogens in the blood of neonatal sepsis patients.

ix. Development of new products such as Glycerin Lubricant Eye Drops, Paracetamol Injection, Gentamicin Injection, Metoclopramide HCL Injection, Tramadol Injection, Ketoprofen Injection, Risperidone Tablet, Oseltamivir Capsule.

x. Development of Vildagliptin MR Tablets, Safinamide Tablets, Posaconazole Delayed Release Tablets, Sacubitril and Valsartan Tablets, Tolperisone Hydrochloride &Diclofenac Sodium Extended Release Tablets, Comb kit of Ticagrelor Tablets and Aspirin Gastro-resistant Tablets, Imputes WS (Veterinary Product), Ticagrelor Sustained Release Tablets, Dapagliflozin+Teneligliptin Tablets, Ticagrelor dispersible Tablets, Orbifloxacin Bolus (Veterinary Product) and new processes developed for Ticagrelor Tablets, MycophenolateMofetil Oral Suspension, (Powder for reconstitution), Metformin Hydrochloride Prolonged-Release tablets, Glimepiride Tablets IP.

xi. Development of Baclofen (Muscle Relaxant), dabigatran (Antithrombic)

xii. Development of Lumefantrine, Artemether, Dihydroartemisinin, Amodiaquine Hydrochloride, Misoprostol Fumarate.

xiii. Development of new products in categories such as Liquid Parenterals, Topical Creams, Capsules.

xiv. Development of Lacosamide, Levetiracetam, Tetracaine Hydrochloride, 4-(Chloromethyl)-5-methyl-1,3-dioxol-2-one (DMDO-CI), TritylOlmesartanMedoxomil, Allyl Isopropyl Acetyl Urea, Warfarin Sodium and new processes developed for Preparation of Apronal and its intermediate, Linagliptin and its salt.

xv. Development of Baclofen Muscle Relaxant, Dabigatran (Antithrombic).

xvi. Development of Vildagliptin Tablets, Escitalopram Tablets, Apixaban Tablets, Eslicarbazepine Tablets, Esomeprazole Granules 10mg, L-prolinamide, Fluconazole, Alpha lipoic acid, Trimethy lsulfoxonium Iodide N, N, N- Tris p-Toluene Sulphonyl Diethylenetriamine, Telbivudine, Flucytosine, Hydroxychloroquine sulfate, Ezetimibe, Acyclovir Sodium dehydrate.

xvii. Development of Coagulation factors purification from Plasma – Purification of Factor VIII and factor IX from plasma using chromatographic technology.

xviii. Development of novel diagnostic method for disease detection – Extrapolating the developed bio-sensing technique for detecting other pathogens.

xix. Development and Evaluation of a Gold nanoparticle-based nucleic acid Biosensor for detection of Hepatitis C viral RNA.

xx. Development of Formulation and scale up studies of vaccine against COVID-19 infection using adenovirus vector based Nasal and Liquid Vaccine

xxi. Development of Formulation and scale up studies of vaccine against COVID-19 infection using whole inactivated vaccine.

xxii. Tissue Culture based Fowl Pox Vaccine.

xxiii. Development of ELISA kits for diagnosis of poultry diseases by employing IgY antibodies from egg yolk.

xxiv. Development of Everolimus Eluting PTA dilatation balloon catheter.

xxv. Development of generic therapeutic equivalent formulation of Theophylline

Extended Release Tablets 300 mg and 450 mg indicated for the treatment of symptoms and reversible airflow obstruction associated with chronic asthma and other chronic lung diseases, e.g., emphysema and chronic bronchitis.

xxvi. Development of Emulsion based iodine non-ionic contrast agent for diagnostic imaging.

xxvii. Development of functional bone substitute using 3D printable biocompatible polymer composite and cytotoxicity evaluation.

Chemical Sciences:

i. Development of new products such as Acid Black-48, a High end Black Acid Dye having very good colour strength and fastness properties, developed process for Imide which is an important intermediate for Disperse Blue-60.

ii. Development of new products such as Cobalt oxide from secondary cake, Zinc sulphate crystals from zinc dross.

iii. Development of new products such as Epoxies, silicones, Synthetic Elastomer solvent based, Synthetic Elastomer tapes putties.

iv. Development of new processes such as Ferule acid to vanillin by fermentation, Xylose to xylitol by fermentation.

v. Development novel surface treatment technique for the development of TiO_2 pigment having good dispersion and durability.

vi. Development of new products such as Coupling Grease SAM 2810, Hinge Grease, Wire Harness Grease for Low Temperature application, Waterless Hand wash.

vii. Field trials for Suspension Bearing Grease for ALCO locomotives of Indian Railways, Synthetic Traction Gear case oil for Indian Railways, Energy efficient Synthetic Gear oil, High performance Grease for Aluminum Overhead Electrical Conductors, Chlorine Free Water Soluble Cutting oil for Machining Hard materials, High Performance Fire Resistant Grease for Steel Mill application, High Performance Long Life Wheel Bearing Greases (1.5 Lakhs Km Run) for Auto OEM under trial, High Performance 13 Diesel Engine Oil meeting the requirements of Prescribed Standards (for Auto OEM), PT Grease for Construction Industry.

viii. Development of new products such as Bio fiber enzyme cocktail fiber enzyme, Bioethanol enzyme cocktail, palm oil enzyme cocktail for enhancing oil recovery from palm fruit (Power), Bioplastic from Microorganism, clarification of fruit juice (Spark enzyme), Pyrazinamide.

ix. Development of new products such as Gas processing adsorbents for the removal of H2S from natural gas, Copper chromite catalyst for hydrogenloysis of fatty acid esters.

x. Development of process for in house khadi/ silver glitter preparation for rotary printing, saving in chemical cost due to in-house manufacturing of Glitter &khadi.

xi. Development of Cyclohexyl Salicylate, Triacetin, PTBCHA with Marlon As-3, 2 MCH, Delph one.

xii. Development of Methyl [4-(trifluoromethoxy) phenyl carbamate 4-chlorobutanoyl chloride p-phenyleneisocyanate 1-(4,5-Methylenecedioxy)-2-nitrophenyl ethyl chloroform ate N-Methyl-M-phenyl carbonate Ortho Phthaloyl Chloride developed new Process for Polyquat, Vinyl chloroform ate 1-Chaloroethyl chloroform ate 3,4-Dichlophenyl isocyanate 4-Chlorophenyl isocyanate.

Engineering / Information Technology:

i. Development and Launch of vehicles with adoption of BSVI norms, Diesel Engine Development completed with BSVI norms.

ii. Development of new products such as FMTMS conductivity based Tap Monitoring system, Warms Acoustic Trap & valve monitoring system, Steam Tracer system, epoxy-VC Electro-pneumatic value positioner, Compact retro Remote Terminal unit.

iii. Development of Electronic Controllers Head Rest actuators for automotive seats, Active grill shutter for radiated grill, Motor for Van Stepper.

iv. Development of new products such as Traveler T1Electric Vehicle,T1N (BSIV), Traveler (T2) Electric Vehicle, Force Traveler Mono Bus BSVI -41+D, Force Traveler T2FM2.6CNG BSVI, Tax Refresh Keytar Refresh Cruiser, Force Traveler T1 BSVI 3350 wheel base, Force Traveler T1 BSVI 3700 wheel base, Force Traveler T2 BSVI 4020 wheel base, T1N (BSVI),Tax FM2.6CR BSVI, Gurkha 4x4 BSVI, Kargo King FM2.6CR BSVI, T2 Smart City Bus short wheel base electric vehicle, Small Commercial electric vehicle – Passenger carrier, Small Commercial electric vehicle – Goods carrier, Balwan 39hp tractor model, Tractor reliability improvements, A205 Trans axle with 540 RPM PTO for rotator application, Force Tool Carrier Tractor, A212 Trans Axle with Power shuttle.

v. Development of Platina 110 5 speed, Boxer 150 UG, RC 125 BS4, CT110, CT100 Tricycle, Pulsar NS 200 10 ML ABS, Pulsar 125 BS4 and new processes developed for Quale CNG BS6 Monofuel with Lime phone, Quote LPG BS6 Monofuel with Lime phone, RC 125 MY21, RC 200 MY21, RC390 MY 21, H105 INH, Pulsar N 165 and improvement in existing.

vi. Development of Mini Pump with Al Design 0.5 to 1.0HP, Mini Pump fully SS Pump Side, Bottom Suction Pump with Control Panel (Dry run features), MHS with Noryl impeller & Diffuser, i-Smart with Mobile App.

vii. Development of Choke Block, Side Underride Protection Device (SUPD) for HD Vehicle, Rear Underride Protection Device (RUPD) for HD Vehicle, Vehicle Cabin Mule, Vehicle Engine Mule, Fuel Cell Cover, Composite Railings & Bollards, Composite Road Dividers & Barricades.

viii. Development of Coil drive module for MCX contactor, Mechanical Interlock Kit for MO frame.

ix. Development of H6 180HP BSVI CNG Retro fitment, P15 FCNG -45 HP NA.

x. Development of Raider, Jupiter 125, Jupiter Grande, 3W Cargo, Stryker Refresh, Notre SSE, IQUBE, RTR 2004V, NTORQ XP, TVS Duramax.

xi. Development of SOLIS 4015, TIGER 50, SOLIS 5015, SOLIS 6024, BHARAT (TREM) Stage IV Emission Norms – 60 HP, New Multispeed – Shuttle Tech Gearbox and new processes developed Torture Track Testing SOP Created, Cyclic Test SOP created, Driver Seat Bump Test new setup Created, PTO Test SOP.

xii. Development of Improved EMI protection in Mobile Shelter EMI 80db, EMM Mast for Higher load of antenna, and Higher Height, antenna handling system, Mobile Portable Decontamination System, Mobile Portable Decontamination System.

xiii. Development of Machine suitable for Table Chuck 0-630, 0 1000 mm, Single lifting machine and plug & play type for easy installation, Live tool & turning tool servo turret for all job operations.

xiv. Development ofwireless charger, TCU-DICV, OBC800, AIS TCU 140, Harley Davidson Lamotta Switch, Smart Plug 2 W.

xv. Development of Generators for Marine Application, for Diesel Engine application in Salient pole construction, Generator for Hazardous area, Vertical hydro of higher ratings.

xvi. Development of telematics, Hydro pneumatic mount development for car engine mounts application, Automatic adhesive spraying machine for flat metallic components implemented by replacing manual spray process, Electrostatic Paint on products.

xvii. Development of Chloride Treated, high value added product with extra efficiency and longer shelf life and operational life.

xviii. Development of Aramid poly-v belts for automatic application, New coolant hoses for HCV vehicles, Both side fabric timing belts for auto application, Radiator coolant hose for tractor application.

xix. Development of Innovative Cored Wire Magnesium Treatment, Core stand Suitable for Hydraulic Castings, SMED projects on pattern and core box mounting on the respective machines, Solidification of Ductile Iron, Correlation between Chemical Composition & Mechanical Properties, SMED of Tool Changing, Developing Rib Mould, Optimization of Gating System.

xx. Development of A4 Range Extension and Smart Motors, Fire fight motors, Apex Series Motors- IE4 (up to 250Kw), Smoke extraction motors up to 200Frame.

xxi. Development of Table top Nano dentation and Scanning Probe Microscope test instrument precise positioning stage controller for Nano mechanical testing.

xxii. Development of Automatic Slack Adjuster, Air Disc Brakes, Clutch booster 102 die, Clutch Booster 102 Die Low Pedal Effort and New Processes developed such as for the first time industry, MEI introduced 'Induction Hardening' of the Automatic Slack Adjuster (ASA) housing at select locations instead of conventional heat treatment (Nit riding the entire housing).

xxiii. Development of Zero Water Pressure Intake Technology development in Washing Machine.

xxiv. Development of Bi-Polar Power supplies for Magnet applications.

xxv. Development of Automatic Bobin Winder

xxvi. Development of Auto Ball Winding machine

xxvii. Development of On grid solar inverter 3kW and 6kW with MPPT single phase.

xxviii. Development of 27000 Compact Globe control valve.

1.2.7 Imports Made by In-house R&D Units

The recognized in-house R&D units have imported a variety of equipment, raw material and reference standards for their R&D activities. These include: HPLC GC-MS, Rotavapour, Laser Scattering Particle Size Analyser, Microwave Digestion System, Dehumidifier for FTIR System, Counter pressure autoclave, EGT Tester, XRF, Brake Data Logger, Pedal force sensor, Parking Brake kit, Engine EMI Gasket Sensors for Warning System, Micro Plasma Machine, Mass Flow Controller, Belt Sander, Fuse Box & Relay Assembly Body function control module, CNC, VMC, Lathe Machine, Radial Drill M/c, Surface Grinder, Tool End Cutter, Electronic Balance, Low Temperature Synthetic Grease, Drill Pipe grease based on Copper, Rock Splitter Grease, Hammer Grease, Friction Paper, Seals, Liner, Solenoid valves, PMR Yoke and Magnet Laser Welding, Delta Switch, NTK Pneumatic suspended seat, Climate Chamber for Rust preventive properties, Deionizer,Impeller Shroud with CD Nozzles, Impeller, Flame Tube, Nozzle Guide Vane, Turbine Rotor, KCTI-120

Engine Parts Impeller Assembly, NGV Assembly, Applying Torque, Exhaust Module Assembly, Air Intake Module Assembly, Dusting gauze unit & test swatches, Bomb calorimeter, Membrane Millipore oil filter papers, Hyaluronate and Cells, peptide, culture medias, Human Ipsc, drug reference standards etc.

1.3 SCIENTIFIC AND INDUSTRIAL RESEARCH ORGANISATIONS

1.3.1 Recognition of Scientific and Industrial Research Organizations (SIROs)

The DSIR had launched a scheme of granting recognition to SIROs in 1988. The SIROs recognized by DSIR are eligible for customs duty exemption under notification no. 51/96-customs dated 23.07.1996; notification no. 24/2007-customs dated 01.03.2007; notification no. 43/2017-customs dated 30.06.2017; notification no. 42/2022-customs dated 13.07.2022;notification no. 07/2024-customs dated 29.01.2024 as applicable and all notification, as amended from time to time. The exemption under the concessional GST notifications has been rescinded through the notification no. 11/2022-integrated tax (rate) dated 13.07.2022 with effect from 18.07.2022.

The DSIR has brought out Guidelines for Recognition of SIROs, which gives procedural details and application proforma for seeking recognition under the SIRO Scheme. Functional SIROs having broad based governing council, research advisory committee, research personnel, infrastructural facilities for research, well defined, time bound research programmes and clearly stated objectives of undertaking scientific research, are considered eligible for recognition by DSIR. The investments of surplus funds not needed for immediate research should be in accordance with the Income-tax Act, 1961.

Applications for seeking recognition under the SIRO scheme are considered in DSIR by a Common Inter-departmental Screening Committee constituted for both In-house R&D Units (RDI) of Industries and Scientific and Industrial Research Organizations (SIROs) schemes with members from Council of Scientific and Industrial Research (CSIR), Indian Council of Medical Research (ICMR), Indian Council of Agricultural Research (ICAR), Indian Council of Social Sciences Research (ICSSR) and Department of Biotechnology (DBT), National Research and Development Corporation (NRDC), Department of Pharmaceuticals (DOP), Ministry of Electronics & Information Technology (MeiTY), and others. The recommendations of the Screening Committee are put up for approval of the competent authority. The recognition is effective from the date of the Screening Committee meeting. Retrospective approval is not granted.

During the period 1st January 2023 to 31st March 2024, the Screening Committee met 13 times and recommended 73 cases for recognition as SIROs. These include 32 cases in the Natural and Applied Sciences, 01 case in the area of Agricultural Sciences and 05 cases in the area of Social Sciences and 35 cases in the area of Medical Sciences. The sector-wise list of these SIROs is furnished at Annexure - 6. Out of the 73 recognized SIROs, 38 SIROs were issued registration certificates for obtaining customs duty exemptions (GST concession has been rescinded with effect from 18.07.2022).

1.3.2. Renewal of Recognition of SIROs

Recognition granted to SIROs is for duration ranging from one to three years. The SIROs are advised to apply for renewal of recognition well in advance (3 months prior to the date of expiry of recognition). Such applications received for renewal of recognition are examined by Research Review Group (RRG) by involving representatives from DST, ICAR, ICMR, CSIR, ICSSR, NRDC and UGC depending on the area of research. Based on the evaluation made by the RRG, renewal of recognition is granted to SIROs. During the period January 2023 to March 2024, RRG met 06 times and recommended 271 SIROs for renewal of recognition out of which, 203 cases were recommended for period beyond 31.03.2023 and 68 beyond 31.03.2024. Out of the

271 recognized SIROs, 160 SIROs were issued registration certificates for obtaining customs duty exemptions and concessional GST(GST concession has been rescinded with effect from 18.07.2022).

As present, there are 891 SIROs duly recognized by DSIR; of these,429 are in the area of natural and applied sciences, 354 are in the area of medical sciences, 41 are in the area of agricultural sciences and 67 are in the area of social sciences.

The SIROs have employed qualified scientists and researchers and have also established good infrastructural facilities for research. They have developed new processes, procedures, techniques and technologies and also filed several patents. They have also organized seminars/ symposiums/ workshops and published research papers / reports / books.

1.3.3 Online Application submission of Fresh SIRO recognition and Renewal of recognition of existing SIROs.

The application for Fresh SIRO recognition and Renewal of recognition of existing SIROs are invited online through DSIR website. The applicant is taken to the Service Plus Portal developed by National Informatics Center (NIC), Government of India, which is a unified service delivery platform to provide services to the client citizen by the Central and State Governments. Service-Plus is a meta-data based e-Service delivery framework which is built on Low Code–No Code (LCNC) architecture for delivering electronic-services to citizens. After submission, the applicant can track their application status online at all times. This provides complete transparency to the client citizen, for the action being taken on their application till the delivery of service.

1.4 FISCAL INCENTIVES FOR SCIENTIFIC RESEARCH

Government has evolved, from time to time, fiscal incentives and support measures to encourage R&D in industry and increased utilization of locally available R&D options for industrial development. New incentives to encourage investments in R&D by industry are announced in the Union Budget. Fiscal incentives and support measures presently available include:

I. Weighted tax deduction u/s 35(2AA) of IT Act 1961 for sponsored research programs in approved national laboratories, universities and IITs;

II. Weighted tax deduction u/s 35(2AB) of IT Act, 1961 on In-house R&D expenditure for any company engaged in the business of biotechnology or in any business of manufacture or production of any article or thing not being an article or thing specified in the list of the eleventh schedule of IT Act, having R&D facility approved by Secretary, DSIR.

III. Customs Duty exemption on capital equipment, spares, accessories and consumables imported for R&D by approved institutions/SIROs;

IV. Customs Duty exemption on specified goods (comprising of analytical and specialty equipment) for use in pharmaceutical and biotechnology sector;

V. Accelerated depreciation allowance on plant and machinery set-up based on indigenous technology;

VI. Customs Duty exemption on imports for R&D projects supported by Government.

Information on some of these fiscal incentives implemented by DSIR is given in the following paragraph.

1.4.1 Accelerated Depreciation Allowance on Plant and Machinery Setup Based on Indigenous Technology

Secretary, DSIR is the Prescribed Authority to certify expenditures for accelerated/ higher rate of depreciation for the plant and machinery installed for the manufacturing of products using indigenous know-how as per provisions of rule

5(2) of IT Rules. Guidelines have been issued for availing the benefits under Rule 5(2) of IT Rules. All such applications received are examined in the department, and discussions and visits by experts to verify the claim are made to the plants by expert teams. Based on a detailed examination, certificates are issued for claiming accelerated depreciation on eligible expenditure of Plant and Machinery.

The Department certified an amount of Rs. 89,106.32 Lakhs for the financial year 2020-21 towards the cost of Plant and Machinery installed for manufacture of light olefins for INDMAX unit at Bongaigaon, Dhaligaon, Assam for claiming accelerated depreciation under Rule 5(2) of the Income Tax Rules by M/s Indian Oil Corporation Ltd.

1.4.2 Reference on expenditure on scientific research under Section 35 (3) of Income Tax Act, 1961.

Section 35(3) of Income-tax Act, 1961 provides that if a question arises as to whether and, if so, to what extent any activity constitutes or constituted or any asset is or was being used for scientific research, the Central Board of Direct Taxes (CBDT) would refer the question to the Prescribed Authority. Chief Commissioner Income-tax in concurrence with Secretary, DSIR who is the Prescribed Authority for taking decision on such cases.

A reference u/s 35 (3) of IT Act 1961 in the case of M/s Kansara Bearings Ltd, Jodhpur for AY (1997-98) was received from the office of Principal Chief Commissioner of Income Tax (Exemptions) New Delhi for opinion/concurrence of DSIR on "Whether a Testing equipment i.e. Spectrometer is being utilized for Research and Development Activities by the Assesse Company during AY (1997-98). The Department sent concurrence for the decision of the Jurisdictional IT Authority on the case.

1.4.3 Approval of In-house R&D Centres and Reporting of R&D Expenditures to CCIT(E) under Section 35(2AB) of I.T. Act 1961

In order to encourage R&D initiatives of industry, the finance bill 1997 introduced a sub section (2AB) in section 35 of the IT Act, 1961. The provision introduced initially was for select sectors of industry i.e. drugs, pharmaceuticals, electronic equipment, computers, telecommunication equipment, chemicals and provided weighted deduction of 125 per cent on expenditure on in-house research and development facility as approved by the prescribed authority i.e. Secretary, DSIR. From the year 2009 onwards, the benefits of weighted deduction on R&D Expenditures have been extended to all sectors of industry with a select list of non-priority items. The rate of weighted tax deduction was raised from 125 per cent to 150 per cent subsequent to the year ending March, 2000. The rate of weighted tax deduction was further enhanced to 200% from 1st April 2010. Initially the provision was introduced up to 31st March, 2000. The provision was extended from time to time initially till 31st March, 2005 and then up to 31st March, 2007, further up to 31st March 2012. In the Union Budget 2012, the provision was extended up to 31st March 2017. In the Union Budget 2016, the provision has been further extended up to 31st March 2020. The rate of weighted tax deduction was lowered from 200% to 150% from 1st April 2017 to 31.03.2020. Further the rate of weighted tax deduction has been lowered from 150 % to 100% with effect from 1st April 2020.

During the period from January 2023 to March 2024, the Department accorded fresh approvals in Form 3CM to 27 companies and extension of approvals in Form 3CM to 191 companies under Section 35(2AB) of Income Tax Act, 1961. Department reported R&D expenditure of Rs. 17,666.41 Crores for 110 approved companies to Chief Commissioner of Income Tax (Exemption) in Form 3CL, as required under the IT Act.

1.4.4 Customs Duty Exemption to Recognized & Registered SIROs

All SIROs recognized and registered by DSIR (other than hospitals) are eligible for customs duty exemption on import of equipment/instruments and their spares and consumables; under notification No. 51/96-Customs dated 23.07.1996,

No. 24/2007-Customs dated 01.03.2007 & No. 43/2017-Customs dated 30.06.2017, notification no. 42/2022-customs dated 13.07.2022, notification no. 07/2024-customs dated 29.01.2024as amended from time to time. The department was issuing essentiality certificates to SIROs for obtaining customs duty exemption. As per notification No. 24/2007-Customs dated 01.03.2007, the Director or Head of the Institute/organization is empowered to sign the essentiality certificate.

1.4.5 Other Benefits Availed by the Recognized R&D Units

The Department provides assistance to recognized in-house R&D units in a number of ways, such as cases of industrial R&D units requiring allotment of special controlled materials for R&D, permission to export of specialized products reserved for small scale industries by medium scale industries for test marketing in other countries and disposal of imported R&D equipment/instruments and pilot plant produce are examined for making suitable recommendations to concerned agencies.

1.5 Registration of Public Funded Research Institutions

Public funded research institutions, universities, IITs, IISc., Bangalore, Regional Engineering Colleges (other than a hospital) are eligible for availing concessional customs duty exemption on import of equipment, spares, accessories and consumables for research purposes through registration with DSIR. Custom Duty Exemption is available in term of Notification. No. 51/96-Customs dt. 23.07.1996, amended by Notification 43/2017 dated. 30.06.2017 further amended by Notification No. 42/2022-Customs dated 13.07.2022 & No. 07/2024- Customs Dated 29.01.2024 as amended from time to time.

Coinciding with the presentation of Union Budget for the year 2004, Ministry of Finance amended the notification No. 51/96-customs vide notification No. 28/2003-Customs dt. 01.03.2003. As per the amendment, departments & laboratories of central government and state governments (other than a hospital) are not required to register with DSIR for availing the concessional customs duty exemption. They can clear the consignments by producing a certificate from the Head of the institution certifying that the said goods are required only for research purpose. Another significant change in the Notification was that Regional Cancer Centers have been included in the list of institutions eligible for DSIR registration for importing goods for research purposes at a concessional rate of customs duty.

The Union Government of India enacted 'The Constitution (101st Amendment) Act, 2016 w.e.f. 16th September 2016, as introduction of Goods and Services Tax to concurrently empower the Centre and States to levy and collect Goods and Services Tax (GST). Central Government vide Notification No. 03/2017-Central Tax, dt. 19-06-2017 has notified Central Goods and Services Tax Rules, 2017 w.e.f 22nd June 2017. The introduction of Central Goods and Services Tax Act, 2017 (No. 12 of 2017) on 1st July, 2017 was a very significant step in the field of Indirect Tax Reforms in India. After introduction of CGST Act, 2017 (No.12 of 2017) from 1st July, 2017, import of goods was treated as inter-state supplies and was subject to integrated tax (IGST) in addition to the applicable customs duties. Updates can be viewed at http://www.cbec.gov.in/htdocs-cbec/gst/index.

Central Government vide Notification 47/2017-Integrated Tax (Rate) dt. 14.11.2017 and Notification No. 45/2017- Central Tax (Rate) dt. 14.11.2017, Notification No. 45/2017- Union Territory Tax (Rate) dt. 14.11.2017, as amended from time to time granted concessional GST benefits to Public funded research institutions, universities, IITs, IISc., Bangalore; Regional Engineering Colleges (other than a hospital). During the year 2022-23, Central Govt. vide Notification No.42/2022-Customs dated 13.07.2022 had issued amendments in main Notification No. 51/96 -Customs dated 23rd July 1996, so as to withdraw the exemption of the Integrated Goods and Service

Tax (IGST). Central Govt. vide Notification No.11/2022-Central Tax (Rate) Dated 13.07.2022 rescinded the Notification No. 45/2017- Central Tax (Rate) Dt. 14.11.2017 & vide Notification No.11/2022- Union Territory Tax (Rate) dated 13.07.2022 rescinded the Notification No. 45/2017- Union Territory (Rate) Dt. 14.11.2017 and vide Notification No.11/2022- Integrtaed Tax (Rate) Dated 13.07.2022 rescinded the Notification No. 47/2017- Integrated Tax (Rate) Dt.14.11.2017.

Details about the scheme and application process for registration / renewal of registration of Public Funded Research Institutions (PFRIs) are available on DSIR website (www.dsir.gov.in). Application for registration are submitted online at the Service Plus Portal at the given link - https://serviceonline.gov.in/dbt. The registered institutions are advised to apply for renewal of registration well in advance before the date of expiry of their registration. The applications complete in all respects as per the prescribed proforma and guidelines are considered by an Inter-Departmental Screening Committee constituted by the Department for considering the requests of various institutions / universities for fresh registrations.

The Screening Committee met twice during the period under report and considered 34 applications received from various public funded research institutions. 15 fresh registration certificates were issued to such public funded research institutions for availing Customs Duty exemption on import of scientific equipment, spares, accessories and consumables for scientific research. There are about 591 PFRIs registered with DSIR as on 31.03.2024. The registration to public funded research and other institutions is granted for a maximum period of five years.

During the period under report 104 institutions were due for renewal of registration as on 31-08-2023. DSIR received 74 renewal applications. These were processed on individual files and approval of Competent Authority was obtained and 61 renewal certificates were issued.

1.6 Outreach Activities

1.6.1 Rashtriya Boudhik Sampada Mahotsav" (RBSM)/" National Intellectual Property Festival

As a part of the celebrations of Aazadi Ka Amrit Mahotsav (AKAM), DSIR along with Department for Promotion of Industry and Internal Trade (DPIIT) launched the "Rashtriya Boudhik Sampada Mahotsav" (RBSM)/" National Intellectual Property Festival" during the month of July 2023. The objective of the campaign was to spread awareness about generation and protection of Intellectual Property Rights (IPR) such as patents, copyrights, trademarks, geographical indications, designs, semi-conductor layout designs and plant varieties across the country. The partners on the RBSM include the Council of Scientific & Industrial Research (CSIR), Office of Controller General of Patents, Designs & Trade Marks (CGPDTM), Protection of Plant Varieties and Farmers' Rights Authority (PPVFRA), National Research Development Corporation (NRDC).

The inaugural function of the RBSM was held on 30.06.2023 at New Delhi under the chairmanship of Dr. Jitendra Singh, Hon'ble Minister of State (Independent Charge) of Science & Technology. Nationwide programmes were organised targeting stakeholders who include institutes, industry, MSME, artisans, academia, researchers and students, besides the common public. NRDC under the aegis of DSIR conducted five workshops Pan-India on "Intellectual property Rights" in the month of July 2023. A total of 189 events were organized by CSIR, the autonomous body of DSIR under the campaign. Interactions were held with the participating stakeholders during the campaign. Various valuable suggestions/inputs were received such as regarding current state of IPR generation and protection ecosystem in the country, need to enhance filings especially from Government Labs and industrial in-house R&D units, need to reduce period of IPR registrations and its cost, strengthening / developing of specialized Government institutions like NRDC for facilitation of IPR related services, and launching

of ease of IPR registrations and protection in the country among others. The following reports were released:

i. Report of "Rashtriya Boudhik Sampada Mahotsav"/ "National IP Festival"

ii. Report on DSIR-NRDC workshops conducted on Intellectual Property Rights –summary & key take-aways

iii. Compendium of Intellectual Property Rights (IPR) of industries approved by DSIR

1.6.2 Chintan Shivir / Stakeholders Brainstorming on Fiscal Incentives (FI) programme of DSIR

Three Chintan Shivirs / Stakeholders Brainstorming meeting on Fiscal Incentives (FI) programme of DSIR were organized with stakeholders from Pharma Sector on 3rd May 2023, Agriculture/ Agro Chemicals/ Biotech was organized on 21st August 2023 and Engineering & Automotive Sector on 17.11.2023. The interaction outlined ways to develop enabling mechanisms and modalities for greater private sector participation in R&D through industry-centric motivational measures/incentives in sectors. Participants highlighted the need for incentivizing private sector R&D space and devising new methods to encourage it so that more industries with the passion for scientific research are attracted towards it. The participants included industry associations, industries and representatives of concerned ministries/departments. The stakeholders during the chintan shivirs opined that the weighted tax deduction may be restored.

CHAPTER 2: PROMOTING INNOVATIONS IN INDIVIDUALS START-UPs AND MSMEs (PRISM)

PROMOTING INNOVATIONS IN INDIVIDUALS START-UPS AND MSMEs (PRISM)

1.0 PREAMBLE

Department of Scientific and Industrial Research (DSIR) has launched a new programme viz. Promoting Innovations in Individuals, Start-ups and MSMEs (PRISM) during 12th Five Year Plan. The Scheme has now been extended till 30.03.2026. The programme aims to support individual innovators having original ideas to convert them into working models, prototype etc. It also aims at supporting autonomous institutions or organizations or registered society for developing state-of-art new technology solutions aimed at helping MSME units in industrial clusters. PRISM Scheme is now a component scheme of Industrial Research and Development (IRD) Scheme of DSIR. The Department has supported 28 (twenty eight) new innovative projects of individual innovators during the period 01.01.2023 to 31.03.2024. The department also rendered financial support to 30 (thirty) ongoing projects during the period under report. The details of the new projects and ongoing projects supported under PRISM are given in Annexure-9. The department has successfully completed 25 (twenty five) PRISM projects supported during the period under report i.e. from 01.01.2023-31.03.2024 and the details are given in Annexure-10.

2.0 HIGHLIGHTS OF THE COMPLETED PRISM PROJECTS

2.1 Ergonomically Designed Working model of Fruit Plucking Device

The innovation developed by Dr. Sanjay Mohan has been supported under PRISM Scheme of DSIR. The proposal was scouted and mentored by TOCIC, CSIR-CSIO, Chandigarh and DSIR. The product developed included various such as it reduce the number of workers involved in apple plucking, the developed system is very economic and minimal maintenance, male as well as females, both can carry out plucking with ease; no power source required to operate the system as it is operated manually. The person need not hold any bucket or some container for gathering apples as compared to the conventional system of plucking. Presently, there is no such equipment which addresses the drawbacks existing in the conventional plucking systems such as excessive labour, musculoskeletal disorders, accidents due to imbalance of stairs, plucking with both hands while standing on ladder, bruising of apples, etc. There is no use of ladder and thus there is no risk of any injury.

Fig 1: Final Prototype of fruit plucking device

2.2 Affordable Prosthetic Hand for Transradial Amputees with Adaptive Grasp and Pinch Capabilities

The innovation developed by Sh. Nishant Agarwal, Uttar Pradesh, has been supported under PRISM Scheme of DSIR. The proposal was scouted and mentored by TOCIC, IIT, Kanpur and DSIR. The innovator has made remarkable strides in creating an affordable, technologically advanced prosthetic hand with a focus on user satisfaction and functionality. The project distinguishes itself with unique features such as aesthetics, EMG sensors, customizable grip patterns, and IoT capabilities. The innovator successfully filed a patent for the prosthetic hand, underlining the project's innovative nature. The comprehensive review of existing prosthetic hands guided the development, incorporating

compliant joints, adaptive grasp mechanisms, water resistance, and advanced manufacturing techniques like 3D scanning and printing with FDA-approved biocompatible materials. The proposed upper limb prosthetic hand, weighing under 450 grams, integrates user-defined grip patterns, non-invasive myo-sensors, and advanced EMG sensors for precise control. The achievement of a Technology Readiness Level (TRL) of 7 for the EMG sensor demonstrates the project's advanced stage.

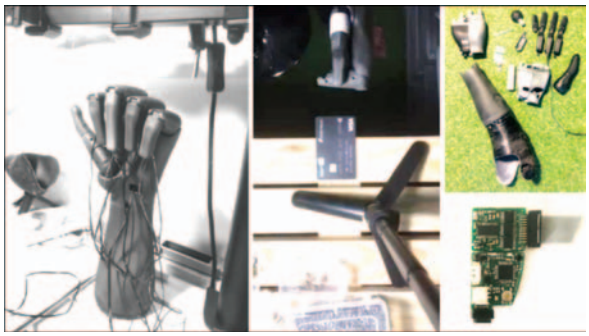


Fig 2: Affordable, technologically advanced prosthetic hand

2.3 Enhanced potato yield and nutritional value using Tuberonic Acid based novel approach

The PRISM project "Enhanced potato yield and nutritional value using Tuberonic Acid based novel approach" was executed by the innovator Dr. Rajesh Patkar, Mumbai, through the TOCIC at GSBTM, Gandhinagar. Tuber initiation in potato plants is associated with a dramatic up regulation of TuberonicAcid (TA) - the plant hormone derivative produced naturally and endogenously by plants by conversion of JasmonicAcid (JA) into 12-hydroxyjasmonic acid. Unfortunately, TA is commercially very expensive and not always available. Moreover, it is very tedious and expensive to chemically synthesize in a large quantity. Therefore, using a biotechnological approach, he has developed a plant-based surrogate system to produce TA (biostimulant) in an organic manner. The surrogate system, expressing a novel gene, produced TA in an organic cocktail that was used as a spray product to test its efficacy under the field conditions. Importantly, this TA-containing spray product proved to be effective in enhancing not just the yield but also the nutritional value (increased protein content) of the potato tubers by up to two folds, when compared with the control set. Further analyses show that the TA-containing spray product would be cost-effective and environmentally friendly and has a sufficient shelf life. With these encouraging results at the field level, he has recently incorporated a start-up named M/s Phymone Biotech Pvt Ltd. The innovator has demonstrated the technology/spray product at the Pre- Vibrant Gujarat Summit-2023 was also well received by the various stakeholders.

Fig 3: Enhanced potato yield and nutritional value using Tuberonic Acid based novel approach

2.4 AMBU (Aqua Management Binary Unit)

The innovation developed by Mr. Virendra Singh Choudhary, Jaipur has been supported under PRISM Scheme of DSIR. The proposal was scouted and mentored by TOCIC, CTAE, Udaipur and DSIR. The innovation aimed at designing AMBU (Aqua Management Binary Unit) which is a Smart Static Water Meter based on the ultrasonic principle utilizing transit time method. The work involved designing a Static water meter, PCB assembly, development of pipe design and sensor placement in pipe such that with different flow rates, water currents did not produce air bubbles in pipe. The prototype was demonstrated through working of test bench with different settings off low rates establishing proof of concept of ultrasonic water meter, DN15 size and accuracy of device with respect to ISO standards. The innovator achieved on overall accuracy as per Class-B of ISO: 779 Standard and submitted that the product was designed to possibly

continue to work on primary lithium battery for 10 years.

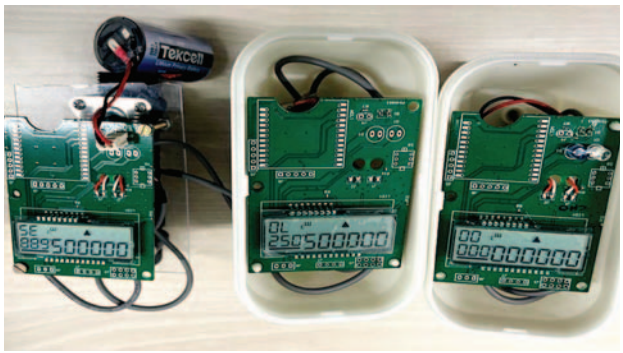


Fig 4: Final developed prototype of Static Water Meter - Aqua Management Binary Unit

The project activities have been successfully completed with the primary objective of design and development of a low cost indigenously designed, highly accurate, long life (with no moving parts to avoid wear and tear) static water meter that will be deployed in domestic potable water metering projects and will enhance the water grid infrastructure in India. Other key features included Automatic meter reading (AMR) with data encryption, daily and monthly consumption logs, tamper / alerts notifications etc.

2.5 Infusion Flow Monitoring Device

The innovation developed by Mr. Kumar Kalika, Jharkhand has been supported under PRISM Scheme of DSIR. The proposal was scouted and mentored by TOCIC, IIT Kanpur and DSIR. The innovation aimed at designing are usable non-invasive Infusion flow monitoring device, which will accurately calculate and display flow rate of the Intravenous (IV) Fluids. The work involved designing a controlling device to precisely set the flow rate, build back blood flow protection, display the flow rate in the OLED display, an in-built battery and alarm system to alert a healthcare worker and monitor multiple devices centrally with IOT based central dashboard. The system is designed to raise an alarm if the flow rate is adverse or, when the bottle will be empty, or when it will detect air bubble.

Fig. 5: Final developed prototype of Infusion Flow Monitoring Device

The device implemented features such as an IR sensor with higher sensitivity and daylight blocking enabling it to accurately monitor the true flow rate by detecting drips. Additionally, the device featured a simple interface with a single push button,a calling button or switch for patients to contact nurses, easily set or input the desired flow rate, and displayed the remaining time required to finish the current bottle. The project activities have been successfully completed with the primary objective of design and implementation of a reusable non-invasive Infusion flow monitoring device achieved.

2.6. Casil-O-Scope- The affordable & portable eye examining device

The innovation developed by Shri Mohan. V, Chennai has been supported under PRISM Scheme of DSIR. The proposal was scouted and mentored by TOCIC, University of Madras, Chennai and DSIR. The innovation aimed at designing a Casiloscope, an affordable, user friendly anterior eye examining head-mounted portable device with custom optics for diagnosis. The work involved development of the device having binocular microscope with different magnification lens for imaging, a semi-circle body giving an even rotational axis, an illumination system supported by a lithium-ion battery which could be recharged by a USB type-C slot. The prototype was demonstrated by the innovator with device operation including optical mechanism, filter mechanism, image capturing

techniques, and placement of product from doctor's view point. The possible future scope of prototype included a smart phone as an accessory to record and share clinical data, use of additional accessories, converting existing device for dual use (i.e with and without headband). During use, the device is held in position by the binoculars, the projection unit provided illumination into the patient's eye which is viewed by the user through binoculars. The device implemented features such that smartphone could be attached with binocular through the adapter to capture & store images. Additionally, two li-ion batteries provided with adapter and USB charging cable for faster recharge. The prototype validation study was conducted on small scale in lab to achieve the product specifications as well as validate the ability to screen and diagnose disorders of anterior human eye.

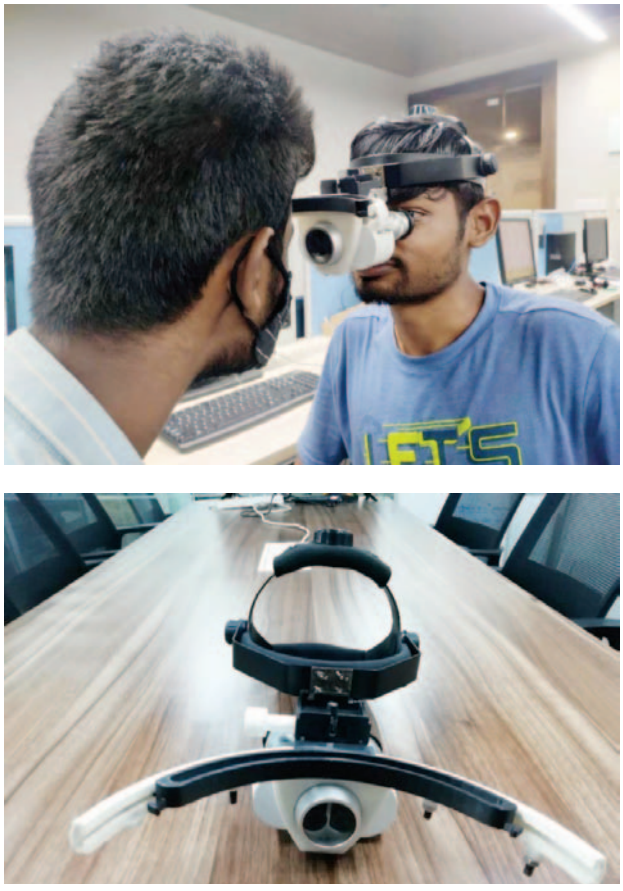


Fig. 6: Final developed prototype of Casil-O-Scope- affordable & portable eye examining device

The innovator plans to commercialize this device which shall belong to Class-A low-risk category Medical Device to prevent needless blindness across the globe. The project activities have been successfully completed with the primary objective of fabrication of Casil-O-Scope, a portable eye examining device design and implementation of preliminary validation stage achieved.

2.7. Building Zinc Gel Battery for e-Rickshaw (electric three wheelers)

The innovation developed by Mr. TejasKusurkar, Kanpur UP has been supported under PRISM Scheme of DSIR. The proposal was scouted and mentored by TOCIC, IIT Kanpur and DSIR. The innovation aimed at designing a 2 KWh zinc gel battery prototype which can run electric three-wheeler (E3W) with specifications as per industry standards using existing lithium-ion battery manufacturing setup. The work involved development of 2KWh battery prototype and testing for various physical performance parameters in terms of energy efficiency, humidity tests, charging speed, load carrying capacity, flammability, safety, charging procedures and discharge performance etc. The prototype was demonstrated with the batteries deployed in electric three-wheeler (E3W) passenger vehicle and pilot runs conducted as last mile mobility vehicle within the IIT Kanpur-Noida extension centre campus.

Fig. 7(a) Zinc Gel Battery

Fig. 7 (b)series of battery

Fig. 7(c)prototype of Zinc Gel Battery deployed in E3W passenger vehicle

The device deployed in E3W passenger last-mile mobility vehicle in a 48V, 100 Ah Battery pack implemented a range of 100 to 110 Km, with peak power of 3.5 KW and a charging time of 90-120 minutes. The battery prototype was tested by an external agency as well as In-house testing and performance fine tuning done to achieve the product design that can fit inside any E3W from existing manufacturers, thus opening a huge market potential for Zinc gel battery bank. The project activities have been successfully completed with the primary objective of design and implementation of zinc gel battery prototype which can run electric three-wheeler with target specifications stage achieved.

2.8 Power Appliance for Toilet cleaning

The Swachh Bharat Mission is one of the great missions of Government of India. One of the PRISM innovator has developed a mechanical Power appliance for cleaning of Toilet & bath rooms to contribute for the Swachh Bharat Mission. The Doom type brush of the machine is designed in such a way that it suits for both Indian & western style commodes. It comes with a special type holder hence people need not touch the toilet brush providing better hygiene and health. Also the device is rechargeable one and consumes very nominal power input, hence it is economical. An extension handle is provided to suit the height difference comforting elders, ladies and all members of the family. This Power-Assisted Toilet Cleaner device have numerous advantages including i) simplifying toilet maintenance and reducing physical strain ii) Eliminating close contact with harmful cleaning agents, hence avoiding allergies related to chemicals and subsequent medication iii) Eliminating the need to endure unpleasant odors and unhygienic environments iv) Adding dignity to job by easily accessible simple technology. The device is a useful home appliance & soon will replace the toilet brush in every house. Millions of people will be benefited by this development. The innovator has obtained an Indian patent for this innovation.

Fig 8(a)

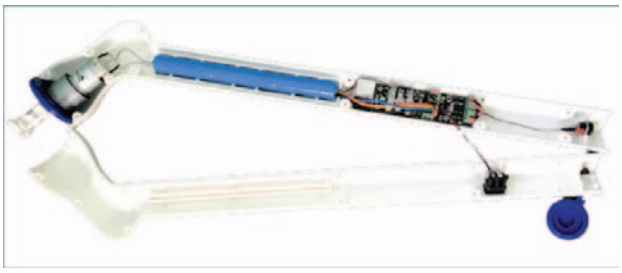


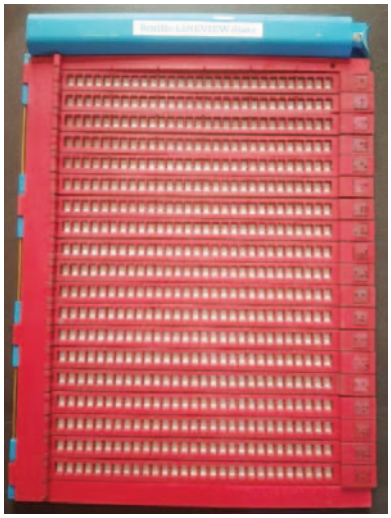
Fig 8(b): Power Appliance for Toilet cleaning

2.9 Braille Slate for Maths Learning"

The innovation developed by Mr. Anupal Kumar Garg, IIT Kanpur has been supported under PRISM Scheme of DSIR. Current Braille Slates present significant challenges for addressing mathematical needs. The requirement to write Braille in a mirror-image form, known as "Indirect writing," results in a cumbersome and unpleasant writing experience. Additionally, the absence of back-referring and back-editing capabilities during the writing process hinders the effective execution of mathematical tasks.

In the realm of mathematics, both back-referring (viewing previously written content) and back-editing (making small additions or markings in prior content) are indispensable. These functionalities are crucial for tasks ranging from basic arithmetic operations to more advanced concepts like algebraic expressions and identities.

The New Braille Slate for Maths Learning: The innovative "Braille LINEVIEW Slate" addresses these challenges by providing a slate-like experience without the need for mirror-image writing, allowing for "Direct writing." This slate facilitates easy location, reading, and writing of Braille cells anywhere on the page, enabling effective back-referring and back-editing.



The Braille LINEVIEW Slate consists of four key components:
Fig 9 (a)

1. S**late Base:** This solid back part features a matrix of rows and columns of hemispherical pins arranged in a 6-dot Braille grid. Each row corresponds to a Braille text line on the page, and the pins create embossed bump impressions when pressed against Braille paper using the "Upwrite Dot stylus."

2. **Slate Frame:** A frame-like structure hinged to the slate base, allowing insertion of Braille paper. The slate frame incorporates line guides with magnets for perfect alignment, enabling effective back-referring and back-editing.

3. **Line Guide Unit:** Comprising hinged line guides, each corresponding to a line of Braille text, with braille numbering and embossed markings for easy location on the paper. The guides can be lifted and aligned magnetically for reading and editing.

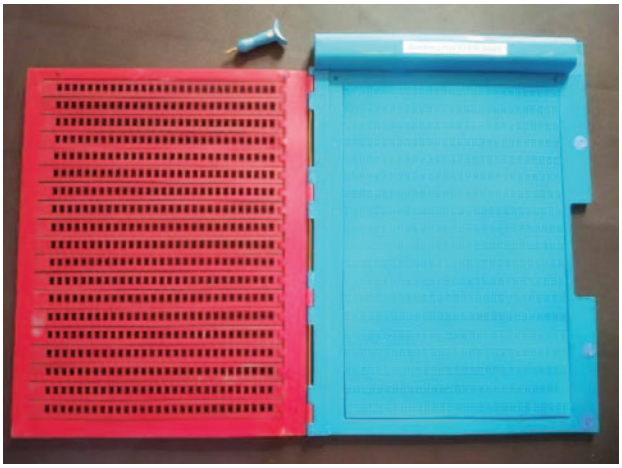


Fig 9 (b)

4. **Upwrite Dot Stylus:** An innovatively designed stylus with a hollow or concave tip for creating embossed bump impressions without tearing the paper, facilitating "Direct writing" of Braille.

This Braille Slate has been granted a patent in India (no. 334158) and published under PCT Publication no. WO 2019/138423 A1.

Benefits of the Braille LINEVIEW Slate:

The Braille LINEVIEW Slate empowers visually disabled users to easily back-reference and back-edit Braille cells anywhere on the page. It offers

a familiar slate-like experience, allowing direct writing and convenient location of Braille cells using line guides and embossed markings.

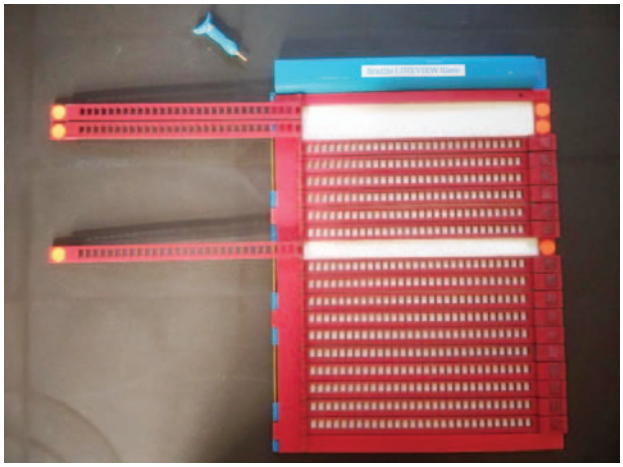


Fig 9 (c)

Mock Trial of the Prototype and Outcome:

Despite challenges during fabrication, a Mock Field Trial at Saksham Resource Centre demonstrated the Braille Slate's back-referring and back-editing capabilities. The major concern was a 30% misalignment between hemispherical pins and line guides. While this exceeded the quality criteria, feedback suggested that overcoming this issue could make the Braille LINEVIEW Slate a game-changer for visually disabled students, particularly those from economically weaker backgrounds. Addressing misalignment requires the use of a high-cost "Permanent SS Mould/Die," surpassing the project's scope.

Fig 9 (d)

2.10 Use of waste biomass for the development of edible coating

The innovation developed by Mr. Dr. Shashikant Yadav, Assistant Professor, Dr. B. R. Ambedkar National Institute of Technology Jalandhar, Punjab has been supported under PRISM Scheme of DSIR. Edible films and coatings have received increasing attention in recent years as a sustainable and biodegradable alternative to conventional food packaging materials. In this project starch based edible films and coatings were developed by incorporation of cross-linking agents and others additives which can maintain a barrier around the fruits and vegetables such as water vapor, oxygen and carbon dioxide permeability. The coating also improved appearance, structural integrity, and mechanical handling properties of fruits and vegetables.

In this project, innovator prepared and characterized edible films and coatings using finger millet starch and potato starch as starch sources, D-sorbitol and glycerol as plasticizers, and maleic acid, citric acid, and succinic acid as crosslinking agents. Gelatin and silver nanoparticles were also used as other additives to enhance the functional properties of the films and coatings. The films and coatings were prepared using a casting method and characterized for their mechanical, barrier, thermal, and biodegradable properties. The results showed that the addition of crosslinking agents, plasticizers, and additives significantly improved the mechanical and barrier properties of the films and coatings. The addition of silver nanoparticles also enhanced the mechanical properties of the films and coatings. The films and coatings prepared using finger millet starch exhibited higher tensile strength and lower water vapor permeability compared to those prepared using potato starch. Additionally, the films and coatings showed good thermal stability. The results suggest that the use of finger millet starch can lead to the development of edible films and coatings with improved mechanical and barrier properties.

2.11 Compact Societal Composter

The compact societal composter has all mechanical operations needed for preparing the composting process in one unit in compact manner. It is suitable for metro city residents, apartments societies etc. The compact composter machine has Shredder to cut down the wastes into small pieces to make them easier for composting process. Then the mixing module mixes grounded wastes with dry leaves for better compost processing. After accelerated composting process the dry compost is segregated using the vibrating mesh screen in the siever unit.

Variable speed 3 phase, 1 hp motor was used for this prototype. The variable frequency drive (VFD) is used to vary the speed and direction of rotation. Based on the requirement operator can change the speed instantly during operation. Shredder, mixer and siever were driven by the same motor through pulleys and belts system.

Foot print: 3 ft × 4ft, Cost : Less than 2 lakhs for 20 houses capacity

Working concept:

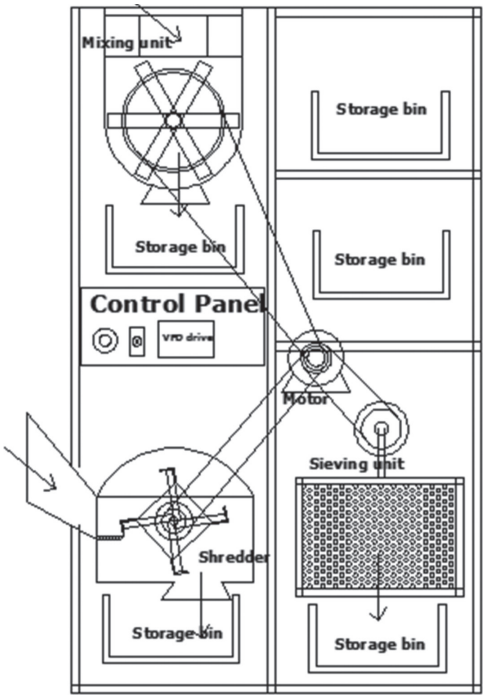


Fig 10 (a)

PRISM Prototype:

Fig 10 (b)

USEFUL COMPOST prepared at CSIR-NAL waste treatment plant:

Fig 10 (c)

Fig 10 (d)

2.12 Battery Enclosure development for power enhancement in electric vehicle

An innovative battery enclosure was developed

by Mr. Deepak Singh to increase the power of lithium-ion batteries for use in electric vehicles. Mr. Singh is a Research Scholar at the Indian Skill Development University, Jaipur. This project was carried out in collaboration with TePP outreach as cluster innovation center (TOCIC),College of Engineering and Technology (CTAE), Maharana Pratap University (MPUAT), Udaipur. This project presents an innovative thermal management solution with composite material enclosures.

Based on the study of thermal dissipation in lithium-ion batteries, the use of state change material (PCM) has been proposed for protection inside the battery enclosure by absorbing the heat emitted from the cell so that the battery pack from external shock and high temperature damage. It has been claimed that the thermal management system can be used as an ideal thermal management solution, resulting in a 16% increase in electrical power for batteries.

A disadvantage of a high-density battery is that when working in an electric vehicle, the cell emits more heat, mainly in areas of internal resistance, thermal flow failure, mechanical damage, short-circuiting, or inappropriate electrochemical reactions. The temperature of the cell becomes higher than the safe value, which causes the heat to spread into the surrounding environment and the temperature of the cell increases rapidly.The design and construction of composite EV battery enclosures have specific fire, thermal and electrical requirements for which composites are well suited. With the use of composites, an enclosure can be easily made into complex shapes and more robust with a careful layer of fiber-reinforced composite material to suit specific needs.

Even with the use of composites, the shape of an enclosure can be made to suit specific needs more easily and at a lower cost. Fiber-reinforced composites can be made and reinforced with careful layering to create complex shapes.

This approach opens up new and different enclosure shapes for designers. Engineering expertise in design to create high-tech enclosures for the battery pack.

This battery enclosure has been tested with the AIS 156 standard at the testing laboratory in Gurugram to meet the requirements, which means that the enclosure is made of a hybrid sandwich construction, in which biaxial fiberglass cloth, reinforced core and Kevlar are used. This battery enclosure can be used in two wheeler, four wheeler and solar system power storage.

Fig 11 (a) Battery enclosure

Fig 11 (b) Battery System with Charging and AC Power system

2.13. Vertical Quadripilator Lathe

The innovation developed by Mr. Dhirendra Singh has been supported under PRISM Scheme of DSIR. The 'Vertical Quadripilator Lathe' represents a groundbreaking leap in lathe technology, addressing industry challenges with remarkable achievements. In a market dominated by horizontal lathes handling one job at a time, the innovator introduced a vertical

lathe capable of multitasking, processing at least four jobs concurrently.

This innovation reduces manual labor, enhances efficiency, and fills a vital gap for small, non-metallic materials. Overcoming technical challenges in design engineering, the innovator pioneered an optimized assembly of gears and spindles for vertical job processing. The prototype showcased successful face-plate turning, hollowing, and over four spindle incorporations, marking transformative progress. Milestone-wise advancements include completing design engineering, prototype development, achieving a Minimum Viable Product (MVP), and optimizing the final product, promising increased efficiency and versatility in lathe technology.

Fig 12 Final Vertical Quadripilator Lathe

2.14 Design of a Compact Multiband Patch Antenna for Wireless Application

The innovation developed by Ms. Akansha Suthar, College of Engineering and Technology (CTAE), Maharana Pratap University (MPUAT), Udaipur has been supported under PRISM Scheme of DSIR. The proposal was scouted and mentored by TOCIC, CTAE, Udaipur. The innovation aimed at designing the compact triple-band antenna that covers the S, C and X-band applications. These bands are specified at WiMAX, WLAN and X-band applications and the operating frequencies are 3.26 GHz, 5.95 GHz and 8.83 GHz. Slots in radiating patch and partial ground is used to achieve the triple-band frequency resonance, more compactness without compromising the performance of antenna. The antenna design consist of four inverted U-shaped slots of proper dimensions inside the radiating patch and partial ground is used. It has more compact size, minimum return loss, high bandwidth and good radiation characteristics. Compared to the conventional antenna the proposed antenna obtained 52.10% miniaturization. The antenna is printed on low-cost FR4 substrate material with size of 18×21.3mm2 with high impedance bandwidth and maximum gain of 2.634 dBi. The distinguishing performance attributes of designed antenna suggest its applications in future wireless networks, cellular and satellite applications.

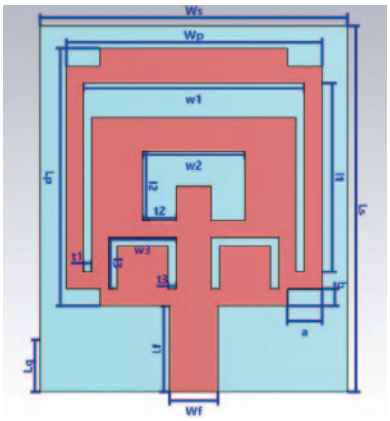


Fig 13: Design of a Compact Multiband Patch Antenna for Wireless Application

CHAPTER 3: PATENT ACQUISITION AND COLLABORATIVE RESEARCH AND TECHNOLOGY DEVELOPMENT

PATENT ACQUISITION AND COLLABORATIVE RESEARCH AND TECHNOLOGY DEVELOPMENT (PACE)

1.0 PREAMBLE

The Department of Scientific and Industrial Research (DSIR) through its "Patent Acquisition and Collaborative Research and Technology Development (PACE)" scheme provides catalytic support to industries and institutions for development and demonstration of innovative product and process technologies, traversing the journey from proof of concept or laboratory stage to pilot stage, so that they can be launched for commercialization. The scheme supports ingenious work and assists in development of new technologies or creative/ innovative application of the existing technologies to solve unmet needs of industry. The scheme also strengthens the interface between industry, R&D establishments and academic institutions by supporting collaborative proposals. The scheme also jointly supported initiatives of other Ministries / Departments aimed at technology development and demonstration, e.g. IMPRINT initiative of Ministry of Human Resource Development/ DST, wherein institutions of higher learning were supported for development and demonstration of technologies. Now in the phase during 2021-2026, the IMPRINT component is dropped. However, on-going IMPRINT projects will be supported till they are completed. Support is provided for proposals which give clear evidence of existence of proof-of-concept and aim at developing an innovative content for fulfilling an unmet need. Development and demonstration of technologies can be undertaken by industries alone (such as in-house R&D centers of the industry recognized by DSIR) or in collaboration with Universities, Public Funded Research Institutions or academic institutions. The technology development projects supported under the scheme aim at development of a new product or a process with attractive market potential which will result in significant benefits to the industry concerned in terms of raising its technological level, turnover, energy and material savings/recovery, export sales etc.

2.0 OBJECTIVES

The objectives of the scheme are:

i. To support development and demonstration of indigenous product / process technologies, either by industry or by R&D organizations/ academic institutions/ universities aimed at commercialization of new products and processes;

ii. To support collaborative research between Indian Industry and R&D organizations/ academic institutions/ universities for development and demonstration of lab scale technologies, aimed at commercialization of new products and processes;

3.0 ONGOING TECHNOLOGY DEVELOPMENT AND DEMONSTRATION PROJECTS DURING 2023-24

3.1 Development and standardization of manufacturing processes for large scale production of valuable secondary metabolites from callus-derived cells of vascular cambial explants of selected woody plant species – M/s Sami Sabinsa Group Limited (formerly Sami Labs Limited), Bangalore.

M/s Sami Sabinsa Group Limited, Bangalore has undertaken to develop and standardize the manufacturing processes for large scale production of valuable secondary metabolites from callus-derived cells of vascular cambial explants of six selected woody plant species and established a 20 litres suspension culture pilot plant facility. The company is currently manufacturing the targeted

secondary metabolites by direct extraction methods and the current project has developed a new route of continuous perfusion of in vitro cambial tissue cultivation for commercial production of secondary metabolites from cambial explants of six medicinal plants. The new technique has led to cost reduction, reduction in energy consumption /emissions and would have positive impact on environment by preventing deforestation.

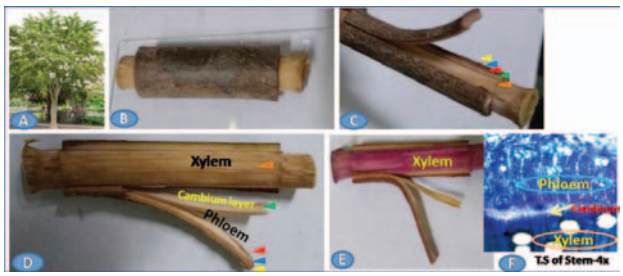


Fig. 3.1 (a) to (e) Isolation of cambium layer.

As part of the project, six woody species namely *T. arjuna, S. album, B. aristata, P. marsupium, O. indicum* & *Salacia spp* were chosen based on their commercial importance. The project demonstrated the separation of pure cambial explant for in-vitro cultivation and viable growth upto callus stage for all the explants.

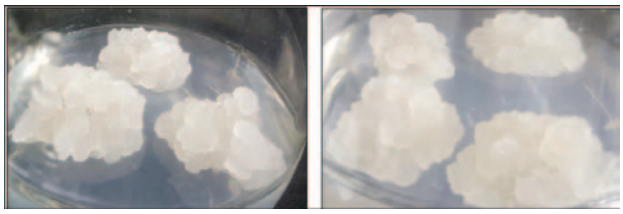


Fig 3.1 (f) Initiation of callus from cambial tissue

At completion of project, out of six woody species, team was able to proceed with four woody species (*Terminalia arjuna, Oroxylum indicum, Santalum album* and *Salacia sp*.) to the pilot scale of 20 Lit using the air lift bioreactor. *Pterocarpus marsupium* & *Berberis aristate* didn't show significant growth of calli prior to suspension culture trials. The team was able to extract secondary metabolites via solvent extraction method and performed standard analytical test to confirm the metabolite.

The yield of Arjunolic acid from *Terminalia arjuna* was found to be maximum at three weeks. Arjunolic Acid obtained from callus showed higher activity of DPPH radical scavenging activity and Reactive Oxygen Species Scavenging activity compared to those obtained from plants. Lipid Peroxidation Cell Free Assay is almost half of those derived from plant extract.

Oroxylum indicum biomass growth was found to be maximum at about three weeks of incubation and yield of oroxylin-A was found to be maximum at three weeks. Both the DPPH free radical scavenging assay and the ROS scavenging assay were found to be better than the plant extract. The anti-inflammatory property was almost comparable to the plant extract. Through pilot run, it was concluded that cost of run was very high compared to the cost/kg of the bark extract.

Santalum album biomass callus growth was enhanced by 2-3 folds by 60 days in suspension culture, which gave maximum yield of 8.0% having a maximum Alpha Santalol purity of 40% and 30% for Beta Santalol. The anti-inflammatory property was almost comparable to the plant extract. It was concluded that though yield & assay obtained appears promising, but company is not currently promoting this product as cost viability of the process developed could not be compared.

Salacia sp., callus growth was initiated after 30 days of inoculation and suspension culture had a maximum extract yield of 18%. The biological activity, especially the alpha glucosidase inhibitory activity is quite promising suggesting a good scope of this product for anti-diabetic properties. In terms of economics, it was found that process developed is viable

The project has been supported by DSIR with revised loan amount of Rs.90.00 lakh out of a total project cost of Rs. 197.80 lakh. The Project has been completed.

4.0 Recommended Projects for 2023-24

Sr No.	Name of Applicant / Company	Title of Project
1.0	M/s Devashish Polymers Private Ltd., Mumbai	Development of high performance synthetic Elastomeric compounds for use in LPG and allied industry
2.0	M/s GPS Renewables Pvt Ltd., Bangalore in collaboration with Maharashtra Association for the Cultivation of Science (MACS)- Agharkar Research Institute (ARI), Pune	Unlocking Sustainable Energy: Scaling Up and Pilot Trial of Enhanced Microbial Methane Production from Agricultural residue using anaerobic fungi

CHAPTER 4: COMMON RESEARCH AND TECHNOLOGY DEVELOPMENT HUBS (CRTDH)

Building Industrial Research & Development and Common Research Facilities (BIRD-CRF)

This scheme focuses on creation of Common Research facilities for micro and small enterprises i.e. CRTDH (Common Research and Technology Development Hubs) with an aim to enhance translational research and foster industry institution interaction targeted towards innovative product development.

1.0 Preamble

Micro, Small and Medium Enterprises (MSMEs) play a pivotal role in the overall economy by promoting equitable development in India. They need to be sensitized towards translation of public funded R&D into products and processes. Their higher involvement, especially in application-oriented R&D is expected to enhance the private sector's share in national R&D expenditure. Common Research and Technology Development Hubs (CRTDHs) aim to enhance translational research and foster industry institution interaction targeted towards innovative product development. DSIR extends grants to institutions for setting up of these hubs/centres, which include R&D facilities/infrastructure, analytical test facilities, design centres, pilot plant production facility, design engineering and prototype development, demonstration units, product display centre etc. The facilities at CRTDHs are used by the Micro, Small and Medium Enterprises (MSMEs), Innovators and startups. The CRTDHs evolve a business model for self-sustainability and operate on a cost plus non commercial basis.

1.1 Aims and Objectives

The CRTDH programme is aimed at creation of common research facilities equipped with analytical equipment and pilot plant facilities to facilitate and encourage innovators, startups and micro, small and medium enterprises for R&D and technology development. These hubs are currently engaged in activities like procurement of equipment, setting up infrastructure and essential facilities for R&D. The hubs have started identifying needs of the enterprises through seminars and workshops as well as through interaction with the MSME Development Institutes (MSME-DI), Directorate of Industries (DIC), S&T Councils and other state government bodies. Technological development involving MSMEs and host institutions in project mode has begun and several agreements have been signed with enterprises as well as state government agencies for the benefit of the MSMEs and start-ups.

1.2 Achievements

The highlights of achievements of the ongoing CRTDHs are summarized below:

1.2.1 CRTDH at CSIR - Central Electronics Engineering Research Institute (CEERI), Pilani, Jaipur

The CRTDH established at CSIR- CEERI, Pilani is dedicated to Electronics/Renewable energy sector. The centre has been instrumental to MSMEs/ Start-ups in assisting them to conduct their research and development activities including testing of innovative products and technologies in Advanced Electronic Systems, Power electronics and Renewable energy.

CSIR-CEERI is dedicated to collaborate with MSMEs across various domains, including electronics, semiconductors, power electronics and control, renewable energy, automobiles, electro-medical devices, microelectronics, manufacturers of solar photovoltaic systems, digital inverters, automotive electronics, robotics, multimedia, mobile manufacturing, hydro and thermal power, water purifiers, RO water automation companies,

textiles, manufacturers of milk analyzers, railways, strategic sector companies, foundry and forging, surgical instruments, and traditional arts and crafts.

The real-time embedded systems CRTDH played a crucial role in showcasing prototypes and facilitating their commercialization through partnerships with MSMEs and startup companies. The center developed a prototype of a mercury-free plasma (MFP) UV lamp for efficient water disinfection, and the MFP-UV lamp technology was transferred to M/s YOUWE (UV) Purifiers, Jaipur, and M/s Arkin Techno Pvt. Ltd., Pune.

Under Power Electronics and Renewable Energy, a solar grid-tied inverter testing facility has been established. It is 10th facility in India which has been granted NABL accreditation as per ISO 17025:2017. As an accredited facility, Solar grid tied inverter can be tested for efficiency, maximum power point tracking, and anti-islanding.

Fig 1: Actual grid tied inverter test setup at CSIR-CEERI Jaipur Centre

As part of the CRTDH project, an electronic assembly unit utilizing Surface Mount Technology (SMT) for medium to mass production of electronic devices was established at the Jaipur extension center of CSIR-CEERI Pilani. SMT robotic assembly technology, a modern manufacturing environment, enables the high-speed placement of electronic/mechanical components in desired locations on PCBs.

Fig 2 Surface Mount Technology (SMT) based pick and place robotic assembly unit at CRTDH Jaipur

Other facilities include product design and fabrication, an Analytical Instrumentation Laboratory, PCB designing, 3D printing, and prototyping. The hub has also developed analytical testing facilities for dairy products, water testing, general spectral characterization, and a workshop facility to support manufacturing operations.

The hub has successfully secured consultancy projects from various funding agencies, such as the spectroscopic soil health analyzer, development of honey adulteration detection system, adulteration detection system for edible oils, development and validation of fluori PCR, and development of a single-beam UV-vis spectrophotometer.

Additionally, the hub has played a key role in conducting industry-sponsored research, including technology transfer agreements with M/s REIL, Jaipur; M/s Qbiods, Gurugram; M/s. Parappadi Technologies (P) Ltd., Trivandrum; M/s Raytrig Innovation Pvt. Ltd., Jaipur.

Among its diverse activities, the center has organized workshops and awareness programs, benefiting MSMEs by providing a wide range of support through the CRTDH. Six startups were incubated and MSME regularly use the facilities at CRTDH.

The CRTDH facility is spread across 26910 square foot areas and during course of its establishment centre has developed 10 technologies, incubated

7 startups, filled one patents and trained 650 manpower. The CRTDH facility has been successfully established at Jaipur centre of CSIR-CEERI, Pilani and having attained its objectives, CRTDH project at Jaipur centre of CSIR- CEERI, Pilani is closed.

1.2.2 CRTDH at Indian Institute of Technology Roorkee, Uttarakhand

CRTDH at IIT Roorkee, Uttarakhand is the seamless integration of high speed digital communication systems and the ever increasing usage of the mobile phones demand the shielding of harmful electromagnetic radiation which has an adverse effect on the human body. The objective of the CRTDH at IIT Roorkee is to setup the state of art facilities for characterization of microwave materials with Radar Cross Section and EM wave radiation measurements for benefit of MSMEs with R&D intervention and to develop and characterize the cost effective advanced materials and techniques that can be used for shielding the microwave radiation and stealth applications like camouflage net and radar cross section reduction. The facilities created at CRTDH is state of art facilities for designing and fabrication of new materials and techniques for stealth and EM shielding applications. The equipment required for characterization and testing have been established at the CRTDH Center: i) Free Space Measurement for Transmission and reflection loss of EM wave in microwave region; ii) Radar Cross Section (RCS) measurement; iii) EM radiation level from different communication devices; iv) Thermal absorption of camouflage network and Radar Imaging; v) Vector Network Analyzer Measurement of complex-Coaxial Waveguide, Coaxial Probe Liquids & Rectangular Waveguide; vi) Camouflage Net Testing – Reflection Loss & Transmission Loss; vii) Antenna Characterization – Radiation Pattern, Gain Measurement & Return Loss and Material Characterization for their electrical properties. The facilities for material testing, Measurement of complex permittivity and permeability from 2-18 GHz (i.e. Coaxial wave guide-powder sample in pellet form, Rectangular wave guide- powder sample in pellet form and Coaxial probe-liquids); Camouflage net testing (i.e. Reflection loss and transmission loss); Antenna Characterization (i.e. Radiation pattern, Gain measurement, Return loss (5kHz-26.5 GHz)) have been created at the CRTDH Center. CRTDH center developed ten new compositions of composite using materials like: i) Zinc Oxide and Graphite 6.45 (4-10.45 GHz; ii) Silicon Oxide and Zinc Oxide 7.55 (5.45-13 GHz); iii) Iron Oxide based with Aluminium 9.35 (4.65-14 GHz); iv) Silicon Carbide based 2.85 (8.89-11.74 GHz); v) Cobalt based 4.2 (3.5-7.7 GHz); vi) Cobalt based 3.4 (2.2-6.2 GHz); viii) Co/MWCNT 8.22 (3.30–11.52) Elliptical Flake like Morphology; viii) Co/MWCNT 10.00 (3.73–13.73) Elliptical Flake like Morphology; ix) E-waste based, 5.2 (12.2-17.4) Irregular Shapes and x) E-waste based 4.6 (10.1-14.7) as Microwave Absorbing Material and Frequency Selective Surfaces (FSS) based absorber at CRTDH Center. 3 patents on the new materials developed at CRTDH center are under filing. The CRTDH hub at IIT Roorkee has successfully established a large database of advanced radar absorbing materials. During the project, Indian Institute of technology Roorkee organized various events / awareness program on the facilities available at the CRTDH for new Materials/Stealth Applications and around 300 participants attended from different institutions. About 100 startups / MSME were sensitized under CRTDH centre and the industry partners have been associated with the project like Motley Exim Co.; Raksha Supreme Camouflage Private Limited; Uptech Engineering; Kusumgar Corpora; Academic Institutes; DRDO Labs etc.

CRTDH Center at IITR

Fig 3 Development of Prototype: MAMs coated structures

1.2.3 CRTDH at Indian Institute of Technology Gandhinagar, Gujarat

The CRTDH established at Indian Institute of Technology, Gandhinagar is dedicated to new materials and chemical process sector.

The center has played a crucial role in offering

research and knowledge-based assistance to MSMEs and innovation-driven startups, demonstrating a steadfast commitment to developing newer and improved technologies. The primary focus of the CRTDH at IIT Gandhinagar is aligned with addressing and tailoring R&D requirements for various dye industries, emphasizing both waste minimization and waste treatment. The facilities established under CRTDH have positioned IIT Gandhinagar to actively collaborate with nearby dye industry clusters, meeting their technical and R&D needs for effective management of dye effluent, including testing requirements.

The center achieved success in dye production using a Microreactor, enhancing the yield of acid Yellow 23 dye.

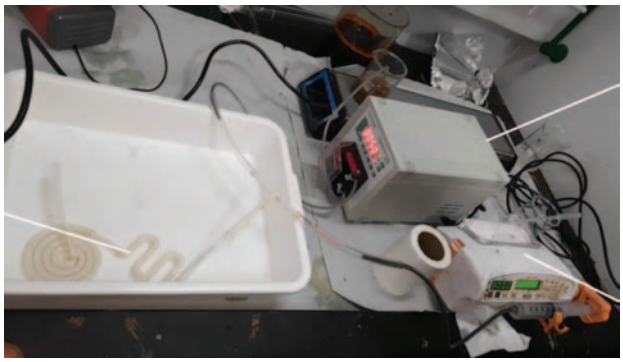


Fig 4. Set up for dye production using microreactor.

In the realm of wastewater treatment solutions, the center has devised various procedures and solutions, such as COD reduction through coagulation followed by Catalytic Fenton, sewage water treatment utilizing Aluminum hydroxide chloride (AHC) as a coagulant, and advanced chemical oxidation for COD reduction followed by bio-coagulation. Other innovations include addressing issues like Chromium (VI) reduction, washing problems in process industries with organic products, batch-to-continuous dye manufacturing, enzyme efficacy on methane formation in Municipal Solid Waste (MSW), formulation of high-performance dishwashing tablets, activated carbon production from waste treatment, solutions for CETP effluents, and hydrodynamic cavitation and chlorination. The DSIR-CRTDH Lab's Water and Wastewater testing facility has earned NABL accreditation for ISO/IEC 17025:2017.

Additionally, CRTDH at IIT Gandhinagar has contributed to diverse projects, such as the development of aerogel microparticles for prolonged pulmonary drug delivery, biopolymeric composites for improved cell adhesion and wound healing, synthesis of Para Amino Phenol (PAP), designing of a Vapor Recovery unit, recycling of Li-ion batteries through extraction, development of a novel carrier for anticancer drug delivery, and Li-ion battery anode preparation from water-based CNT dispersion.

Throughout its operations, CRTDH at IIT Gandhinagar has actively engaged with 256 dye industries and MSMEs, addressing their technical and testing requirements alongside fulfilling their R&D needs. The hub's success extends to conducting 10 workshops and interaction sessions, providing training and knowledge dissemination for MSMEs involved in dye manufacturing.

The CRTDH facility at IIT Gandhinagar is spread across 2165 square foot area. During course of its establishment, the centre has developed 3 technologies, filed three patents, sensitized 250 MSMEs and trained 100 manpower. The CRTDH facility has been successfully established at IIT Gandhinagar it remains committed to continue with research activity and develop sustainable technologies having practical applications and contribute to the growth and success of the industry. Having attained its objectives, CRTDH project at IITGandhinagar is closed.

1.2.4 CRTDH at Indian Institute of Technology Kharagpur, West Bengal

CRTDH-IIT Kharagpur is involved in the affordable healthcare sector. It has more than 4,000 square feet of designated space, a pilot plant facility specifically designed for the production of diagnostic kits, biosafety units, and additional laboratory spaces for research and development on diagnostic technologies. The hub's objectives

are to develop innovative portable devices—rural health kiosks—that can be used in rural healthcare facilities to provide fast, accurate, and reasonably priced diagnosis; to move products from the bench to the bedside; and to offer MSMEs training and consulting services to help them advance their technical knowledge and skill sets. Hence, the CRTDH facility would be used to assist startups, MSMEs, and entrepreneurs in carrying out their R&D projects.

Modern manufacturing facilities and R&D support have been made available to emerging businesses and MSMEs by the CRTDH. State of the art facilities includes -Pilot plant for manufacturing paper based diagnostic devices for blood hemoglobin and glucose level detection; Pilot manufacturing unit for COVIRAP device for the MSMEs; COVIRAP/ PINAT test kit preparation unit for manufacturing COVIRAP strip preparation and packaging; Data Science R&D unit for development of data-driven research on various frugal health applications and software development; Electronic analysis and readout device prototype fabrication unit; Lateral flow strip manufacturing unit; Bio-Safety level facilities (2 units) for testing and validation of medical devices; Rapid prototyping unit with 3D printer and laser cutter; Electronics System Design & Manufacturing facility; Mass Manufacturing Plant for POC devices. Thus, CRTDH provides a wide range of services to MSMEs, start-ups, rural business owners, and frontline healthcare delivery employees. Enterprise incubation, technology-focused training and mentoring, knowledge transfer, and assistance with lab-to-market translation are some other forms of support.

Under the CRTDH, following technologies have been developed for societal needs, some are already approved for manufacturing while some could be offered to MSMEs for technology transfer-

- **PrePAP:** A device freepaper microfluidics based kit for detection of vaginal pH which is a marker to several diseases including HPV which is one of the major reason for cervical cancer. The technology is co-developed with the industry collaborator and already have received manufacturing license from CDSCO
- **UroQR:** A device free paper based technology for measurement of urine glucose level. The clinical trial with large dataset is already done and waiting forthe required licenses.
- **Differential diagnostics of infectious diseases on a multiplexed LFA platform technology:** This is a multiplexed Lateral Flow Assay (LFA) platform technology for detection of various communicable and non-communicable diseases using gargle samples.
- **PINAT:** The RT-LAMP kit is an in vitro nucleic acid amplification kit for the qualitative detection of SARS-Cov2, Influenza A and TB directly from nasal/oral/sputum sample.
- **ChestXAI:** CXAI is an artificial intelligence-enabled ML driven scientific and technology utility app that helps to screen COVID-19 patients based on “Digital Frontal Chest X-rays” images either obtained from X-ray machine or portable X-ray setup.
- **Lipidest**: It is a CD microfluidics-based device developed for complete Lipid profile tests from whole blood.

CRTDH has engaged 17 MSMEs, organized 6workshops/conferences with MSMEs and frontline health workers to provide training and consultancy for skill development and augmenting technical knowledge

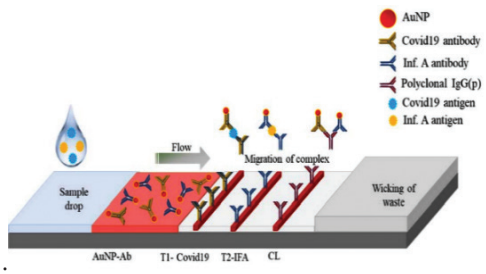


Fig 5 (a) Technologies developed (above) & Fig 5 (b) Diagnostic camp (below)

1.2.5 CRTDH at CSIR - Indian Institute of Toxicology Research (IITR), Lucknow

CRTDH in the sector Environmental Intervention and Monitoring was established at IITR, Lucknow, and is now fully operational with the goal to develop skilled people resources; to support and mentor R&D startups and MSEs; and having following objectives:

- Drinking water disinfection and water quality assessment technologies
- Technologies for treatment of industrial effluent from Pulp & Paper industries
- Build predictive models including source apportionment for air quality as well as pollution abatement.
- Develop customized training programs / workshops for specific cluster to generate trained human resource

IITR has acquired a variety of capital equipment under CRTDH in accordance with the project plan, and the procurement process is still under progress. Anaerobic workstations, 3D printing portable fine dust aerosol spectrometers (FIDAS), Cirrus sound level meters (model: CK-152B), and other significant facilities established under CRTDH are utilized by MSMEs. In order to support industry and public awareness, the institution has started primary efforts in three areas: (i) water treatment and monitoring; (ii) effluent treatment; and (iii) air pollution abatement together with skill development and training.

Achievements recorded under the CRTDH at IITR, Lucknow includes: (A)Water Treatment Sector: i) Degradation of Antibiotics from Effluent Water Sample by Fenton' Reagent and Electrocoagulation Process developed and tested at lab scale; ii) Degradation of Poly Cyclic Aromatic Hydrocarbons (PAHs)- Sono-Oxidation Fenton Method was developed to treat industrial discharge iii) Hydrogel Membrane- The developed prototype of a hydrophilic hydrogel membrane derived from biomass for the removal of heavy metal ions present in natural water resources/effluents. (B) Effluent Treatment Sector: i) Portable Chromium Monitoring and Reduction for Hexavalent Chromium Ion from Tannery Wastewater; ii) Biochar from sewage and paper mill sludge waste is tested and treatment of textile effluent at the lab scale. (C) Skill Development

and Training: i) Five workshop/ Events conducted; ii) More than 150 manpower trained through customized training programs & workshops; iii) One Day Chintan-Shivir on "CRTDH Empowering MSMEs" conducted. (D) Air Pollution Monitoring and Management: i) Conducted air Pollution Assessment for Lucknow city during Pre-monsoon, 2023, Post-monsoon, 2023; ii) Assessment of Air Pollution in Lucknow City and Water Quality Indexing of U.P. A Coherent Study, 2023 (iii)More than 09 MSMEs served through various services and technology support.

1.2.6 CRTDH at CSIR - Central Drug Research Institute (CDRI), Lucknow

The then-Union Minister of Health and Science and Technology, in the presence of the Secretary, DSIR, launched the CRTDH at CSIR-CDRI Lucknow in the domain of affordable health. This CRTDH is established for developing and operating a Pharmaceutical Formulation Development and National Clinical Trial Batch Production Facility (via Quality by Design (QbD)) to support industrially-scalable process-cum-product technology packages for different dosage forms (oral, topical and sterile products) and manufacture batches of drug products and corresponding placebos for Phase I and Phase II clinical trials under Form CT-10, CT-11 and CT-12 vide the New Drugs and Clinical Trials Rules, 2019. The hub also aims to establish and operate a Unit for GLP-compliant Pre-clinical and Clinical Bioanalysis (PK, BA, BE) and Drug Testing Laboratory (DTL) that will undertake activities pertaining to generation of chemical and pharmaceutical information on API and formulations; quality assurance, monograph and final/batch release specifications including Stability Studies; *in-vitro* pharmacokinetics and metabolism; preclinical pharmacokinetics, absorption, distribution, metabolism and excretion; and bioanalysis for clinical pharmacokinetics, including bioavailability and bioequivalence.

Micro-scale, GMP-compliant (per Schedule M) manufacturing equipment for tablets, capsules, liquid orals, topical preparations (gels, ointments, creams) and dry powder inhalations were procured to establish testing and GMP compliant pharmaceutical manufacturing facility. Although facility creation under CRTDH is ongoing, it is ready to support MSMEs for activities such as formulation, pilot scale process, product characterization, pharmacokinetics, on-site troubleshooting, consulting and training and regulatory filing support. A Form 37 License to function as a Drug Testing Laboratory for MSME under the Drug & Cosmetic Act was granted to the CRTDH at CDRI after joint inspection of the CRTDH by the Central Drugs Control Standard Organization (CDSCO) and Uttar Pradesh Food Safety and Drug Administration (UPFSDA).

Technological solutions developed by CRTDH includes – i) Tablets and syrup formulations of umifenovir (Medizest, Goa), dry powder inhalation of favipiravir (Windlas, Dehradun) for COVID-19. Ii) Dry powder inhalation for anti-tuberculosis medicines (Camus, Jaipur); iii) Tablets of CDRI's anti-platelet New Chemical Entity S007-867 (Marc, Lucknow). iv) Valorization of poultry industry waste for use as excipient in drug products (Helixion, Hyderabad). v) Technology Feasibility Assessment, Detailed Project Reports, Regulatory Filings in India and Europe– Consultancy Services etc. In a study of one of the client, CRTDH at CDRI was able to detect impurities in 'Glycerin IP' beyond limit, which saved the client to procure substandard material and also enabled CDRI to issue an advisory/publication for attention of the formulations/repackaging industry, suggesting precautions needed for procuring glycerin IP and related excipients such as propylene glycol for their products.

CRTDH at CDRI has served many MSMEs such as Aizant, Hyderabad for Pharmacokinetics in rats, Althea DRF Lifesciences for RNA therapeutics, Dasha Pharmaceuticals, Hyderabad for Formulation, Standard Analytical Protocol, Product Monograph for generic drug in international market, Dr Reddy's Labs, Hyderabad for Nose-to-brain drug delivery formulation, COVID-19 inhaled vaccine, Sumit Pharmaceuticals, Lucknow for Accelerated stability studies etc.

Awareness regarding capabilities and activities was spread through the offices of the Uttar Pradesh Drug Manufacturers Association (UPDMA) and various other workshops/seminars. A Conclave of MSMEs, academics and regulatory authorities was conducted, which was attended by 26 online and 82 in-person participants. Speakers delivered talks on a range of topics of concern to MSME in the Pharmaceuticals Sector, to enhance their knowledge and enable them build capacity and ensure regulatory compliance. A 10-minute video clip has been also prepared, describing the CRTDH. This was seen by more than 500 students and MSME visitors who visited CSIR-CDRI under various outreach programs and Open Day and at the CRTDH Conclave in Gandhinagar in November 2023.

1.2.7 CRTDH at CSIR-Central Scientific Instruments Organization Chennai Centre (CSIO), CSIR Madras Complex Taramani Chennai.

The objective of the CRTDH at CSIR-CSIO, Chennai is to provide technical support, infrastructure and sophisticated analytical as well as advanced research equipment facilities to the MSMEs for carrying out technological research with a view to translate new ideas into marketable products as well as to scale-up already developed technologies available with CSIR-CSIO for taking them to market. The Center has created the 30 kVA Solar Inverter Test Facility (Installed), Solar Photovoltaics (SPV) Test Facility (Under Progress), Electronic Design & Development Facilities (Installed), Engineering Design and Idea Incubation Centre. The laboratory can test solar PV inverters with a rating of up to 30 kVA with an integrated setup comprising of solar array simulator, grid simulator, RLC load and power meters. CRTDH had implemented an optical sensor setup and dark room setup for measuring the irradiance, dose, temporal stability and leakage of the UVGI systems at various planes and heights according to the type of the systems. CRTDH is developing in-house Standard Operating Procedures (SOPs) and test procedures. 06 SOPs of Inverters to be used for Micro-inverters and EV Inverters has been developed. These procedures are specifically tailored to meet the requirements and challenges posed by the Indian context in the fields of renewable energy and UVGI (Ultraviolet Germicidal Irradiation). CRTDH has provided services to about 40 MSEs and demonstrated the performance and reliability of their renewable energy systems and UVGI equipment. Apart from the inverter test facility, the CRTDH-CSIO, Chennai team is in the process of setting up a solar PV testing laboratory whose function is to evaluate solar panels for their performance, which could help solar project owners and operators to capitalize on the production.

Fig 6 (a): 30 kVA Solar Inverter Test Facility

Fig 6(b): Test setup with APFC panel

Fig 6 (c): UVGI Testing Setup

1.2.8 CRTDH at CSIR- Institute of Minerals & Materials Technology (IMMT), Bhubaneshwar

The CRTDH centre was established in the area of "New materials & Chemical Processes" addresses concerns of large number of MSEs working on processing of metal, alloy & materials, chemical processes that require R&D inputs/ interventions to meet the emerging market needs and for their own sustenance.

CSIR-IMMT is actively advancing innovation-driven interventions across various domains, including Mineral Processing, Industrial Waste Utilization, Coatings & Surface Engineering, Chemical Processes, Metallurgical Processes, New Materials, and Testing & Quality Assurance Services.

The CRTDH facility spans 9000 square feet and houses equipment acquired under the project. This facility serves as a showcase for developed technologies and offers space for startups. In conjunction with the CRTDH facility, a functional metal craft center showcases a functional improved brass melting furnace.The center has successfully developed 'Nutrient-Enriched Biochar for Organic-Based Fertilizer,' and licensed it to M/s Indian Plant Feeds, Cuttack. Notable technologies that have been commercialized include the Automated Chemical Dosing System by M/s. Innocule Materials and Additives Pvt. Ltd. and Wireless Temperature Sensing & Recording.

The CRTDH facility is actively supporting M/s. Pyrotech Minerals, Jhansi, in developing electrophoretic deposition (EPD) as a coating tool for coating cerrusite on an aluminum substrate. This coating enhances the casting capability of aluminum molds by serving as a mold releasing agent.

Addressing the needs of M/s. Hytronics Enterprise, Hyderabad, CRTDH developed a coating of Fluorinated Graphene Oxide (FGO) on phosphor bronze (PB) pins used in railway signaling systems. The coating exhibited excellent adhesion, corrosion resistance, and preserved electrical conductivity.

The center has successfully produced charcoal from paddy husk through crude thermal pyrolysis. M/s Sandhya Arati Private Limited, Khorda, utilized this process to develop incense sticks (Agarbatti) from paddy husk. CRTDH trained 30 Self Help Group Leaders (SHGL) from Khorda district, representing 1000 groups of 15000 women, in the manufacturing of Agarbatti using locally available rice husk.

CRTDH at CSIR-IMMT developed Silicon Carbide powder from rice husk and rice husk ash through plasma processing. M/s- LN IndTechPvt Ltd has expressed interest in technology transfer for potential oil production from volatiles and other value-added products.

The center has developed four bio-additives from natural plants (Bellyache Bush, Malabar Spinach, Reetha fruit, and Eucalyptus leaf). These additives act as environmentally friendly drag-reducing agents in iron ore slurry transportation pipelines, lowering transportation costs. M/s JSPL Raigarh has shown interest in the product and contributed to conducting pilot-scale pipe tests.

In the realm of coating development, the center has created a Transparent Siloxane coating for metal casting, particularly Dhokra art casting, preventing corrosion and preserving shine over extended periods, enhancing its marketability domestically and abroad. CRTDH at CSIR-IMMT has become a prominent hub for coating process development and is sought after by stakeholders seeking solutions to existing challenges.

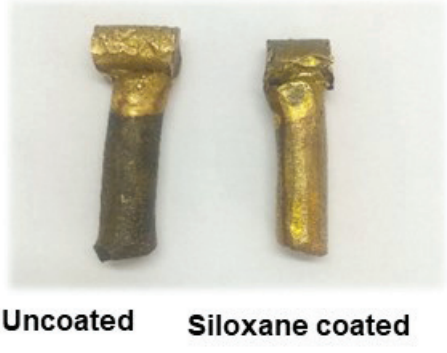


Fig 7. Siloxane coating for metal casting.

As part of training initiatives, CRTDH at CSIR-IMMT provided training on an improved brass melting furnace, biochar processing, and metal craft. Entrepreneurs were also sensitized to coatings, waste-to-wealth practices, and intellectual property (IP).

The CRTDH facility at CSIR-IMMT, Bhubaneshwar is spread across 9000 square foot areas and during course of its establishment the centre has developed 14 technologies, incubated 13 startups, filed two patents, sensitized 87 MSMEs and trained 200 manpower. The project is currently in progress and is expected to finish as per timeline.

1.2.9 CRTDH at Delhi Pharmaceutical Sciences and Research University (DPSRU), New Delhi

DSIR-DPSRU-CRTDH hub will offer a broad range of services, including the development, GMP manufacturing, analysis and extensive evaluation of advanced formulation technologies including but not limited to liposomes, solid lipid nanoparticles, lipid nanocarriers, polymeric nanoparticles, inorganic nanoparticles, multi-particulates, nano-emulsions, nanosuspensions, nanocrystals, as solid, liquid or semisolid products for oral, ocular, transdermal, intranasal, pulmonary, parenteral, rectal and targeted delivery. The focus of centre is to provide the safe and efficient translation of new therapeutic agents from bench to bedside with the goal of improving human health. Further, the application is not only on pharmaceuticals but also to assist development of advanced formulations for biopharmaceuticals, herbal drugs, ayurvedic extracts, cosmetics ingredients, and nutraceuticals as well, precisely fulfil the need of MSME culture and lead to accelerated development of innovative and advanced products in field of healthcare.

The main objectives of the CRTDH at DPSRU, New Delhi are :

i. To accelerate research and development of advance and innovative healthcare solutions through integration of nanotechnology, molecular, preclinical and clinical testing, thus making interventions more affordable, safe and effective**.**

ii. To set up core translational facilities and infrastructure for advanced product development (IPR, market research, preformulation, formulation optimization, dosage form development, characterization, testing, analysis, preclinical and clinical research) accessible for MSME clusture, startups, research institutes/ universities and individuals.

iii. To support and cater the research, development and testing needs of Healthcare MSME clusture, startups, research institutes/ universities and individual and to provide them unique platform to validate their proof of concepts to scale-ups and ultimately commercially viable sustainable solutions.

iv. To develop state-of-art preclinical animal imaging facility which will assist in understanding in vivo molecular interaction and fate of advanced formulations.

v. To develop one-stop solution for translation (bench to bed side) of advance healthcare formulation and products.

vi. To train people in the advanced formulation development technology to serve the needs of development in these areas and to develop affordable healthcare products through novel processes and technologies.

Achievements of the CRTDH Centre at DPSRU, New Delhi:

i. More than 30 MSMEs/Industries were invited in the campus and the areas of collaborative formulation development were identified.

ii. CRTDH, DPSRU has established analytical and Product characterization facility including, Preclinical imaging system, Differential Scanning Calorimeter, Particle Sizer, Hot Melt Extruder, HPLC etc. Being a recent CRTDH, DPSRU, New Delhi would

be establishing Pilot manufacturing facility, and R&D support for advanced formulation development.

iii. Chintan Shivir programme was organized with DSIR on 13th October, 2023. More than 60 Industry participated in the programme as panelists/ Exhibitors/ Delegates.

iv. Eight startups of DPSRU Innovation and Incubation Foundation are supported by DSIR-DPSRU-CRTDH centre.

v. CRTDH at DPSRU, New Delhi is playing an active role by offering R&D formulation development and validation. Hub is providing in-vitro evaluation & characterization and in-vivo animal studies support.

vi. More than 20workshops/ seminars were conducted with industry for awareness about the centre.

vii. Eight Hands on Training are organized under the centre.

viii. MoUs are signed with five industries.

ix. More than 10 publications in journals of repute.

x. One technology transfer is done for the developed product.

xi. Six products includingDetox Water, Immunity Tea, Galactagogue Milk powder, Dispersion for platelet enhancement, Non medicated and medicated Nano-Gels, Medicated Jellies are under development from the centre.

xii. The project is under progress and has been reviewed twice.

1.2.10 CRTDH at National Institute of Technology, Andhra Pradesh (NIT-AP)

Based on the identified unmet R&D & Technology development needs of the clusters in the AP region, a CRTDH has been established at NIT, AP. This CRTDH is aimed at assisting MSE's research efforts in the areas of ideation, evaluation, design, development, and testing of novel products/ processes in the electronic and renewable energy sectors, with the following goals in mind –

i. To help in expanding/ starting of new MSEs/ startups in developing products/software in renewable energy sector.

ii. To help MSEs in adapting Internet of Things (IoT), edge computing, artificial intelligence (AI) driven for increase in productivity or better service or improved security or enhanced reliability or reduced cost in smart integration of renewable systems.

iii. To improve skill sets of MSEs towards knowledge/application of best technology in product manufacturing process/ product/ service by conducting workshops, certification course/ short term programs.

iv. To facilitate on-demand learning facilities to institutes/researchers interested to work in Electronics/Renewable energy sector and encouraging collaborative

v. To develop/design power converter topologies of renewable power generation.

The CRTDH has created the infrastructure for first year as per project proposal and made available the equipment for conducting experiments by MSMEs. The current state of the art facility and work which is ongoing at this CRTDH includes-

i. Established micro grid setup consisting of solar, wind and energy storage technologies to operate in off-grid and grid connected modes.

ii. Integrated different power stacks for developing energy converter configurations

iii. Building rapid prototyping systems based on FPGA based hardware in loop real time digital controllers.

iv. Analyzing the performance of Solar and Wind energy emulators

v. Testing performance under dynamic conditions at source side and load side using programmable high precision AC/DC power sources and programmable AC/DC electronic loads / Bus respectively.

vi. 'The power converters' efficiency and reliability by developing loss models and mission profile parameters for the selection of suitable power converters in renewable systems is exercised for solar generation systems.

vii. Working on computer aided design tools for simulation of renewable energy

viii. Working on electric Vehicle Charging setup in real time conditions

ix. Working on the development of optimal control strategies for solar and wind energy systems are in progress.

x. Working on solutions to MSE's following problems is in progress

a) Optimal design of DC - DC power electronic converters for solar energy systems

b) Electrical Supply system design for Data Centre at Low cost

c) Efficient hybrid energy generation using small scale solar and wind systems

d) Data analytics on energy management in smart grids

e) intelligent EV Battery management system

Expected outcome of this CRTDH is to cater 100 number of MSE's, organising 15 number of capacity building programmes and raising 05 start-ups.

1.2.11 CRTDH at CSIR- National Chemical Laboratory (NCL), Pune.

The CRTDH centre was established in September, 2021 in the area of "New materials & Chemical Processes" to address the unmet needs of MSE in the areas of polymer synthesis and the methods of synthesizing functionalized nanoparticles at a large scale through the unique flow processes developed at CSIR-NCL.

The Center is actively collaborating with manufacturers and processors in the polymer industry, as well as with dyestuff manufacturers and dyestuff intermediate manufacturers, specifically those involved in the production of fine and specialty chemicals. The CRTDH at CSIR-NCL in Pune has achieved success in synthesizing disentangled ultra-high molecular weight polyethylene with outstanding performance. Additionally, the center has designed and commissioned a hydrocarbon gas-drying system for anionic polymerization.

The Center has taken on a consultancy project and provided support to numerous small and medium-sized enterprises (SMEs) and startups in the field of polymers, covering both polymer synthesis and polymer processing, addressing their analytical requirements.

Furthermore, CRTDH at CSIR-NCL in Pune has developed Thermochromic Dye with potential applications in sensors, thermal indicators, memory storage devices, security inks, and dyes for solar cells and other luminescent switches in solid-state materials. Vaccine manufacturing companies have expressed interest in utilizing these dyes for marking their vaccine vials. The Center has also successfully produced reactive dyes like blue 109, known for their ability to yield long-lasting and wash-resistant colors, making them a preferred choice in the textile industry. The Center actively conducts workshops and seminars on a regular basis. The CRTDH facility at CSIR-NCL Pune is spread across 1500 square foot areas and during course of its establishment centre has developed 2 technologies, incubated 3

startups, filled two patents, sensitized 50 MSMEs and trained 200 manpower.

1.2.12 CRTDH at Indian Institute of Technology Guwahati, Guwahati

The project focuses on establishment a Biodegradable Plastics Research and Technology Development HUB for Industrial Commercialization of Sustainable Packaging & Healthcare Products for the benefit of the industries and will bridge the communication gap between the industrial and academic sectors. The project will significantly convert a large number of bio-recourses from agriculture into environment-friendly, biodegradable polymer resins of blown film grade and non-woven fabrics grade, and will also be utilised for peripheral medical products. This centre will open new commercial avenues for the biodegradable plastics, food packaging and textile industries.

Various research related work are undertaken at IIT Guwahati which are having commercial possibilities for the industries which includes Development of sustainable biomaterials for orthopedic biomedical applications. In another work, Development of biopolymer polymer and copolymer pilot plant is going on. Further, various bio-based composites were developed. More than 3000 farmers were trained/demonstrated for such coating technique to the vegetables and fruits at various location in the Assam. CRTDH is also working on development of low cost starch based sustainable packaging materials which will have high commercial impact and shall provide significant social benefits.

IITG has already purchased one of the major facilities namely Inductively Coupled Plasma Mass Spectrometer (ICP-MS). Purchase of Pilot Plant for manufacturing of Biodegradable Plastic and monomer is under process. Further, in order to develop various prototypes moulds for scale-up of injections moulded biodegradable products for industry adoption is also in process. CRTDH at IITG will purchase equipment on priority basis including Cryogenic grinder, polymer non-woven fiber production unit, small scale filament machine, magnetic stirrer, refrigerator cum deep freezer, electronic project display unit, cell culture hood. Further, two prototypes such as composting plant unit and melt crystallizer would be fabricated for the uses.

Industries towards biodegradable Plastic Technology dissemination through CRTDH and about the mandate of IITG-CRTDH are being sensitized. The sustainable plastic industries were requested to join this venture during BIOPLASTEX 2022 International Exhibition & Conference on Bio Plastics & Sustainable Packaging in Bangalore during June 2023.

1.2.13 CRTDH at Indian Institute of Technology Bhilai, Chhatisgarh

The dominance of industrial regions in and around Chhattisgarh shows economic prosperity of the region. However, absence of a state-of the-art material characterization facility always remains a concern and it is preventing the growth of the industry. The raw materials used in the industry such as pharmaceuticals, pigments, textile, dye and dye intermediates, metal and mineral require to be characterized well to determine their key physico-chemical and mechanical properties before using them in large scale production. In a major initiative to work with MSMEs and to help them in improving their processes through efficient material characterization, IIT Bhilai has established a Common Research & Technology Development Hub on New Materials/Chemical Process sector.

Focus Area and Objectives:

- To engage MSMEs to enhance their technical know-how on new material/process development and testing (products/raw materials) etc.
- Reaching out to MSMEs and helping them to adapt facile, cost-effective, green and environment-friendly technologies to mak e globally competitive products.

Specialization of work at CRTDH:

- Organic pollutant/dye removal
- Waste-water treatment
- Green reaction/process development
- Waste recycling
- Carbon capture and storage
- Waste to Wealth

State-of-the-art Facility and R&D support and services to MSMEs:

- **Inductively coupled plasma optical emission spectroscopy (ICP-OES).** ICP-OES is used for characterization materials used in metal/mineral industries. It is an analytical technique used for the elemental analysis of a wide range of samples and facilitates determination of trace elements at low concentration. The emission spectrum obtained from the ICP-OES instrument contains a series of peaks corresponding to different elements present in the sample.

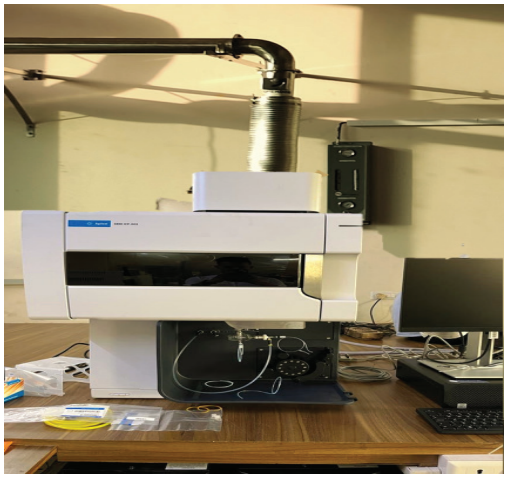


Figure 8: Representative images of ICP-OES.

- BIt is an instrument which is a sealed enclosure that provides a controlled inert environment for handling sensitive and hazardous material. It is designed to maintain an atmosphere that is free from moisture, oxygen and other contaminants. The main purpose of a glove box is to protect both the operator and the materials being handled. It is used for processing/sample preparation of air sensitive materials for pharmaceuticals, pigments, textile, dye and dye intermediates, metal and mineral sectors.

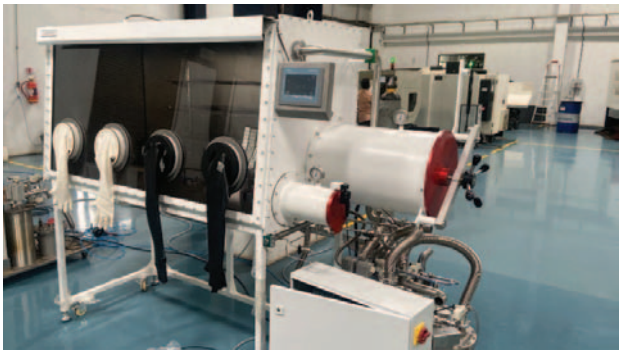


Figure 9: Representative images of Glove Box.

- ***Material Characterization Laboratory.*** Apart from the two-equipment mentioned above procured through the grant received from CRTDH project, IIT Bhilai has a dedicated Material Characterization Laboratory. The facilities at DSIR-IIT BHILAI-CRTDH and the knowledge base of IIT Bhilai along with the other facilities at IIT Bhilai is serving as one-stop solution for MSMEs

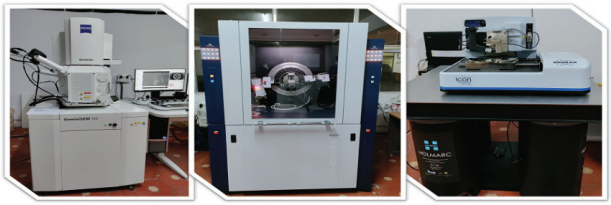


Figure 10 Representative images of the equipments available at Material Characterization Laboratory at IIT Bhilai.

The targeted MSME clusters are pharmaceuticals, pigments, textile, dye and dye intermediates, metal and mineral sectors. The facilities at DSIR-IIT BHILAI-CRTDH and the knowledge base of IIT Bhilai along with the other facilities at IIT Bhilai is serving as one-stop solution for MSMEs. The project started in October 2022.

1.2.14 National Institute of Pharmaceutical Education and Research (NIPER), SAS Nagar, Mohali

CRTDH in the sector New Materials/ Chemical Process has been set up at NIPER - SAS Nagar, Mohali based on the identified unmet R & D & Technology development needs of the clusters in nearby region such as Una (GoI -Bulk Drug Park), Baddi-Brotiwala-Nalagarh, Derabassi-Lalru, Chandigarh-Mohali-Panchkula, Ludhiana-Amritsar, Parwanoo, Kalaamb-Paonta Sahib, Delhi-Noida-Gurugram-Rewari and Jammu etc. This CRTDH is designed to support MSE's research efforts, with the following goals in mind:

i. Building facilities for pharmaceutical companies of India and abroad for pilot trials (GMP), Kilogram scale and research & development

ii. Development of sustainable, cost effective, industry feasible processes for APIs/ KSM/Intermediates (PLI scheme/import molecules/off patented molecules) and extraction & isolation process of high value herbals

iii. Creation of Natural Product Standards Library for use by herbal and nutraceutical Industry

iv. Development of new bioactive materials (High protein affinity)

v. Validation and Contract Research Services to industry

vi. Technology transfer to industry

vii. Skill development trainings for MSMEs/ Chemical startups and refresher courses for other industry employees

Industry and research projects were undertaken and completed using the institutional contributed non GMP facilities and laboratories. Institute was engaged with 2 MSMEs for executing scale up processes and drying troubleshooting for the chemicals/materials. Some of the work executed is provided below:

i. Development and Scale up of chemical process for Clemizole at 0.5 Kg. Approximately 40 gm Clemizole. HCl (HPLC purity >99.5%) has been prepared

ii. Scale-up of oxindoles – a KSM for Ziprasidone drug at 100 gm

iii. Synthesis of new impurity of Thiamine

iv. One herbal standard compound is developed in gram scale

v. One new bioactive material (High protein affinity) - An organic anticancer material having high protein affinity and strong ability to bind to tubulin, inhibit in-vitro microtubule assembly and disrupt MCF-7 cell microtubules has been identified

vi. Seven industry projects of worth Rs 11.00 lakhs were executed during the period

vii. Work order for designing of cGMP pilot Plant has been issued to consultant. Consultant and CRTDH-NIPER team is working on the tender documents for infrastructure establishment (cGMP pilot Plant and laboratories). Technical Specifications for instruments to be purchased are under preparation for indenting

Setting up of CRTDH is still ongoing and expected outcome of this CRTDH includes - 1 GMP certified Pilot Plant and 1 Kilogram/R&D laboratory for APIs, more than 100 Industry projects/Industry engagements, more than 10 cost effective industry feasible synthesis of APIs/KSM/Intermediates and 20 new bioactive materials, creation of Natural Product Standards Library for use by herbal and nutraceutical Industry, 5-6 Transfer - Ready Technologies, around 11 Publications & 9 Patents and training to approximately 350 MSMEs/startup/ staff.

1.3 DSIR CRTDH CONCLAVE 2023:

DSIR has organized two days DSIR-CRTDH Conclave 2023 on 6th & 7th November 2023 at Indian Institute of Technology, Gandhinagar wherein all the supported CRTDHs had participated and showcased their achievements.

Guest of Honor of the Conclave was Dr. N. Kalaiselvi, Secretary, DSIR & Director General, CSIR. Secretary, DSIR talked about the importance of CRTDH programme in making MSMEs more 'Atma-nirbhar' with handholding by the academic institutions.

Dr. Sujata Chaklanobis, Scientist G & Head-CRTDH, DSIR in her inaugural address highlighted the need of innovation and stated that MSMEs being the pillar of the innovation ecosystem can do wonders in making India global R & D and manufacturing hub.

DSIR-CRTDH Conclave 2023 saw the unveiling of two reports. The first report namely 'Ten years of CRTDH - Empowering MSMEs and stimulating transformation' prepared by DSIR showcased the activities and noteworthy achievements of CRTDHs and its stakeholders. The second report namely 'Chintan Shivir Report - CRTDHs empowering MSMEs' is a compilation of the comprehensive discussions, dialogue and key challenges of MSMEs for the five chintan shivirs organized by DSIR.

DSIR-CRTDH Exhibition was also organized where posters, audio visual of the individual CRTDHs and products/prototypes developed by various CRTDHs along with associated MSMEs / Start-ups incubated at the CRTDH were showcased.

During Conclave, five technical sessions during the two day event saw the keynote address from various subject experts. The conclave was attended by various MSMEs, Industry associations, Startups, students & researchers and saw exchange of dialogues and meaningful networking.

1.4 Chintan Shivir

As the CRTDH program is completing ten years, the Department of Scientific and Industrial Research (DSIR) is poised to redefine its role in providing crucial support and fostering an enabling environment for MSMEs. The aim is to set exemplary standards by granting access to cutting-edge facilities and resources. The primary objective is to explore ideas for the improved implementation of the CRTDH scheme, identify upcoming challenges, and devise strategies to enhance the scheme's relevance and vibrancy. The ultimate goal is to ensure ease of research for MSMEs and its implementation by project coordinators.

In view of the above, five such shivirs were conducted between July 27th and October 13th, 2023, at IIT Kharagpur, CSIR-IITR Lucknow, CSIR-CMERI Durgapur, CSIR-IMMT Bhubaneshwar, and DPSRU New Delhi. Each 'Chintan Shivir' commenced with a tour of the CRTDH facility, followed by an inauguration, thematic session and 'Samvad'. These sessions focused on the challenges encountered by MSMEs, startups and innovators exploring potential solutions in collaboration with CRTDH coordinators.

During these 'Chintan Shivirs,' participants delved into the challenges faced by MSMEs, placing a strong emphasis on utilizing research and development as tools for problem-solving. The purpose was to generate fresh ideas, insights and perspectives that can contribute to the development and implementation of policies, programs, and initiatives aligned with the government's goals.

Through these 'Chintan Shivirs', the Department tapped into the collective wisdom, knowledge, and expertise of officials and stakeholders. The approach allowed for comprehensive discussions, thinking and planning for effective policy formulation and execution.

CHAPTER 5: ACCESS TO KNOWLEDGE FOR TECHNOLOGY DEVELOPMENT AND DISSEMINATION (A2K+)

ACCESS TO KNOWLEDGE FOR TECHNOLOGY DEVELOPMENT AND DISSEMINATION (A2K+)

Access to Knowledge for Technology Development and Dissemination (A2K+) scheme has three components (i)'Technology Development and Utilization Programme for Women (TDUPW)' - promotes adoption of new technologies by women for greater operational efficiency and reduction of drudgery; (ii) Support to Studies – undertakes study and analysis of developments in the emerging technology areas and documents the findings, learnings and outcomes for wider dissemination including preparation of status reports on technologies from public funded institutions ready for commercialization and (iii) Support to Events (seminars, workshops, conferences, exhibitions etc.) - provides a platform for exchange of views leading to useful insights on issues relating to industrial research.

1.0 Technology Development and Utilization Programme for Women (TDUPW)

The program is aimed to meet the specific needs of women and to enhance their technological capabilities. The objectives of the programme are the following :

- Promoting the adoption of new technologies by women.
- Awareness creation and training of women on technology related issues with regard to women related occupations.
- Promoting Technology up gradation (through technologies developed by scientific establishments) of micro, small and medium enterprises run by women Self Help Groups (SHGs) / entrepreneurs.
- Showcasing of appropriate technologies developed by scientific establishments and organizing demonstration programmes for the benefit of women.
- Design and development of products, processes (e.g. by utilizing waste) beneficial to women.
- Deployment of technologies developed by scientific establishments for reduction of drudgery and empowerment of women.

The department has supported five (05) new projects (Annexure 9) including initiation of a Women Skill Satellite Centre (SSC) and one project was recommended for support during the period under report. Financial support was rendered to twenty one (21) ongoing TDUPW projects and three (03) TDUPW projects were completed during the period under report from 01st Jan 2023 – 31st March 2024

i) Empowerment of women through silk and cocoon based handicrafts (Wealth from Sericulture Waste) undertaken by Department of Biosciences and Sericulture, Sri Padmavati Mahila Visvavidyalayam (Women's University), Tirupati

ii) Dissemination of Bio-energy Technology through Bio-coal Preparation from Waste Green Coconut Shell as an Energy Rich and Smokeless Cooking Fuel among Rural Women in Puri District of Odisha undertaken by Socio Cultural Development Centre, Jagatsinghpur, Odisha

iii) Building Capacity of Tribal Women Farmers in Production of a Farm Based Nutritious Food Product for Tackling Malnutrition, Drudgery Reduction and Income Generation through Enterprise undertaken by Deepak Foundation Vadodara.

1.1 Ongoing projects under TDUPW Programme:

1.1.1 Promoting Opportunities for Women Empowerment Rejoicing through Traditional Arts/Crafts for Women in Varanasi District, U.P.

undertaken by Sai Institute of Rural Development, Varanasi, U.P

The objective of the project is to enhance the skills, productivity & livelihood of the identified women artisans of Varanasi through capacity building & training in traditional arts/ crafts, embroidery, design making. The project promote adoption of new technologies. The three locations. i) Badagaon Block, ii) Pindra Block and iii) Kashi Vidhyapeeth Block were selected based on the number of trainee calculated in the area and interest of the women conduct the training. The training conducted for 1940 identified women from 3 blocks i.e. Baragoan, Pindra and Kashi Vidyapeeth of Varanasi District and Imparted training to 526 women beneficiaries on Handicraft; 525 women beneficiaries on Embroidery and Textile and 525 Women Beneficiaries on Kabad se Jugad. The various products prepared during the training under Handicraft, Embroidery and textile and Kabad se Jugad (Dress like Kurti and Tops, Ear rings & Bangles, Necklace, Bouquets, Garlands, Flowers, Wall Hangings etc.). Three EDP programs have been conducted for 364 selected beneficiaries. The products made by trained women are being marketed and sold by Hunar-e-Banaras through online and offline markets.

1.1.2 Socio-Economic Development of Women Weavers Community in Dakshina Kannada and Udupi districts of Karnataka undertaken by Dept. of Business Administration, Sahyadri College of Engineering & Management, Mangaluru, Karnataka.

The objective of the project to train women on power-looms to increase efficiency & productivity, to upgrade the skills of women leading to entrepreneurship and to provide awareness on marketing. Under this project, imparting the training to 150 women in power looms, upgrade the skills of women as entrepreneurs and create marketing assistance for women weavers to market handloom products. A total of four batches (45 days each) of Power Loom Training cum demonstration programmes have been conducted for training 120 women identified from Udupi and Dakshina Kannada Districts to develop self-employment ability on production using Power loom. Under the training, women have been trained on use of efficient looms for manufacturing handlooms. The training is creating awareness and providing opportunities for self-employability. It is also giving guidance to the women beneficiaries on procuring financial assistance and marketing strategies to scale up the business. The imparting the training and activities to establish the market linkage for selling of produced products and the EDP trainings to the women beneficiaries are in under process.

1.1.3 Training of Progressive Technologies and Capacity Building for Himalayan Community" undertaken by Himalayan Environmental Studies and Conservation Organization (HESCO) Dehradun, Uttatakhand.

The project has been taken up with a view to train rural Himalayan women of Uttarakhand mainly in two regions i.e. Chakrata & Bandal valley of Dehradun District. This project is to build the capacity of women in Dehradun district of Uttarakahand to be self-reliant by learning technological advancement with local resources. The project also envisages to enhance the entrepreneurial skills of the women as a source of livelihood. The Major technologies under which women were trained are: (i) Herbal incense sticks (Dhoop and Agarbatti); (ii) Herbal Gulal; (iii) Turmeric Capsules; (iv) Dehydration of flowers and foliage to develop products; (v) Distillation Technology. The area chosen for this project is Dehradun District (Chakrata & Bandal Valley) in the state of Uttarakhand where turmeric, flower from temples, waste wood is the abandoned source of raw material for processing of herbal incense sticks, herbal gulal and turmeric capsules. Till date 55 skills oriented training cum demonstration programmes have been conducted in the villages and HESCO campus and trained a total of 1005 women, 49 master trainer identified from both valleys of 10 Villages on preparing these products like Dhoop & Agarbatti, Turmeric Capsules and Herbal Gulal. The installation of a distillation unit for oil extraction

has been successfully implemented at the Chibow project site in Chakrata village. Presently, 10 women groups are actively engaged in product development and marketing. In preparation for Holi this year, the Self-Help Group (SHG) produced approximately 3 quintals of Gulal, generating a revenue of Rs. 60,000. The activities to establish the linkage with the local market and online marketing for selling of produced products and the EDP trainings to the women beneficiaries are in under process.

1.1.4 Training of Rajasthan rural women on use of biofertilizer for crop productivity enhancement undertaken jointly by Amity Institute of Microbial Technology, Amity University, Noida and Arid Forest Research Institute (AFRI), Jodhpur, Rajasthan

The main objective of this project is to train Rajasthan rural women farmers on benefits of biofertilizers based on the endophyte Piriformospora indica for crop productivity enhancement. To select the trainees, the details of the training program was publicized through local newspapers and the same was intimated to Central and State Departments and Women groups, seeking their help in identifying women with entrepreneurial zeal. The five locations: i) 4 Villages of Tiwari Tehsil, (Mathania Block), (i.e. Ramsagar, Kachan, Pipalki, Mathania); ii) 4 Villages of Falodi Tehsil: (i.e. Amla, Bapini, Batiyali, Jaloda) and iii) 4 Villages of Bilara (i.e. Harsh, Deval, Karmavas and Bilara) of Jodhpur Dist., Rajasthan; iv) 10 villages of Osian tehsil (Tiwaron ki dhani, Bhakharon ki dhani, Uchlabam Thob, Chandrakh, Bhanbhuon ki dhani, Baihwasia, Pandit ki dhani, Dudion ki dhani, Khindakaur, Barakhurd) and v) 4 locations of Jodhpur and Nagaur districts at ARS Nagaur, Jayal and Mungdara village and AFRI Jodhpur, were selected to conduct the training programmes under the project. The skill up-gradation training on the applications of bio-fertilizer which increase the yield crops and impart value addition to plants, dose of application and the methods of application, beneficial effect of biofertilizer etc. was provided to 162 Nos of women farmers. During the technical session, the women farmers were briefed about the applications of bio-inoculants which enhanced the yield of the economically important crops and improved value addition to plants. The dose of application and the methods of application were explained to them and along with mass multiplication of these biofertilizers. The Entrepreneurship training has been imparted 42 women of 2 groups till now in which one is related to the NGO which works on welfare of silicosis infected family to upgrade their economic gain by learning the skills of mass production, packaging and marketing of the value added of compost. Pamphlet and brochures incorporating the information about the bio-fertilizers and its applications were prepared in Hindi language and distributed to the women beneficiaries for dissemination of the technology.

1.1.5 Creating sustainable livelihood opportunities to the tribal women of Kuchai Block, Saraikela District, Jharkhand by establishing a Skill Satellite Centre by Deepak Foundation, Vadodara.

The main objectives of the Skill Satellite Centre (SSC) was to give skill development training to women to improve their health and provide a livelihood for themselves and to train local women how to raise goats and poultry in their backyards. One baseline survey was conducted in 27 villages with 2935 households and findings of the study was that most of the teenage girls and women did not use sanitary pads during their menstrual cycles. To raise awareness, 160 women received menstrual health management training. Through the SSC, training on biodegradable sanitary pad production and marketing was provided to these 160 women.

A production machine for pads, a UV chamber, a punching machine, and a packaging machine were installed at the training center. To improve their enterprise management and entrepreneurship abilities, imparted EDP training to 96 women beneficiaries and General Orientation Training (GOT). Fifteen trained women have formed a producer group (PG) called Sarjum Ba Producer Group LLP to produce the final product. Production and sales of sanitary pads started in July 2023, and as of November 2023, members had sold Rs. 44,413/- of sanitary pads. During the second phase of the project, baseline surveys have been conducted in 19 villages. Imparted the training to 35 women beneficiaries on raising goats and poultry in their backyards, with training modules designed to address the challenges encountered. The benificiaries have been made aware regarding the Pradhan Mantri Pashudhan Yojana for goat rearing and poultry. The training to the other women identified is in under process. The activities to establish the linkage with the local market for selling of sanitary napkins and the trainings on goatery and poultry to the women beneficiaries are in under process.

1.1.6 Dehydrated Flowers and Foliages for Women Empowerment undertaken by CSIR-National Botanical Research Institute, Lucknow.

Dry flower industry is growing very rapidly, and at present, contributes about 70% of the earnings of the total floriculture produce. Fresh flowers, though quite attractive, are short lived and available only in particular season. Their freshness and beauty are lost due to various biochemical changes and microbial activities. Dried flower products are long lasting and retain their aesthetic value, irrespective of the season. The main objectives of the project are skilling women for self-employment, income generation and competency, using dehydrated floral crafts (DFC) as enterprise and to establish women Self Help Groups (SHGs) as model DFC entrepreneurs. The area chosen for this project is CSIR-NBRI, Lucknow, Uttar Pradesh which has a Botanical Garden, rich in floral diversity. Seven skill oriented training cum demonstration programmes have been conducted for training of 175 women beneficiaries from January to December 2023. Two training programmes of one month duration have been conducted on Dehydrated Floral Crafts. Training kits (including necessary materials for the artefacts, and literature) were given to each trainee. One monthly training program included presentation sessions, field visits, and identification of common growing flowers and foliages, and their cultivation. The main focus of the training was hands-on training to prepare a variety of artifacts along with the precautions during drying and preservation. The trainees were trained for the collection of plant material, their drying and preservation, making bookmarks, cards, land scape and 3D glass containers (round, cylindrical; small and large) etc. The trainees were also given exposure to make resin-based artifacts and floral candles incorporating dehydrated flowers and foliage. One day training program for 58 women of Tharu tribe women on the occasion of “Janjati Gaurav Diwas” at Maharana Pratap Public School, Sunda, Chandan Chauki, Lakhimpur-Kheeri was conducted on 25 November, 2023. Beneficiaries for the trainings were identified from these training programs and “Kalyani” a self-help group of women has been formulated. This group will help in the development of entrepreneurship by serving positively by increasing income, improving livelihood and thus empowering women. The training to the other women identified is in under process.

1.1.7 "Promotion of Stevia- A gift of Nature "0"calorie bio sweetener- for Income Generation of Female Farmers in Chandrapur District, a backward District of Maharashtra and sugar alternative to diabetic population of India" undertaken by AFORD, Bramhapuri, Dist. Chandrapur, Maharashtra

The main objectives of the project was to form Women Stevia Growers Group (WSGG) and empower them through adaptation of stevia crop for better income opportunities, towards doubling the farm income; to impart training on the stevia cultivation and management, to establish complete value chain from cultivation to marketing of the produce, by providing training and guidance during cultivation and buyback option for the produce. A nursery for Stevia cultivation has been established. 100 women farmers were trained on land preparation, preparation of raised beds, planting of sapling, plantation management covering irrigation, understanding of growth, disease if any and weeding, Harvesting. 100 women in five groups have been provided hands-on training on plastic mulching, harvesting in 10 groups at 5 locations. Training on drying and packaging: how to dry, remove leaves and pack of the stevia leaves was also imparted to the participants on farm. 20 master trainers trained for provided training. Initiated the activities for networking with various framers, farmer producer organizations and state government organizations for promotion of the stevia crop. For the promotion of the crop and sustainability initiated networking with various framers, farmer producer organizations, state government organizations and private groups have approached.

1.1.8 Empowering women through appropriate technology intervention in weaving sector for productivity enhancement and drudgery reduction of artisans undertaken by IIT Guwahati.

The project has been taken up with a view to train women through appropriate technology intervention in weaving sector for productivity enhancement and drudgery reduction of artisans. The main objectives of the project was to impart the training on various techniques like Hank to Bobbin Machine, Pirn Winding Machine, Sectional Warping Machine and Semi Automated Handloom. Two locations i.e. i) Village- Nisalamari, Dhamdhama Development Block and ii) Village - Amingao, Bezera Block, Dist. Kamrup, Assam were selected to conduct the training programmes. Total 11 villages (i.e, Ghoramara, Kadamtola, Thalkuchi, Khagrabari, Garbhitar, Gowalbil, Harharia, Jartaluk, Chamridwar, Madaltana and Nisalamari under Dhamdhama Development Block) in Baksa Dist, Assam were selected and identified the women beneficiaries on the basis of the primary data collected through focused group discussions, interaction meetings with SHGs and block heads with NGO, Gramya Vikash Mancha and willingness of a participant to undertake the training. 300 beneficiaries identified according to criteria decided by IIT Guwahati and the GVM. From the selected beneficiaries, identified 10 master trainers and imparted training on skill training on the use of Semi Automated Handlooms. 84 women beneficiaries in 7 batches, have been imparted training on the use of mechanized tools like Hank to Bobbin Machine, Pirn Winding Machine, Sectional Warping Machine and Semi Automated Handloom. The products prepared using mechanized tools during the training are: Gamosha, Sador, Arnai, Curtains etc. The training to the other women identified and creating a market linkage to help the women beneficiaries in selling the product (Link with SHGs, Khadi Gramodyog outlets in Fairs / exhibitions, Set-up shop in market etc.) is in under process.

1.1.9 Enhancing the livelihoods of tribal and rural women through technological intervention of trainings on postharvest handling and value addition of custard apple and Ber fruits under taken by IARI, New Delhi

The aim behind to take up this important project was to utilize custard apple and ber fruits abundantly available in Saurashtra region of the Gujarat state for livelihood creation to rural women. This region experiences scanty rainfall with arid climatic conditions, predominated by tribal communities. The women constitute about 80% of work force of agricultural and allied activities. The project envisages to enhance the skills of the women on custard apple pulp extraction, preservation hygienic packaging, and marketing through various state agencies. The custard apple pulp is in high demand in ice-cream making units. Besides, custard apple, ber is another important fruit which has very high lively hood potential for rural women in Saurashtra region through ber candy and preserve preparation. The project activities are being carried out at Junagadh District of the Gujarat where custard apple and ber are naturally grown without much expenditure on crop cultivation. 06 skills oriented training cum demonstration programmes on custard apple processing and ber fruit value addition were conducted. Imparted training to 300 women of Ekroda village, Kesodh taluka and Shantpur of Vanthli Taluka of Junagadh under 6 training programmes. In the training, the women were also trained on the waste utilization of custard apple and ber. The women who have acquired entrepreneurial skill are in the process of forming their own SGH group with the help of University Extension Director, State Agriculture Department officials for their easy access to trainees for future continuity of the SHG activities. The training to the other women identified, conducting EDP program and establish the market linkage for the women beneficiaries are in under process.

1.1.10 "Livelihood Enhancement for Resource Poor and COVID-19 Victim Women and Girls through Skilling and Enterprising" undertaking by Coastal Voluntary Network (CVN), Tenali, Guntur Dist., Andhra Pradesh.

The Covid-19 had posed immense adverse effects on the livelihood of the rural women; especially widows and women-led families. The objective of the project is to set up sustainable women-led technological and scientific enterprises through skilled, practiced, made knowledgeable and Capacitated in CSIR-CFTRI developed potential and feasible technologies – Rural/Urban women's scientific and technological work force, Provide highly potential business opportunity through Spices and Masala based making enterprise; capacitating at exploiting best current potential and high-demanding markets and business as of men towards women's financial and livelihood sustainability and to facilitate women and girls' socio-participatory development and empowerment towards collective exertion for their own development, equality (Women come together in participation irrespective of caste, religion and colour). Under the project, it is proposed to set up sustainable women-led technology and scientific enterprises through skilled practiced, made knowledgeable and capacitated in CSIR-CFTRI developed potential and feasible technologies i.e. i). Shelf-stable varieties of curry

pastes for vegetarian & non-vegetarian traditional cuisines (Under it, the Mutton curry, Chicken curry, Fish curry, Fish fry masala, Madras kurma, Mutton Chilli fry, Pulao, Sambar (with coconut), Kitchen king-for vegetarian preparations etc.); ii) Making superior quality white pepper and iii). Masala / Garam Powder making technology. The products include Ready-made Kitchen Shelf Masalas, curry pastes for vegetarian & non-vegetarian traditional cuisines etc. The location i.e. Angalakuduru of Tenali, Guntur, Andhra Pradesh has been selected for identifying the women. The process is underway to provide special training in packaging, labeling, branding and marketing to women beneficiaries and conduct market surveys for products in the market and develop market linkages to help sale the products to the women beneficiaries.

1.1.11 Development of Women Entrepreneurship for Low Cost Sanitary Napkins Production undertaken by JSS Academy of Technical Education, Noida

The aim behind this important project is to train the peri-urban/rural women of two selected villages (Baidpura and Kachhera Varsabad) of Gautam Budh Nagar District for the production of Low-cost sanitary napkin and capacity building of women and to enhance entrepreneurial skills in managing their business. The present work is aimed at developing a low-cost sanitary napkin which can be affordable for low income groups, which has antimicrobial properties and generate employability to empower rural women. In this project, awareness among the women beneficiaries has been created about the significance of menstrual hygiene. Based on the group discussions and baseline surveys 150 women (75 each from two villages) have been selected for training. Three weeks training program was conducted in Baidpura to train the women beneficiaries for the manufacturing of low-cost sanitary napkins from raw materials. 4 Entrepreneurship Development Programs have been conducted to empower women beneficiaries for equipping them with the necessary skills and knowledge to start their own sanitary napkin manufacturing business. The women beneficiaries have been imparted with the knowledge of business plan describing the unique selling points of manufactured sanitary napkins, identifying target market, making marketing and selling strategies. Detailed information about the various government schemes, subsidies, and support programs for women entrepreneurs has been shared with them. The beneficiaries have been explained about the necessary permits, licenses, and certifications required for sanitary napkin manufacturing.

1.1.12 Development of Women Entrepreneurs in Different Sericulture Sectors: Available technological strategies to develop a cluster-scale sustainable training for women empowerment in and around Virudhunagar district undertaking by Kalasalingam Academy of Research and Education, Anand Nagar, Krishnankoil

The objective of this project work is to promote technology adoption and provide technical training for the cultivation and management of mulberry, create awareness for rearing silkworms for quality cocoon production to promote the utilization of mulberry as an alternate feed for cattle, sheep and goat and to prepare animal feed from sericulture waste. The proposed location for the project from where the women beneficiaries will be selected villages i) Five Villages (Achanthavilthan, Inamkarisalkulam, Pillaiyarkulam, Malli and Nakkamangalam) from Tehsil - Srivilliputtur, Dist:- Virudhunagar, Tamil Nadu; ii) Five Villages (Iyyankollankondan, Chokkanathanputtur, Kilavikulam, Sankaralingapuram and Kottaipatti) from Tehsil - Rajapalayam, Dist:- Virudhunagar, Tamil Nadu; iii) 03 Villages (Nalli, Naranapuram and Muthusamipuram) from Tehsil - Sattur, Dist:- Virudhunagar, Tamil Nadu; and iv) 03 Villages (Sundrapandiam, Kadaneri, and Sevalur) from Dist:- Virudhunagar, Tamil Nadu to conduct the training programmes under the project. The project started with creating awareness on sericulture technologies in the selected villages, and further identified the women farmers are registered for training based on their land availability and interest to learn the

sericulture related technologies. Total 150 women trained by 7 training programmes in various training modules. The selected women farmers are trained in various specified techniques including Land preparation, (ii) Soil Sampling, (iii) Plantation method, (iv) Mulberry Variety, (v) irrigation (vi) Pruning and Propagation method, (vii) Irrigation and manure, fertilization (viii) Harvesting and Storage of Mulberry Leaves. The women visited cocoon rearing and silk processing units in nearby areas. Also, the women from SHGs are involved in pupae processing and value addition to by-products in sericulture waste. The women beneficiaries were demonstrated young age silkworm rearing and silk worm seed production. The training to the other women identified is in under process.

1.1.13 Skill Development Program on processing, preservation and value addition of Food & Agro based products for commercial use in Eight Aspirational Districts of Uttar Pradesh with special emphasis on development of women entrepreneurs undertaken by CSIR-CFTRI (Regional Centre), Lucknow.

The main objectives of The project is to (i) to utilize The Agro/food based raw materials available in abundance in The region for making various value added products. Thereby benefiting The growers of The region, and upliftment of status of common masses by generating self-employment and income; (ii) to generate considerable employment for The skilled as well as unskilled population especially The women entrepreneur by means of setting up tiny/cottage/small scale food industries based on simple technologies developed by CFTRI; (iii) to empower women entrepreneurs through training in generating self-employment opportunities and also to provide The basic nutritional requirements to The common masses for maintaining better health standards; (iv) to catalyze The establishment of full-fledged food processing units in The region. Upgrading the existing traditional methods with adaptation of newer technologies. They have already imparted training bilingually by creating a bilingual training manual both in English & Hindi regarding Geography, production of fruits and vegetables, cereals and pulses, and other agro crops grown in the region. They have included preparation, preservation and management of The Food and Agro based value added products as proposed in the project. The training manuals were, distributed among women trainees selected in Sonbhadra, Chandauli, Fatehpur and Chirtakoot districts of Uttar Pradesh. Further they have carried out the survey in the above districts for finalizing Food and Agro based raw materials availability and training schedules. They met concern State Government official who is working in developmental scheme and women empowerment in The Government of Uttar Pradesh in These Aspirational districts. They have selected prospected women entrepreneur with the help of leading NGOs as well as through state government officials for imparting of training – cum-demonstration programs. They have conducted 5 days Lecture, training-cum- demonstration programs to 101 Women Entrepreneurs from Dec, 2022 to Nov, 2023 on CFTRI-based technologies as per 5-days schedule of the training program. They have demonstrated many CFTRI based products to the 40 Women Entrepreneurs & 61 Women Entrepreneurs at Sonbhadra and Chandauli districts, respectively. On the last day in Valedictory

Function they had distributed Training Certificates to the 101 Women Entrepreneurs. The Chief Guest also delivered the lecture on food processing prospects for Women Entrepreneurs at Sonbhadra and Chandauli districts which has lots of scope for selling up products as mentioned above under small scale food industry by the women SHG's. They have imparted training-cum-demonstration towards preparation, preservation and management of The Food and Agro based value added products as proposed in the project. The training manuals were, distributed among women trainees selected in Sonbhadra, Chandauli, Fatehpur and Chirtakoot districts of Uttar Pradesh.

1.1.14 Women Empowerment through Silkworm Culture in Tribal Dominated Mayurbhanj District of Odisha undertaken by Mayurbhanj Biological Research (MBR), Odisha.

The specific objectives of the project is to (i) to undertake capacity building programmes by organizing training courses on latest technologies for silkworm rearing to increase silk production, reduce silkworm diseases, pest control, and larva care systems for retention of improved silkworm races; (ii) to expand employment and livelihood opportunities through development of skills of women on cluster-scale mulberry cocoon production, and its demonstration; (iii) to ensure marketing opportunities for sericulture produce; (iv) to identify socio-economic and technical indicators for expansion of area under sustainable sericulture. They have already started imparting training-cum-demonstration programs to 50 Women Beneficiaries/ Women Farmers in Four Villages of Mayurbhanj District i.e., Alubani, Jhilirbani, Mudrajodi, Kitadihi. Further they have taken technology support from Central Silk Research & training Institute (CSRTI), Berhampur, WB. They have conducted 2-day initial training and awareness program in Mulberry plant Cultivation & Silk Worm Culture in Alubani, Jhilirbani, Mudrajodi, Kitadihi villages with approximately 12-18 Women Beneficiaries in each village. The organization has created a bilingual training manual (English & Odiya) were, distributed among women trainees selected from Alubani, Jhilirbani, Mudrajodi, Kitadihi villages of Mayurbhanj district 50 Women Beneficiaries and training schedules. They have selected prospected women farmers with the help of state government officials for imparting of training – cum-demonstration programs. They have conducted 2-days of 5 trainingcum-demonstration programs to 50 women beneficiaries in Alubani, Jhilirbani, Mudrajodi, Kitadihi villages from April, 2023 to November, 2023. They have imparted training-cum-demonstration towards Mulberry plant Cultivation & Silk Worm Culture, land preparation towards Mulberry plantation, Mulberry Stem Cutting & planting with Weed Management, Application of Bio-fertilizers to Mulberry plantation, training and Demonstration on Mulberry Rise-Bed Development technology, Mulberry plantation Management, pest & Disease Control on Mulberry plantation (Tukura Disease Control on Mulberry leaf) as proposed in the project. the training manual were, distributed among women trainees selected from Alubani, Jhilirbani, Mudrajodi, Kitadihi villages of Mayurbhanj district of Odisha.

1.1.15 Mechanized system for making hawaijar-A traditional fermented food of North-East India by ICAR-Central Institute of Post-Harvest Engineering and technology, Ludhiana, Punjab.

The objective of this project is to create an automated system for producing hawaijar, a traditional fermented soybean product known locally in Manipur, North-East India. The production and sale of this product are currently managed exclusively by the women in the region.

The objectives are (a) Fabrication & validation of mechanized system for preparation of hawaijar (b) Awareness & Capacity building of women entrepreneurs/SHGs of North-East India on this technology and (c) Entrepreneurship development training of women beneficiary on the technology developed.

Under the first objective, a prototype for making hawaijar has been developed. Refinement and

fabrication of three more prototype which are going to deliver to the women group are in progress. A study has also been conducted on the effect of processing treatment on physiochemical properties of two varieties of soybean for preparation of hawaijar as per the suggestions of the Project Review Committee. Characterization of the hawaijar has also been done to compare the quality of the developed product. The drying of the soybean has also been experimented using different drying methods viz. tray dryer, fluidized bed dryer and sun drying method. The storage study of hawaijar using different packaging materials such as glass and steel containers is in progress.

As a part of second objective, a four- day awareness training programme for women SHGs/ Entrepreneur/FPOs was organized at Manipur during 13th – 16th March 2023. The training was conducted at Chandonpokpi Village of Chandel district, K. Salbung of Churachandpur district, Ebudhou Thongju Lakpa, Imphal East and KVK Andro, Imphal East District on 13th , 14th , 15th and 16th March 2023 respectively.

The attendees included members of the self-help group through Village Level Federation (VLF), and representatives from food producer organisations and prospective entrepreneurs. The training at Chandel district, Churachandpur district, and Andro were coordinated by the Subject Matter Specialist (SMS) working at the respective KVKs. However, the training conducted at Ebudhou Thongju Lakpa, Imphal East was coordinated by women leaders of Village Level Federation (VLF).

The participants were briefed on the advantages of Hawaijar and its numerous value-added products, along with insights into its economic potential in both domestic and international markets. They were also educated about an ongoing project involving a mechanized system for producing Hawaijar, including the scientific methods and hygienic practices essential during the preparation process. Details about the design and operation of the mechanized system were also conveyed to the participants. Special attention was given to encourage them to explore start-up opportunities or enterprises, to enhance their income and establish their own businesses. The training was attended by a total of 129 women from different locations.

1.1.16 Empowerment of rural women through capacity building training program in food processing sector by Department of Home Science, The Gandhigram Rural Institute Deemed to be University, Gandhigram, Tamil Nadu.

The main objective of the project is to impart Hands on Training for rural women in Dindigul District, focusing on the Value Addition of Fruits and Vegetables. It focuses on Food Product Development and food quality evaluation to encourage rural women's participation in Entrepreneurship and empower rural women by facilitating the marketing of the end products, ultimately elevating their economic standards. Completed seven village visits, engaging 210 participants from 12 SHG clusters in the Viruveedu, Kalikkampatti, Nilakkotai, Vedasandur, Sirumalai, Athoor and Munillakkotai regions of Dindigul district. Organized four One-day Training programs for 139 rural women hailing from various regions in Dindigul District, including Viruveedu (50 participants), Kalikampatti (17 participants), Sirumalai (27 participants), Vadamadurai (19 participants), Nilakkotai (19 participants), Vedasandur (4 participants), Athoor (3 participants) and Ambaturai (4 participants). According to the area and availability of resources the training manual was designed and Hands on training was conducted for rural women. Women from the SHGs in Sirumali received training in preparing Lemon RTS and Squash, while those from Viruveedu and Kalikampatti trained on dehydration of vegetables. In parallel, SHG women from Nilakkotai and Ambaturai were specifically trained in the preparation of Grape Squash. The training was conducted in the Food Science Lab, Department of Home Science, GRI. Inspiring sessions were conducted for the rural women on the One Day Hands on Training to sensitize & impart knowledge on the field of Food Processing and promote women

to start their Entrepreneurial journey. The expertise sessions focused on "Value addition of Fruits and Vegetables" by Dr.R.Saravanakumar, Professor, Community Science College and Research Institute, Madurai; "Nuances and complexities in Marketing of Fresh and Processed Food products" by Dr. Rajesh Nalliaiah, Director, RNR Agri Developers, Madurai; "Sustainable Food Product Development and Scope of Food Business and Export Opportunities" by M. Sasikumar, CEO, Jerem Food, specialized in Food products (RTS) business Consultant, Perambulur; "Value Addition: Transforming Lives and Boosting Economies" by Mrs. Poornam, CEO, ORISH Tech, Madurai and "Value Addition: Transforming Lives and Boosting Economies" by Mrs. Ponnarasi, CEO, Arasi Murungai Products, Dindigul.

1.1.17 Recycling for Conservation of Environment by Birla Institute of Technology & Science, Pilani, Rajasthan

The project aims to establish an enterprise that will be overseen by a newly established women's self-help group (SHG). The women will receive training in waste paper recycling and the development of manual paper crafts, in accordance with industry standards. The goal is to create commercially viable products that will provide social, economic, and environmental benefits. It supports women who have been identified by enhancing their productivity and helping them build entrepreneurial skills, enabling them to earn a living. The project is situated at the BITS Pilani. The training location is located at House No. 70, Paschim Marg, BITS Pilani. The beneficiaries are selected from three adjacent villages, namely Baasgaon, Garinda, and Jherli, based on the women's enthusiasm and the convenience of accessing the training site regularly to finish the training programme. At now, there are 50 women undergoing training in the recycling of waste paper. Their training encompasses the gathering of recyclable waste paper, the effective processing of the waste paper using a paper recycling machine, the development of useful products made from recycled paper, and the marketing of these products. Thus far, a total of 20 training sessions have been carried out. A 5-day workshop by an industry expert has also been conducted, and an EDP and 2 awareness programs are scheduled to take place in the coming weeks. The various products prepared during the training are chart paper, envelopes, file cover, decorative items etc. The products made by the trained women is being marketed BITS Consumer Co-operative Store and at various stalls of NSS wing of BITS Pilani. The current results of this initiative include the dissemination of technical and entrepreneurial knowledge to the women beneficiaries, as well as the conservation of the environment through the recycling of around 3 tons of waste paper. The project has received recognition from the local authority. Neighboring villages and schools in Pilani town where we did our awareness program and invited them to visit our training site. In addition, we collaborated with an NGO called "Nirman" to broaden the scope of this initiative and distribute our items through their channels. The process of providing training to other identified women and conducting market research to explore new markets for the absorption of final products, to assist the beneficiaries is currently underway.

1.2 Women's Day Celebration:

On March 7, 2023, Department organized an event called "DigitAll: Innovation and Technology for Gender Equality" in honor of International Women's Day. The event brought together key stakeholders of TDUPW programme of DSIR including Principal Investigators of ongoing projects, Implementing Agencies, representatives from food processing organizations, micro- finance-rural banking, online marketing experts and women self help groups (SHGs). The participants were motivated during the event and success stories of DSIR-TDUPW scheme were shared in empowering women for technological capacity building.

Invited speakers shared their expertise on micro-finance and digital marketing opportunities for rural women entrepreneurs/SHGs. A panel discussion was also hosted during the event,

wherein experts expressed their insights and experience on technology, gender equality and increasing accessibility of digital technology, marketing opportunities for women. Deliberations were conducted to create study materials and a database of trusted resources by collaborating with project managers, field staff, and experts to support the implementation of an Entrepreneurship Development Program (EDP).

Celebration of International Women's Day (IWD) 2024: IWD-2024 program was observed on 8th March 2024 on the theme "Invest in Women: Accelerate Progress", in collaboration with PSGR Krishnammal College for Women, at Coimbatore. The event was organized under Technology Development & Utilization Programme for Women (TDUPW) program of DSIR. Various women entrepreneurs, Social organizations, Incubators, academic & Research Institutions participated in the event and shared the challenges faced by women owned enterprises and role of S&T in women empowerment.

A stakeholder interaction meet was also organized during the event that marked participation of officer's from Food Safety Organization, Technology Incubation Parks, a women CEO, and a young women entrepreneurs and startups. The progamme also marked inauguration of TDUPW- Skill Satellite Centre at PSGR Krishnammal College for Women Coimbatore District, Tamil Nadu supported under TDUPW/A2K+ scheme of DSIR. This center will provide the technological intervention and capacity building to women on food processing, fortification and value addition utilizing raw material from local rural areas and also financial literacy and enterprise development training. This centre is expected to help the local women uplift their socio-economic status significantly.

2.0 ACCESS TO KNOWLEDGE FOR TECHNOLOGY DEVELOPMENT AND DISSEMINATION (A2K+) – STUDIES

2.1 PREAMBLE

The objectives of A2K+ Studies program is to support studies in current and emerging areas of technology aimed at providing useful information and knowledge base to industry, industry associations, academia, research institutions, consultants, entrepreneurs, research students and policy makers for doing any further work in these areas; to study and analyze the developments in the emerging technology areas and document the findings, learning's and outcomes for wider dissemination and preparation of status reports on technologies from public funded institutions that are ready for commercialization with a view to catalyze the translation of research output from institutions to market. Department has supported 10 (Ten) new and 22 (Twenty Two) ongoing study projects during the period under report. The department has successfully completed 02 (Two) A2K+ studies during the period under report.

2.2 New Study Themes

During the period under report, a fresh call for proposals was advertised on following five study topics well-aligned with current societal challenges,

research priorities, and national visions. 76 (Seventy Six) new applications were received by the Programme Division for financial support under A2K+ (Studies) programme of DSIR under fresh call for proposal.

Theme I: Affordable and Clean Energy (Ensure access to affordable, reliable, sustainable and modern energy) – Research & Development support and mobilization of public and private capital for innovation in clean and renewable energy.

Theme II: India's technological import liabilities and the development of frameworks and methodologies for S&T interventions on import substitution.

Theme III: Women and Technology: STI Investments and Policy Foresights for Economic and Social Empowerment of women.

Theme IV: Funding mechanisms for strengthening Industrial R&D and Innovation landscape in India.

Theme V: Scope of artificial intelligence based technologies in sectors such as healthcare, education, agriculture, smart cities and infrastructure and smart mobility and transportation.

Eight proposals are recommended for support under A2K+ (Studies) programme of DSIR.

2.3 Online application submission of fresh Application under A2K+ Studies

The application process for funding projects under A2K+ (Support to Studies) programme is available for online submission at service plus portal through DSIR website. The service plus portal is developed by National Informatics Center (NIC), Government of India. This portal serves as a unified service delivery platform to provide services to citizens. Once the application is submitted at the portal, applicants gain access to a comprehensive online tracking system, allowing them to monitor the status of their application in real-time. This approach ensures complete transparency for applicants providing visibility into the progress of their application from submission to the final delivery of services.

2.4 Brief highlights of the study projects completed during the period under report

During the year 10 Studies completed under A2K+ (Studies) Programme, notable accomplishments include:

2.4.1. Readiness and interest of organizations for adopting emerging technologies like AI and ML supported to Indian Institute of Technology, Indore

The study entitled "Readiness and interest of organizations for adopting emerging technologies like AI and ML" was conducted by the Indian Institute of Technology Indore. The main objective of the project was to develop the data analytics monitoring tools that extract information from the synchronized measurements utilizing AI/ML techniques. Thus, aiding the system operator in making better decisions to maintain the power systems stability and reducing the probability of occurrence of blackouts. The study involved creation of a database of synchrophasor data from the IEEE 39 bus system, collected by PMUs at generator terminals under various operating conditions. It uses an intelligent AI/ML technique, the Long Short-Term Memory – Autoencoder (LSTM-AE), for more efficient and accurate Transient Stability Assessment (TSA). It highlights the growing demand for real-time TSA and beneficial in enhancing the efficiency and reliability of power grid operations. The study recognizes the industry's keen interest in AI/ML techniques, particularly in load forecasting and fault identification. However, the lack of practical expertise in handling AI/ML tools among human resources poses a barrier to their implementation. To address this, the proposed tool serves as a decision-making tool that minimizes the need for frequent training programs, reducing the overhead on industries. In addition, a survey was conducted to study the readiness and interest of organizations in adopting AI and ML technologies.

The study is completed and the results of the study indicated that LSTM-AE for normalization and dimension reduction optimizes feature selection, reduces computational complexity; the unsupervised LSTM-AE classifier achieved a test accuracy of 98.88% surpassing PCA-based LSTM; LSTM-AE classifier achieved 100% accuracy in predicting transient stability; LSTM-AE utilized direct synchrophasor data, eliminating the need for rotor angle estimation in transient stability prediction. Survey results suggested that about 89.5% power utilities are highly interested in utilizing AI/ML techniques, with a focus on renewable generation forecasting, recognizing the potential benefits they offer to their operations.

2.4.2 Forecast Model to Predict Leather Footwear Trade data for the year 2030 using Artificial Intelligence Approach by CSIR-CLRI, Chennai.

The study entitled "Forecast Model to Predict Leather Footwear Trade Data for the year 2030 using Artificial Intelligence Approach" has been granted to CSIR-Central leather Research Institute, Chennai. The objective of the study is to have the insight into the trade data on India's export of leather footwear and prediction of leather footwear trade for the year 2030. The study was completed on 30.09.2023. The project team has compiled 18 years of Leather Footwear data for the period covering between 2003-04 to 2021-22 was collected for this study. On analyzing the 37 leather commodities for the recent five years from 2017-2021, it is observed that the commodity 64039190 tops the list for all the five consecutive years. It holds approximately 13% to 19% of the India's leather export in terms of Quantity. On the other hand, commodity 64031920 was in 25th and 26th in list in 2017 and 2018 and has risen to second in demand in the foreign markets during 2020-21 and 2021-22. It has been exported around 15 million to 24 million pairs in two years with 15 to 18 percentage of share in total export. The commodity 64032023 has been exported for the highest price i.e., 358.13 US dollars per pair in the year 2020-21 followed by 64032040 has been exported for 326.93 US dollars per pair in the year 2017-18. Forecasting models such as Artificial Neural Network (ANN), RNN-LSTM, Convolutional Neural Network and Autoregressive Integrated Moving Average (ARIMA) were adopted, along with activation functions such as Rectified Linear Unit and Leaky Rectified Linear Unit, Sigmoid, Linear and Hyperbolic tangent. The optimizers such as Adaptive Moment Estimation, Stochastic Gradient Descent, Stochastic Gradient Descent with momentum and Root Mean Square Propagation has been integrated to bring out a reliable prediction. Evaluation metrics such as Mean Absolute Error, Mean Absolute Percentage Error, Root Mean Square Error and percentage of variation have been implemented in this study that has been extended to 37 leather commodities out of 57 commodities for 268 countries. However, the model prediction with RNN-LSTM has been implemented since data is in time series nature. The model that has provided better results by validating with various other types of domains like Textile and Clothing industry, Exchange rate of USD to INR and Export of Steel of UK, USA and India. Further, Country-wise, commodity-wise, Price Volume basis and overall export for the year 2030-31 has been forecasted. India's Overall Leather Footwear export is expected to grow around 6.54% in terms of Quantity in the year 2030-31 in a period of nine years i.e., approximately from 130 million pairs to 139 million pairs. But in the case of a 10-year growth rate comparing from 2020-21 the export value has grown up to 38.98% surging from approximately 100 million pairs. The final outcome have been presented in various conferences and published in various papers.

2.4.3 Readiness and Interest of Organizations for Adopting Emerging Technologies Like AI and ML: A Research Study Proposal supported to All India Management Association (AIMA), Delhi.

The study entitled "Readiness and Interest of Organizations for Adopting Emerging Technologies like AI and ML" has been supported to All India Management Association (AIMA). The objectives

of the project are to (i) study technology readiness for AI and ML implementation (identify major AI technologies available in India); (ii) identify key factors impacting the adoption of AI in organizations; (iii) design and validate the framework over a set of organizations to identify factors which impact AI adoption; (iv) examine key challenges being faced by the organizations to implementing the technology/ies and recommendations to minimize the challenges; (v) identify key sector, sub sector for AI implementations in India and suggest relevant AI technologies; (vi) develop an AI-readiness framework like a capability maturity model at firm level and sector level (road map for AI implementation sector wise, Firm wise); (vii) suggest key organization task/ processes where AI implementation is easy, cost effective and does not disturb the current organization structure. The study is being conducted using a well-structured questionnaire and expert interviews to get qualitative and quantitative inputs. At least 200 organizations in various sectors such as automobile, power, education, health care, FMCG, agriculture etc. have been surveyed in the study. Training programs/workshops titled Digital Innovation and Transformation for Enterprises: Next best practices in AI/ ML Implementation has also been conducted under the study. Specific outcomes of the study includes – i) validation of the framework over a set of organisations to identify factors which impact AI adoption; ii) A detailed report on the readiness of Indian organisations in adopting AI and ML technologies covering wide range of organisation from different sector, various of size of organisations from both private and public sectors; iii) A detailed list of AI technologies adopted by organisations, sector wise; iv) AI-readiness framework like a capability maturity model at firm level and v) Key recommendations for smooth implementation of ML and AI sector wise.

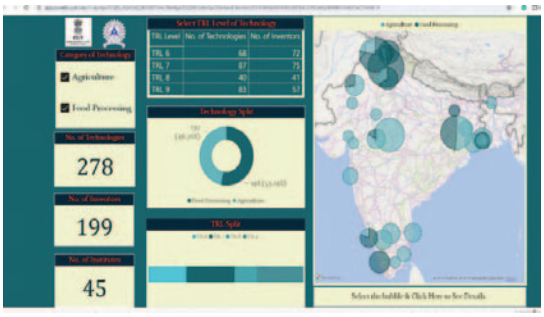
2.4.4 Artificial intelligence based loaded forecasting models for load dispatch centers in India supported to Symbiosis institute of digital telecom management (SIDTM), Pune

The study entitled "Artificial intelligence based loaded forecasting models for load dispatch centers in India" has been supported to Symbiosis institute of digital telecom management, Pune. The objectives of the study are (i) to develop a graphical user interface (GUI) based load forecasting models; (ii) load forecasting for long term for load dispatch center (LDCs) in India; (iii) to improve the accuracy of the load forecasting using different AI techniques. The study has obtained and analyzed data from four different load dispatch centers from the State of Maharashtra, Telangana, Odisha and Delhi. The project embarks on a comprehensive exploration of diverse machine learning techniques to forecast daily electricity load. Employing a range of methodologies, including regression models, Artificial Neural Networks (ANN), and the innovative one-dimensional convolutional neural network model – Bi-directional Long Short-Term Memory (1D CNN BI LSTM) – the project underscores its commitment to unearthing the most accurate and effective forecasting approach. Extensive experimentation and evaluation culminate in a pivotal discovery – the supremacy of the 1D CNN BI LSTM model. Demonstrating an unprecedented capacity to outperform its counterparts across all regions. This finding not only validates the project's methodological choices but also lays the foundation for reshaping load forecasting practices in India's energy landscape. The present study has published research articles.

2.4.5 Accessing the Techno-commercial Status of TRL-6 and above Technologies in the field of Food Processing and Agriculture by Indian Institute of Technology (ISM) Dhanbad.

The study entitled "Accessing the Techno Commercial Status of TRL-6 and above technologies in the field of Food Processing and Agriculture" was conducted by the Indian Institute of Technology

(ISM), Dhanbad. The main objectives of the project were (i) to access the techno-commercial status of at least 100 or more TRL6 & above technologies are developed in academic institutes, research labs and MSME sector in India, (ii) to prepare the status report on the techno-commercial status of at least 100 or more identified TRL6 & above technologies, (iii) to identify the challenges faced by academic institutes, research labs and industry in the commercialization of technology and iv) to prepare/ create the road-map for policy makers, technology developers and commercializing agencies for translation of research output from institutions to the market. Under this study, conducted two pivotal stakeholder meetings and brainstorming sessions on September 26, 2022, at IIT (ISM) and October 10, 2022, at IIF IIT (ISM) Centre in New Delhi. These sessions brought together representatives from significant stakeholders such as CSIR, IITs, ICAR, State Agricultural Universities, Incubation centres, Start-ups, and MSMEs, actively involved in the agricultural sector. Stakeholders' seminars served as platforms for experts to discuss prevailing issues and challenges in technology innovation within these sectors. This study has developed a status report on the Techno-Commercial status of 278 technologies in the field of Food Processing and Agriculture. A nationwide survey was conducted to collect technological data from academia, research labs, incubation centres and industries, such as – state Agricultural Universities, Central Universities, IITs, ICAR Labs, Food processing Institutes and MSMEs and a total of 278 technologies were collected from 55 institutes. A systematic and uniform approach is used to evaluate all technologies across different application categories in order to assign them a TRL, and based on the recommendation of the expert committee, the study identified 278 technologies with TRL 6 and above. TRL-wise classification of technologies are: TRL 9 – 83 Technologies (Fully developed and commercialized); TRL 8 – 40 Technologies (Developed technologies ready to commercialize); TRL 7 – 87 Technologies (Promising technologies demonstrated in operational environment); TRL 6 – 68 Technologies (Promising technologies demonstrated in the realistic environment). The study has conducted a total of two events, three TRL validation meetings, and three case study meetings to solidify its impact and contribution to the technological landscape. The study is beneficial in linking the commercializing agency with technology makers. The study will act as a catalyst in commercializing the technologies and give future direction to policymakers to design suitable policies for promoting the commercialization of the technologies in the country. This study has also prepared the road map for the policymaker, which will give the framework with a responsibility assignment matrix based on the inputs from stakeholders.



2.4.6 Performance Evaluation of Advanced Dielectric Materials in Transformers" by NIT, Srinagar.

A study entitled "performance evaluation of Advanced Dielectric Materials in transformers" has been granted to "National Institute of Technology, Srinagar". the objectives of the study are: (i) to study the dielectric behavior of various transformers

installed in Kashmir region; (ii) to examine the influence of several working stresses on operating performance of transformers; (iii) to investigate the advancements in solid & liquid dielectrics of transformers; (iv) to study the recent advanced technologies to determine the health status as well as faults present in transformers; (v) to develop a new & generalized algorithm for transformers health assessment based on the collected primary & Secondary Data. Under this study the dielectric behaviour of various transformers installed in various climatic temperatures has been analysed. Several Stakeholder meetings & Pilot Surveys were undertaken from different substations located at different places across cold climate states like Jammu and Kashmir, Himachal Pradesh etc and was decided to give priority towards Problem-solving Providing solutions for proper working of Transformers. From this data and detailed studies, it is observed that load variations have less effect on the both oil and winding temperatures of transformers installed in cold climatic conditions. From the field studies and the test data the impact of various stress on the operation of transformers have been studied and several issues associated with the transformers in the cold regions have been accessed. At low enough temperatures, the oil pumps and flow meters do not function properly on cold-start with mineral oil. Similarly, the other issues noticed is that specific designs of the cooling system may nominally operate for cold-starts at slightly warmer temperatures. The identified solutions to all the problems discussed above are detailed. A wide range of the modern liquid and solid dielectrics have been identified. The properties of these dielectrics have been studied. In order to find the best dielectric materials for the cold climatic conditions various comparative tests have been done and the comparison of these test reveals the use of Esters as best suited option for the transformers installed in cold regions. The performance data obtained through the field and experimental studies on transformer are very useful for experts to analyze the transformer health status. The detailed analysis on various types of health assessment methodologies have been carried out, apart from these health assessment methodologies existing in literature, a new multi-criterion based fuzzy logic method have been introduced to find out the health index of power transformers installed in cold climatic states. The key recommendations of the study highlighting specific issues faced by transformers in hot and cold regions, providing utility companies with valuable information to optimize transformer design and operation. This optimization can lead to enhanced performance, reduced maintenance costs, and informed decisions regarding the deployment of transformers based on climatic conditions. The study emphasized the critical role of transformers in the electrical grid and offers insights into factors affecting their reliability, enabling utilities to implement strategies for improved system reliability and additionally, focusing on the health assessment and fault detection technologies, coupled with machine learning techniques for asset management, which can result in more efficient maintenance practices, reduced downtime, and cost savings. Furthermore, the study suggests that optimizing transformer performance and minimizing frequent replacements can have positive environmental impacts by reducing waste and lowering energy consumption. Further understanding transformer behavior in extreme climates contributes to grid resilience, ensuring the electrical infrastructure can withstand challenging conditions and reducing the risk of power outages during adverse weather events. Lastly, the study's insights into transformer behavior and performance can inform long-term planning for utilities, aiding them in making informed decisions about investments in infrastructure, including transformer replacement and upgrades.

Transformers Inspection/Pilot Survey at Pinjora Shopian Receiving Station.

Transformers Inspection/Pilot Survey at Receiving Station – Batpora Shopian.

2.4.7 Study on air ventilation in central Air-conditioning units in post-COVID-19 scenarios guided by machine learning and artificial intelligence techniques by IIT Delhi.

Adequate ventilation plays a crucial role in mitigating the spread of airborne diseases by reducing the presence of droplets and aerosols in the air, thereby minimizing the risk of airborne transmission. Air filtration contributes to this process by refreshing the air and replacing contaminated air with fresh ambient air. Current air recirculation systems face a challenge in incorporating high-efficiency particulate air (HEPA) filtration due to high-pressure drop and size limitations. Consequently, this project aimed to address this limitation and provide a sustainable solution for post-COVID-19 air ventilation in central air-conditioning units, utilizing machine learning and artificial intelligence techniques. The entire project is divided into seven specific objectives, mainly focusing on the requirements of the Indian market and its stakeholders. A critical analysis of the national and international status of current filtration technologies concerning COVID-19 was conducted. In addition, a targeted questionnaire was sent to sixty-four companies to achieve this goal. Further, samples from well-established industries like AFI India and Elofic and Industries Limited were collected and tested according to the ISO 16890 standard. This data was coupled with the data obtained from an extensive literature review to create a database using MySQL workbench. Subsequently, the database was used to develop and test ML and AI-based models to predict filtration efficiency and pressure drop of filter media. Finally, the findings of this project created a set of policies to serve Indian-based requirements of filtration in HVAC systems in India. In this regard, a stakeholder workshop was conducted with over 20 delegates, including the filter media industry, certification bodies, educational institutes, and machinery manufacturers. During the workshop, the study's results were showcased, and diverse stakeholders provided their perspectives on the findings. Based on the stakeholders' inputs, a key set of recommendations was prepared for creating a set of filtration policies in India and an elaborate roadmap for implementing said policy. A critical review of ML and AI's potential in improving filtration and HVAC systems in India was also conducted. The findings of this project, along with the key set of recommendations for policy development and the roadmap for policy implementation, were compiled into a technical report. In addition, the deliverables of this study included ML and AI models, MySQL database, stakeholders' workshop and various demonstrations to stakeholders.

Demonstration of needle-punched nonwoven line held in IIT Delhi on 11/07/2023

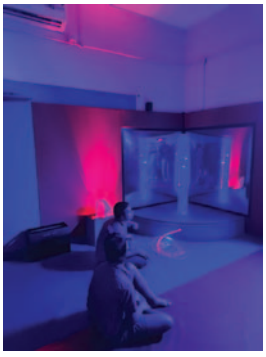
2.4.8 A Report on ICT Tools Catering to a Wide range of Learners, Including Children with Special Needs by Cochin University of Science & Technology, Cochin

This study is intended to understand the current status of availability of various ICT tools catering to special needs, and ascertain the extent of use of these tools. The study envisaged an exhaustive inventory of existing ICT tools that support the needs of a wide variety of learners and assessed the extent to which the same was embedded in the curriculum. The researchers undertook a study in selected special schools in the states of Delhi, Haryana, Goa and Kerala (The states with highest density of special schools).

The key objectives included the understanding of the current strategies and guidelines provided by the government for driving the adoption & usage of ICT tools for children with disabilities, secondly the study identified various ICTs across the country for children with disabilities and their current usage by special educators and investigates the extent to which these tools were integrated with the existing curriculum. The list of schools in each state was taken from the 'The National Institute for the empowerment of persons with intellectual-disabilities'(NIEPID) website for the survey. Two states each from the country's northern and southern zone with the highest density of special schools were selected. The states of Goa and Kerala were selected from the southern zone, and Delhi and Haryana were selected from the northern zone. A total of 113 schools were covered in all, which included 34 schools in Kerala & Delhi, 28 schools in Haryana and 17 schools from Goa. A survey method was adopted to collect the data from each of the 113 schools using a structured questionnaire. Two sets of questionnaires were designed to interact separately with the school administration and parent stakeholders.

It was found that the commonly used ICT resources including, Mobiles, Tabs, Laptops, Desktops, Smart TV, Smart Boards, were found in deficit numbers in most special schools with one device to cater to approximately thirty-six students. While special equipments were even more sparsely available with approximately one device available for seventy- two students. Teachers, however are aware of the benefits of ICT use and were found to be lacking training and device support in their respective institutions. Most of the special schools lacked advanced assistive ICT enabled tools. The results revealed that the schools had a low to moderate usage of ICTs. The special educators in most schools had moderate skill.

The study suggests that the special educators should be trained and engaged in ICT integrated special education to provide an empathetic teaching learning environment that support children with disabilities. A close linked partnership may be built between special educational institutions and technology solution providers and institutions so as to foster better understanding of needs. The promoters could also approach companies seeking to give Corporate Social Responsibility funds to finance initiatives of building technology tools and devices to better assist learning needs of children with disabilities.



Sensory technologies used in sensory rooms

2.5 Highlights of ongoing A2K+ Study Projects

2.5.1 Techno-commercial assessment of TRL-6 and above technologies developed in India in academia, research labs and industry supported to Indian Institute of Technology, Roorkee

The study entitled "Techno-commercial assessment of TRL-6 and above technologies developed in India in academia, research labs and industry" has been supported to Indian Institute of Technology Roorkee. The objectives of the study are to (i) identify already existing successful epitome of TRL6 level or above technologies at least 100 in number) in Indian Institutes, Universities, startups and Industries; (ii) identify types of obstruction and their nature in already existing TRL6 or above level technologies in academic and industrial environments; (iii) develop a database of technologies developed by academia, research labs using Government funding's and mapping them on the TRL scale; (iv) study the challenges in the commercialization of technologies developed in academia and research labs; (v) conduct the case studies on success stories of the technologies(projects) which are in the TRL-6 and above in academia, research labs; (vi) develop the clusters of technologies based on the potential of commercialization and accordingly proposing the strategies for different clusters and to provide recommendations for policymakers. The study has used Survey Questionnaire, Brainstorming sessions, Interactions/ meetings/case studies (success), Expert interview and literature review as an instruments to conduct the study. In addition, database of the TRL 6 and above technologies in the sector Manufacturing, Electronics and Telecommunication has been developed. Currently the study is on the verge of completion and expected specific outcomes of the study will be to: (i) develop a cloud-based database Management System; (ii) propose strategies to increase the possibilities of commercialization of technologies based on important challenges and relationships; (iii) identify the challenges in the commercialization of technologies developed in academia, research labs and industry; (iv) identify the factors making TRL6 or above level technologies a success or failure; (v) identify barriers impeding the higher performance.

2.5.2 Machine Learning in Mechanics: Current Status and Future Prospects supported to Indian Institute of Technology, Tirupati

The study entitled "Machine Learning in Mechanics: Current Status and Future Prospects" has been supported to Indian Institute of Technology, Tirupati. The objectives of the study are (i) Significance of existing computational strategies in mechanics and their relation to ML. (ii) Explore the class of problems amenable for solutions within the ML framework. (iii) Integrate ML tools within the computational mechanic's framework to aid informed decision making. (iv) Identify specific engineering problems where newer ML tools need to be developed. The study has conducted (i) detailed review of recent progress on the use of ML algorithms in mechanics and SHM applications and identify the major challenges and prospects; (ii) small stakeholder survey to understand the extent to which Machine learning (ML) based solutions are currently being used in the industries in the region, and the challenges faced by industries in adopting ML based solutions in composite design and manufacturing and (iii) demonstrated the applicability of ML based solutions for a typical case study involving the prediction of carbon fiber which is important in the composite design. Currently the study is ongoing and the work will highlight the state of knowledge in applying ML tools to various problems in mechanics, which will serve as a useful guide for academia and industry to make informed choices. The findings of the study will help organizations understand the requirements of ML tools, recognize their preparedness, and equip themselves in adopting these tools to develop solutions to mainstream applications. Expected specific outcomes of the study includes - i) a state-of-the-art review paper on the application of ML in mechanics and (ii) a detailed technical report stating the feasibility and providing guidelines for adopting ML tools in areas of health monitoring, material characterization and computational mechanics.

2.5.3 Readiness and interest of Indian refineries for adopting AI/ML technology for operations supported to Rajiv Gandhi Institute of Petroleum Technology (RGIPT), Amethi, UP

The study entitled "Readiness and interest of Indian refineries for adopting AI/ML technology for operations" has been supported to Rajiv Gandhi Institute of Petroleum Technology (RGIPT), UP. The objectives of the study are to (i) Creating awareness among Indian refineries regarding the applications and benefits of AI/ML. (ii) Understanding the readiness of Indian refineries for the implementation of AI/ML technology. (iii) Generating a patron database, to help Indian refineries develop prospective solutions for related problems employing AI/ML technologies. To examine the readiness level, three types of questionnaire were prepared: (a) details of refinery units with their capacity, (b) software in use for varied pain points of refinery, and (c) general questions related to any current implementation of AI/ML technology and its benefit, level of knowledge about the technology in refinery, investment plan for implementation, and possible challenges in implementation. The study is conducting survey in Indian Oil Corporation Limited (IOCL) and Bharat Petroleum Corporation Limited (BPCL), Hindustan Petroleum Corporation Ltd. (HPCL) and other refineries to understand the current challenges they face, and the most suitable aspects for disruptive AI/ML intervention. The study plans to utilize the vast stores of process-data collected over several years and stored by refineries, and use them to develop intelligent industrial setups. Currently the study is ongoing and expected outcomes of the study are to: (i) enhance overall visibility and efficiency; (ii) AI-powered optimization insights to improve refinery operations; (iii) Predictive analytics for proactive maintenance of critical and super-critical assets; automated spares-inventory management; and development of automated process-control Operator Training Simulators. The study will provide a detailed report consisting of analyses of discussions, hurdles that industries are facing in implementation and final recommendations. It is expected that such transition in industrial setups would maximize operational and managerial efficiencies, and drive down functional costs significantly.

2.5.4 A study on application of effective digital technologies for managing municipal waste (MSW) in smart cities: A case of Andhra Pradesh supported to Indian Institute of Management, Vishakhapattanam

The study titled A study on application of effective digital technologies for managing municipal waste in smart cities: A case of Andhra Pradesh has been supported to Indian Institute of Management, Vishakhapattanam with the objectives to (i) identify the relevant smart technologies for improving residential waste management in the smart city context; (ii) analyze the adoption of smart technologies (smart bin, smart truck, and smart disposal mechanism) for managing residential waste in the smart city context; (iii) to develop a technology adoption (practice) maturity decision framework for assessing the technology maturity of select smart cities. The study is still ongoing and expected deliverables include (i) identifying the weakest and strongest link of the digital technologies adoption in smart cities for managing MSW from a sustainability business perspective; (ii) highlighting the role of management theories in the development of a digital MSW technologies especially in smart cities for upliftment strategies for city livelihood improvement; (iii) exploring the role of digital technologies and circular approaches adoption for reducing the MSW; (iv) Implementation and verification of the decision model; application of proposed decision model to selected organizations for testing its applicability and performance during and after the duration of the project; (v) key recommendation for improving the residential waste management through greater adoption of digital technologies; (vi) Papers in scientific journals, brochures, and trade journals for dissemination of project outputs and encourage interaction between the academic and user communities.

2.5.5 Study of specific areas registering high failure rate of distribution transformers to analyze the cause of failure and suggest a solution to overcome this problem by applying IT technology and integrating it with metering solutions by PDPM Indian Institute of Information Technology, Design and Manufacturing Jabalpur, Jabalpur MP

The study supported to PDPM Indian Institute of Information Technology, Design and Manufacturing Jabalpur (IIITD&M) under the theme area 'Study of specific areas registering high failure rate of distribution transformers to analyse the cause of failure and suggest a solution to overcome this problem by applying IT technology and integrating it with metering solution'. The significance of the study lies in the restructuring of the power system, where distribution companies (DISCOMs) function autonomously. A majority of these DISCOMs experience consistent revenue losses. Among the critical issues faced by DISCOMs, the failure of distribution transformers stands out as a major contributor to revenue loss. This failure can be linked to various technical and operational factors. The objective of this study is to develop an artificial intelligence-based solution for the analysis and prediction of distribution transformers using metered data. The anticipated outcome of this project is to uncover the root causes of transformer failures in specific areas and reduce the incidence of such failures. The study aims to achieve the following objectives: (i) Collecting data related to transformer failures within a distribution area (DISCOM), (ii) Analyzing and interpreting the data to identify the primary causes of transformer failure, (iii) Identifying key parameters for potential remedial solutions, and (iv) Developing an information technology-based solution to minimize the rate of transformer failures. The study is currently underway, with two review meetings already held to evaluate the progress. The anticipated completion of the study is within the current financial year.

2.5.6 Studies on the implementation of stainless steel fabricated by additive manufacturing and computational forecasting technique for high temperature applications by Indian Institute of Technology Jammu, Jammu

The study supported to Indian Institute of Technology Jammu, Jammu was under the theme area 'Technology Foresight studies on Advanced manufacturing technologies for sustainable future'. The study is pertinent given the global shift towards green manufacturing, emphasizing the reduction of waste materials. Additive manufacturing emerges as a highly effective solution in this context. This technology enables the fabrication of structures with intricate geometry, ensuring high precision and the ability to tailor their composition. Its versatility is particularly crucial for the advancement of the Indian manufacturing sector. Additive manufacturing is currently applied in the powder-based production of stainless steel structures, predominantly utilized in the oil and natural gas sector. Consequently, there is a necessity for a study to investigate the potential of employing additive manufacturing to fabricate other grades of stainless steel and super alloys such as Inconel and Stellite across various sectors of the Indian manufacturing industry. This study is relevant given the established presence of additive manufacturing in the global market and its gradual integration into the Indian market. The objective of the study is to furnish a comprehensive report on additive manufacturing within the Indian context. This report will encompass insights into policies, forecasting, and diverse applications, outlining the trajectory for future developments in this field. The study aims to achieve the following objectives: (i) Implement the additive manufacturing technique for the production of stainless steel structures across diverse applications, (ii) Create intricate three-dimensional structures/products and explore their various applications, (iii) Conduct life cycle analyses of the products in different applications, (iv) Investigate the fabrication efficiency of stainless steel structures to enhance manufacturing and machinability, particularly for products widely utilized in the Indian market, (v) Analyze the performance and machinability of conventionally

manufactured stainless steel structures in comparison to those produced through additive manufacturing, (vi) Examine the behavior of additive-manufactured stainless steel structures in high-temperature applications using computational fluid dynamics software, and (vii) Propose policies for the effective fabrication of stainless steel structures, along with a reliability report on their performance in high-temperature applications, especially under conditions similar to those in India. The study is currently underway, with two review meetings conducted to evaluate the progress. It is anticipated that the study will be concluded within the current financial year.

2.5.7 Study on 'Development of new building materials using agricultural waste in India– A way forward' by IIT Kharagpur.

The study supported to IIT Kharagpur under the theme area 'Development of new building materials using agricultural waste in India– A way forward'. The study has its relevance to the fact that cement and steel, crucial for construction, contribute significantly to greenhouse gas emissions. To counter this, the study explores the recovery and utilization of new building materials from agro-industrial residues. This approach aims to offer an alternative to on-field stubble burning, evaluating practical options for achieving net-zero energy buildings. The proposed framework considers economic and environmental factors, aiming for efficient management of agricultural waste and contributing to the development of a circular economy and decentralized energy systems. This study aims to enhance decarbonization technologies in the built environment sector and prevent agricultural crop burning. It seeks to achieve this by embracing circular economy principles, promoting sustainable farming practices, and reducing greenhouse gas emissions. The study aims to assess agricultural waste management for recovering new building materials, quantify recovery potential, explore innovative approaches, identify optimal uses for agricultural waste in construction, and promote building material reuse to reduce dependency on natural resources. The anticipated benefits include rural growth, job creation, and the development of replicable models for sustainable waste management policies across Indian states. Improved technologies are expected to benefit both the built environment sector and various stakeholders, contributing to bio energy production and better water and air quality. The study is currently under progress and would finish in next financial year.

2.5.8 Study on "Smart Waste Management -Development of cost effective technology- study on Development of high strength and durable material which can be used as a Construction material by recycling the waste plastic" by Rajiv Gandhi University of Knowledge Technologies (RGUKT), Basar.

The study entitled **"**Smart Waste Management -Development of cost effective technology- study on Development of high strength and durable material which can be used as a Construction material by recycling the waste plastic" has been supported to Rajiv Gandhi University of Knowledge Technologies (RGUKT), Basar. The objectives of the study are to i) to study to prepare the study report of about 20-30 available technologies/procedures that convert plastic waste into construction related materials and ii) to develop methodology to attain high strength and durable material which can be used as construction material with reusing of waste plastic under different compositions and variety of base plastics. Methodologies for developing the high strength and durable materials using various compositions of the different materials and plastic waste (in various ratios) has been formulated. Under this study, an extensive literature survey, focusing on compression and bending strength in relation to plastic waste was carried out. This laid the groundwork for identifying key variables and establishing the project's direction. Determining limitations in existing technologies, particularly those converting plastic and solid waste into construction materials, provided crucial insights into potential challenges and opportunities. Methodologies for developing the high strength and

durable materials using various compositions of the different materials and plastic waste (in various ratios) has been formulated. This included successful execution of two cases with positive results through methodological studies. Two compositions have shown higher compressive strength in comparison to available reported data. The Comparative study of the developed composition with the existing technology material revealed that increasing PET in the mix enhanced compression strength, potentially reducing the need for bitumen in construction. Successful experiments, including a composite with 40% PET achieving 40 MPa compressive strength, demonstrated the viability of using waste plastic in construction. Under the study, a brainstorming meeting was conducted on October 20, 2023, at Environment Protection Training and Research Institute (EPTRI), Hyderabad. The brainstorming meeting sessions brought together representatives from significant stakeholders such as CSIR, NEERI, CRRI, NIIST, EPTRI, MoEFCC, TAAPMA and from companies Hydroxy Systems Pvt. Ltd.; Technical Cube Bio Energy Pvt. Ltd.; Re Sustainability Ltd and faculty members from RGUKT Basar. The study is beneficial as their will be reduction in reliance on traditional materials such as asphalt and cement is a positive shift, but a holistic examination is essential to account for potential environmental effects throughout the material's life cycle. The study is currently underway, with two review meetings already held to evaluate the progress.

2.5.9 Study on "Developing a framework for assessing innovation readiness, research intensity and technology resilience of firms" by ABV-Indian Institute of Information Technology and Management, Gwalior.

The study entitled **"**Developing a framework for assessing innovation readiness, research intensity and technology resilience of firms" has been supported to ABV-Indian Institute of Information Technology and Management, Gwalior. The objectives of the study are i. to analyses current state of innovation readiness in the Indian firms operating across manufacturing sector for adoption of Industry 4.0, ii). to examine the role of research intensity in enhancing innovation capability of the Indian firms operating across manufacturing sector for adoption of Industry 4.0), iii) to evaluate the role of technology resilience in managing emerging risks and the development of resilient innovation system in the Indian firms operating across manufacturing sector for adoption of Industry 4.0 and iv) to develop an integrative framework representing structural relationship between constructs of innovation readiness, research intensity and technology resilience. In this study, statistical validity of developed scales as well as fitness of the structural model will be assessed using data collected from various industrial contexts in India. Multivariate data analysis method, namely, structural equation modeling will be used for data analysis. Collecting the information has been initiated and in progress. Under this study, work has developed scale for measurement of innovation readiness, research intensity and technology resilience. Assessment of current status of innovation readiness, research intensity and technology resilience in the Indian manufacturing firms is going on. Identification of barriers and enablers of innovation readiness, research intensity and technology resilience are also under exploration. Extensive interaction with top level managers and plant heads of various manufacturing firms has been conducted. In the face-

to-face discussions the potential role of emerging digital technologies in building competitiveness of firms has been deliberated. It emerges that Innovation is regarded as key to survival and performance enhancement. An integrative framework representing structural relationship has been developed. Scales for measurement of innovation readiness, research intensity, technology resilience leading to production system excellence were developed using review of literature and interrelationship among constructs was developed using multivariate data analysis approach of Structural Equation Modeling (SEM). Perception based data was measured on interval scale such as five-point Likert scale. Out of targeted 500 respondents, 227 valid responses were received. Indicative organizations from where data were collected are: Suzuki, Hero (Gurugram), Tata Motors (Lucknow), Hindustan Aeronautics Limited (HAL) (Lucknow), Ordinance factories at Kanpur, Jabalpur, JK Tyre, Godrej, Bharat Electronics Ltd., Cochin shipyard Ltd., Rail Coach Factory Kapurthala, Bharat heavy electrical limited (BHEL) Bhopal etc. Findings are expected to provide evidence-led strategic roadmap for operationalization of Industry 4.0 and developing competitiveness in the Indian manufacturing organizations. The study is currently under progress and would finish in next financial year.

2.5.10 Study on "Techno-commercially Optimized Waste Management System Based on SMART Trash Bin" by Academy of Technology, Aedconagar, Adisaptagram, Hooghly, West Bengal.

The study entitled **"**Developing a framework for assessing innovation readiness, research intensity and technology resilience of firms" has been supported to Academy of Technology, Aedconagar, Adisaptagram, Hooghly, West Bengal. The objectives of the study are i) to provide an innovative, real-time solution to waste management that is commercially viable for all stakeholders, ii) to design an effective solution that addresses the challenges identified in existing technologies for waste management developed in academic institutions, research laboratories and industries (MSME/Startup) in India, iii) to develop a SMART trash bin based working prototype capable of collecting, monitoring, and facilitating the transfer of household waste from residential complexes for subsequent recycling and toxicity neutralization and iv) to develop an innovative sustainable technology-driven solution for commercial production that policymakers may feasibly market to the manufacturing industry, especially MSMEs. In this study, data collection and literature review on waste management has been done. The approach and methodology of the study and operational steps of the proposed prototype model have been defined. A questionnaire on waste management has been prepared and circulated among stakeholders. Interaction meeting held with the official of Bengal Pollution Control Board, Department of Environment, Government of West Bengal to collect the information and present status of waste management in West Bengal. The field visits to Bansberia Municipality and Chandannagar Municipal Corporation have been undertaken to understand their existing process of solid waste management. The primary development of a prototype model of the proposed waste management for residential or commercial buildings is completed. The testing of sensors and performance analysis of the developed prototype model is in progress. The study is currently under progress and would finish in next financial year.

2.5.11 Study on "Indigenous Development of Membranes for Sewage Wastewater Treatment to Promote its Recycling and Reuse" by The Energy And Resources Institute (TERI), New Delhi.

The study entitled **"**Indigenous Development of Membranes for Sewage Wastewater Treatment to Promote its Recycling and Reuse" has been supported to The Energy And Resources Institute (TERI), New Delhi. The objectives of the study are i) to assess the techno-commercial status of the different indigenous membrane technologies in sewage wastewater treatment, reuse and recycle ii) to assess the efficiency and cost-benefit of different

indigenous membranes in sewage wastewater and reuse in comparison to imported membranes iii) status of indigenous membrane based wastewater treatment technology developed by research academics, industries, and MSMEs iv) Gap analysis and status report on indigenous membrane system developed for sewage wastewater recycling and reuse. Under this study, initially the stakeholders from National institutes, Universities, membrane manufacturing MSMEs and Start-ups and end users were identified to explore the field level commercial status of indigenous based membrane wastewater treatment technology. In-order to identify the actual status of the indigenous membrane technology and its commercial scale application, the questionnaire have been developed and received response from different level of stakeholders in the different stages of development in the scale of Technology Readiness Level (TRL). Visit undertaken to the identified membrane manufacturing industries to know the status of Indian membrane based wastewater treatment technologies. The first stakeholder consultation and Brain Storming sessions were conducted on 30th November 2023 at TERI, New Delhi on Indigenous Development of Membranes for Sewage Wastewater Treatment to promote its Recycling and Reuse. The experts from different organizations including IITs, Research Institutes, Start-ups and MSMEs working in the area of membrane based wastewater treatment provided valuable outcome on development in the sectors, research and commercialization gap and opportunities. Further it is planned to conduct field visit, and stakeholders meeting in different region of India and sector expected to reveal the actual data of indigenous membrane based wastewater treatment, reuse and opportunities. The study is currently under progress and would finish in next financial year.

2.5.12. Study on "A study report on research on indigenous development membranes for hospital waste water treatment in India to promote its recycle and reuse" by Department of Computer Science & Engineering (CSE), SRM University, Sonepat, Haryana

The study entitled **"**A study report on research on indigenous development membranes for hospital waste water treatment in India to promote its recycle and reuse" has been supported to Department of Computer Science & Engineering (CSE), SRM University, Sonepat, Haryana. The objectives of the study are i) to study the existing indigenous membranes and technology for filtering antibiotics and pathogens found in the hospital waste water (HWW), ii) to study the capabilities of existing membranes in India for handling toxic chemicals, waste and bacteria in HWW to promote its recycle and reuse, iii) to find out the best indigenous solution for HWW in India and iv) to prepare a gap analysis report for HWW treatment in India on the basis of our study. Collecting the Information in regards to indigenous membranes and technology for filtering antibiotics and pathogens found in the hospital waste water has been initiated and in progress.

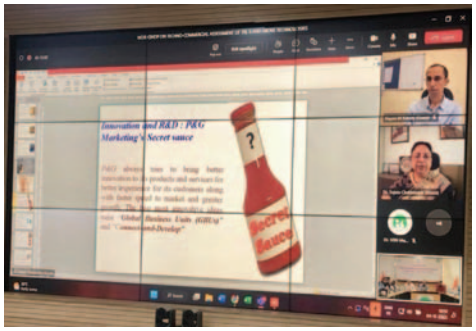
2.5.13 Water Technology: "Techno-commercial Assessment of TRL-6 & above Technologies developed in India in Academia, Research Lab & Industry" by ICCW, Chennai.

The Study entitled "Techno-Commercial Assessment of TRL-6 & above technologies developed in India in Academia, Research Lab & Industry" has been granted to ICCW, Chennai aiming to scout TRL 6 and above level technologies in the sector and identifying various challenges and gaps in commercialization & prescribe solution to government technology Developer & commercial entities. Objectives of the study are: (i) Identification of gaps in implementation of emerging water purification technologies above TRL 6 level for eliminating contamination of drinking water due to fluoride, arsenic, nitrate, iron, coliform bacteria and reduction of total dissolved solids or salinity, (ii) Develop action plans for minimizing gaps to ensure effective implementation. A visit to various hotspots in West Bengal, Punjab and other parts of country wherein the content of Arsenic, nitrate, Flouride, Chloride dissolved solids in drinking water were planned high and further plan to identify & map technologies specific to each containment

& geographical location. As it is an on-going project they plan to conduct 2-3 stakeholders meetings for technology Scouting & assessment to understand the challenges barriers being faced for commercialization of water purification technologies at tRl-6 & above levels. The objective of the meetings is to identify the various issues, challenges, and opportunities of drinking water purification technologies on its technology readiness levels. The Stakeholder Meetings planned would be utilized to achieve the following: (i) Scout for a list of technologies, (ii) Identify the issues, gaps, challenges and recommendations for improvements in the existing commercial technologies. Understand perspectives from technology/service providers, experts, consultants, start-ups, investors, donors, community, NGO, Panchayat, Municipal administration, and Government. The Validation of technologies is: (i) The selected technologies would be visited to understand the ground realities of its operational efficiency using Assured matrix, (ii) Identify opportunities for improvement and gaps in maturity levels required.

2.5.14 Study on "Techno-commercial assessment of TRL-6 and above technologies developed in India by academia, research labs and industry" by Technology Information, Forecasting and Assessment Council (TIFAC), New Delhi.

The study broadly aims at (i) evaluation of the technology readiness level of the technologies in the domains of Chemicals and Pharmaceuticals, Medical Sciences and Health care (ii) analyzing the issues, barriers and challenges in technology transfer/licensing for commercialization. As a part of the study, a questionnaire has been designed and circulated towards scouting of technologies developed by the research labs, academia and startups. Three workshops have been conducted at CSIR-IICT Hyderabad where 11 technologies, CSIR-IICB Kolkata where 12 technologies and NIPER Guwahati where 15 technologies were presented by PIs and discussed. Assessment of the technologies is under process. Issues, barriers and challenges being faced by labs and academia for transfer/licensing of technologies towards commercialization were discussed among panelists during the workshops to capture optimal and sustainable solutions. The study targets at compiling information on approximately 100 technologies at TRL6 and above in the identified domains in the form of a compendium towards necessary policy interventions by the Government.



Experts talk during workshop

2.5.15 Study on "A Study of the Usability and Accessibility of Various ICT Tools related to English Language Speaking and Reading Skills of Children with Autism Spectrum Disorder (ASD)" by MNIT Jaipur.

The Study entitled "A Study of the Usability and Accessibility of Various ICT Tools related to English Language Speaking and Reading Skills of Children with Autism Spectrum Disorder (ASD)" has been granted to Malaviya National Institute of Technology Jaipur. The objectives of the study are: (i) To identify existing ICT tools available for children with autism and analyse current integration of ICT tools (ii) To conduct a study in schools, NGOs and concerned professionals to understand the challenges faced by Autistic children (iii) To review various mobile applications, websites, AR/VR devices available in the market to facilitate the teaching-learning process for autistic children (iv) To recommend necessary improvements in the existing ICT tools. To achieve the objectives of the project, a parallel study is going on which focuses on the surveys to collect data pertaining to the themes of ICT tools and autism spectrum disorder along in children with a comprehensive literature review on

the similar themes. They have visited around 10-12 schools, NGO and Child development centres in Jaipur, New Delhi, Noida, Udaipur, Ajmer and Pushkar such as Shining Star Child Development Center, Udaipur, Swar Speech and Hearing Clinic, Jaipur (Speech Pathologist), Umang School (Jaipur), Sunrise Learning: Special School for Persons with Autism, Noida and Karn Jiva Child Development Centre. Based on the interactions with the professionals and literature review, a questionnaire was designed. They have collected 18 responses till now from various Occupational therapists, Speech Pathologists, Special education teachers, Clinical Psychologists and Physiotherapists based on the technique of random sampling. The approach and plan of action and execution of the study are in alignment with the objectives of the study. The researchers associated with the project have complied secondary data on the similar themes from Scopus and Web of Science database to help understand the growing scholarship around the themes of ICT tools and autism spectrum disorder. The data is being complied ranging from 2010-2023 from these databases to analyze the trends and strategize further studies. To further discuss how ICT tools influence the teaching-learning process of children with Autism, a paper titled "An Analysis of ICT Based Teaching-Learning Tools for Children with Autism Spectrum Disorder" was presented in an IEEE sponsored conference- International Conference on Multidisciplinary Research in Technology and Management, organized by New Horizon College of Engineering, Bengaluru, Karnataka, India from 22nd -23rd September 2023. The paper identifies 24 ICT tools such as mobile applications, websites, and AR/VR devices used to help autistic children. The paper will also suggest guidelines or features these tools should follow to facilitate the teaching-learning process for ASD children. The paper is under the publication process and will be soon released as part of the conference proceedings. As far as the future directions of the above study are concerned, a detailed systematic literature review paper is under development which includes the exploration of the keywords associated with "Accessibility" and "Usability of the ICT Tools" in a Scopus-indexed journal. After collection of considerable responses based on the questionnaires, a pilot study have been planned to record the responses of various stakeholders in designing various ICT tools for children with autism spectrum disorder (ASD). By the end of the project a combined report will be complied based on the surveys conducted and the literature review to recommend various stakeholders such as policy makers, practitioners, educators, engineers to help them design ICT tools catering to the needs of children with autism spectrum disorder.

2.5.16 Technology Readiness Assessment of TRL-6 and above Technologies developed in India in Academia, Research labs and Industry by IIT Jammu

To address the technology readiness in the field of material and manufacturing and the academia-industry gap, a study was undertaken by IIT Jammu in collaboration with IIM Jammu supported by DSIR (Govt. of India) to assess the technology readiness level of new technologies in the Materials and Manufacturing sector and evolve measures to encourage and support start-up businesses. The major goals of this study, with involvement from various Industries, CSIR labs/Academia across the country, are Scouting, identification and tracking of TRL6 level technologies in the material and manufacturing sector, To identify and assess technologies demonstrated successfully and unproven ideas, and amplify the transparency of decisions in development of new technologies, Establish the methodology of technology readiness assessment that can be used for evaluating technology maturity, Connecting stakeholders with technology developers for successful awareness implementation, Delivering and documenting the importance of technology translation and addressing the complications and challenges encountered in Technology translations.. Among the respondents participated, 40.4% were from the R &D labs, 34.5% were from IITs, 16.7% were from Pvt Universities and 8.3% were from Industry/MSMEs.

The major outcomes of the work include:

- Paper entitled "Technology Readiness: An Indian Snapshot of advanced composites and the Frontiers for Development in Strategic Applications" presented in the 35th National Convention of Aerospace Engineers and National Conference on Smart Materials and their application in Aerospace Industries 25-26 November 2022.
- Paper titled "Enabling Smart Manufacturing: A Preliminary Mapping for technology transfer from Academia to Industry" presented in the International Conference on Advances and Creations in Mechanical Engineering 2022 (ICACME 2022) is hosted by the Department of Mechanical Engineering, Savitribai Phule Pune University.
- Paper entitled "Future Production -Development of sustainable Industry-Academia Technology Transfer Models" presented in the 1st International Conference on Industry Focused Research– TEC 2023 by DST-Technology Enabling Centre (TEC), Punjab University, Chandigarh and Confederation of Indian Industry (February 24-25, 2023)
- Conducted Workshop on Advances in the composite product, process, and systems-Technology Readiness Level in Indian Context (01-02 Sep. 2022) at IIT Jammu
- Conducted Workshop on Industry 4.0 Implementation and Practices- Readiness in Indian Context (15-16 Dec. 2022) at IIT Madras

2.5.17 A report on ICT tools catering to wide range of learners, including children with special needs by Symbiosis Institute of Management Studies, Symbiosis International (Deemed University), Pune, India

The study entitled "A Report on ICT Tools Catering to Wide Range of Learners, Including Children with Special Needs" has been granted to Symbiosis Institute of Management Studies, Pune. The objective of the study is to assess the awareness, identify challenges, and explore commercial opportunities for integrating ICT tools designed for children with visual impairment in government, government-aided, and private higher secondary schools. This is an ongoing study and is expected to be complete earlier 2024.

The study covers five States of Western India namely, Maharashtra, Gujarat, Goa, Daman & Diu, and Dadra & Nagar Haveli. The study is based on the research idea of identifying special need of visually impaired students and preparing the list of technological tools to address these special needs of this dedicated group of students. Further, the study identifies the status of availability of these technologies along with their manufacturers and pricing and scope of improvement in existing technologies / tools and development of new technologies.

The project team conducted a three hours long Focus Group Discussion (FGD) on 13th May 2023 to explore various dimensions of the problem addressed in this study. The participants in FGD include all the relevant stakeholders including teachers teaching VI students, VI students, legal experts, coordinators of academic institutions centers catering to students with special needs among the others.

The project team's comprehensive field survey and interactions with NGOs specializing in visually impaired (VI) student support reveal distinct educational requirements of these students at various levels of their academic journey. These include the need for Braille learning resources, mathematics tools, tactile diagrams, and essential tools like OCR, screen readers, and Braille printers. The study underscores challenges in accessing specialized books, especially Indian editions, and highlights the critical need for teacher training and sensitization. It was found that private schools are more aware of ICT tools than government-aided ones, influencing the quality of education for VI students. Particularly in rural areas, there are significant barriers to accessing ICT resources, compounded by language obstacles. The study points out the inadequacy of

financial support for these essential tools and a general lack of awareness about their availability. It suggests adopting technologies like Bookshare and transportation apps to enhance support for VI students, stressing the importance of making government websites and educational materials more accessible to meet their unique needs.

2.6 Outreach Activities:

Department successfully conducted a Sangoshthee on "ICT Tools for School Education - Current Status & Emerging Trends" on 6th September 2023 as part of the A2K+ (Support to Study) programme of DSIR. This initiative aimed to foster in-depth discussions among key stakeholders, including experts from NCERT, IGNOU and other organisations. The primary focus was to gather insights on how the outcomes of the DSIR supported projects, within the thematic scope of the Sangoshthee, can be taken forward so that it reaches the intended audience/ stakeholders.

The primary objective was to facilitate robust conversations that would guide the progression of project outcomes, involving Project Investigators (PIs) of A2K+ supported studies. The event specifically delved into exploring the transformative impact of emerging Information and Communication Technology (ICT) tools on the education landscape and to identify strategies for advancing the outcomes of the studies funded under A2K+ Studies programme.

The programme Division has documented the event in the form of 'Proceedings' for comprehensive record of the presentations, discussions and outcomes, serving as a valuable resource for disseminating the information exchanged during the event.

3.0 A2K+ Events:

The Access to knowledge for Technology Development and Dissemination (A2K+) Events programme of DSIR provides a platform for exchange of views among industry, consultancy organizations, academic and research institutions that would lead to useful insights on issues relating to industrial research and technological innovation and help in evolving tools and techniques to remain competitive in today's business climate.

The objective of A2K+ Events program is to support the organization of workshops, interactions, training programmes, exhibitions and other events for identification of collaborative projects between academia, institutions and industry participating in the events.

During the period under report, seven meetings of the Technical Advisory Committee (TAC) were organized. TAC recommended one event in December 2022, four events in February 2023, two events in May 2023, three events in August 2023, seven events in September 2023, five events in November 2023 and two events in March 2024 for support under A2K+ Events scheme.

Events approved for support under A2K+ Events:

S. No.	Title of Event	Name of Agency
1.	CRISPR/Cas-based Plant Functional Genomics and Computational Modeling	CSIR-North East Institute of Science and Technology (CSIR-NEIST), Jorhat, Assam
2.	Current Technologies and Opportunities in Bio-Sciences	College of Agriculture, Karekere, Hassan, Karnataka
3.	National Deftech Summit : Reimaging the foundation for self reliance in the defence sector	The Southern India Chamber of Commerce and Industry, Chennai
4.	International Conference on Nanotechnology for Better Living-NBL-2023	National Institute of Technology Srinagar, Jammu & Kashmir

5.	Conference on Women in Academia, Research and Management of Food Safety and Toxicology (WARM-FOST)	CSIR-Indian Institute of Toxicology Research (CSIR-IITR), Lucknow, Uttar Pradesh
6.	National conference of Gau-Vigyan in modern life and medical science	Indian Institute of Technology Guwahati, Guwahati
7.	Smart and Innovative Development in Science, Engineering & Technology	Bhilai Institute of Technology, Durg, Chhattisgarh
8.	National Conference on Medicinal Plants, Natural Products and Indian system of Medicine	V Sivaram Research Foundation, Bengaluru
9.	National Symposium on Crosstalk Between Animal Research & Alternatives" NSARA 2023, & one day training cum workshop on laboratory animal science & alternative tools	CSIR-North East Institute of Science and Technology (CSIR-NEIST), Jorhat
10.	International Conference on Petroleum, Hydrogen and Decarbonization (ICPHD) 2023	Indian Institute of Technology Guwahati, Guwahati
11.	International Conference: Advancement in Sustainable Materials for Energy and Environment (ASMEE-2022)	Central Institute of Petrochemicals Engineering & Technology (CIPET), IPT, Raipur
12.	National Conference: Sustainable and Emerging Technologies for Food Safety and Environment Toxicology (SET-FEST)	CSIR-Indian Institute of Toxicology Research (CSIR-IITR), Lucknow
13.	National Seminar & Exhibition: 10th Convention of Society for Ethnopharmacology, India cum National Seminar on "Ethnopharmacology for Bio-economy: The New Para digm "(EBNP-2023)	CSIR-North East Institute of Science and Technology (CSIR-NEIST), Jorhat
14.	National / International Conference: Sustainable Energy and Environmental Challenges (SEEC)	Malaviya National Institute of Technology Jaipur
15.	International Conference: 9th International Food Convention (9th IFCoN-2023)	Association of Food Scientists & Technologists (India), Mysuru
16.	International Conference: 9th International and 30th All India Manufacturing Technology, Design and Research Conference (AIMTDR 2023)	Indian Institute of Technology (BHU), Varanasi
17	National Conference: Recent Technologies and Innovations in Electronics and Photonics: Towards "Atmanirbhar Bharat"	Dr. Vishwanath Karad MIT World Peace University, Pune
18.	International Exhibition: International Conference & Exhibition on "Aerospace and Aviation in 2047" Organized by Aeronautical Society of India on the occasion of completion of 75 years.	Aeronautical Society of India (AeSI) and CSIR jointly with AeSI
19.	Regional Workshop: Workshop cum Training on "Making value added products using CSIR technologies in Andaman region".	CSIR-National Institute of Science Communication and Policy Research (CSIR-NIScPR)

20.	International Conference: "Emerging Trends and Innovation in Biotechnology"	Mar. Athanasios College for Advanced Studies, Tiruvalla, Kerala
21.	International Conference/ Training/ Exhibition: 17th International Conference on Polymer Science and Technology (SPSI-MACRO-2023)	Indian Institute of Technology Guwahati
22.	International Conference: 1st International Conference on AI for 5G & IoT Applications.	Noida Institute of Engineering & Technology (NIET), Greater Noida
23.	National Hackathon: KRIYETA 2.0, 48 Hrs Hackathon	Acropolis Institute of Technology and Research, Indore, MP
24.	International Conference: "BIOTECH NEXUS 2024: Recent advances in Biotechnology and Biomedical Sciences"	Suresh Gyan Vihar University, Jaipur

The following events were organized during the period under report from 2023-24:

1. "International Conference on Recent & Future Trends in Smart Electronics System & Manufacturing" was organized by Symbiosis Institute of Technology, Pune from 01.12.2022 to 03.12.2022. The conference aimed in creating awareness about latest trends and scope in the field of smart electronics manufacturing technology. Further, it addressed the need of fostering research & innovation in both academic institutes and Industries resulting in strengthening of technology development and competitiveness in Smart Electronics System & Manufacturing. Also forged strong collaborative research network of industry, academics and consultancy and research organization to march ahead with newer technologies.

2. "International conference on Biotechnology sustainable Bioresources & Bioeconomy" was held from 07.12.2022 to 11.12.2022 which was organized by Indian Institute of Technology, Guwahati. The conference brought together students, researchers, scientists from North-East academic institutes, parts of India & overseas. Also, participants were from private institutions and research organizations and entrepreneurs. It also effectively addressed & disseminated information on Biotechnology, Bioresources & Bioeconomy of North-East India among Scientific Community, Universities, Industries and provided an overview of different applications. The conference sensitized about the importance of sustainable Bioresources and also the necessity of having a local centre for building local organizations catering to the needs of North-East.

3. "National Conference on Business Sustainability and SDGs" was organized by PHD Chamber of Commerce & Industry (PHDCCI), Delhi on 09.12.2022 at PHD House, New Delhi. The Conference provided a leading platform for the researchers and industry stakeholders to interact and discuss the need and urgency to adopt sustainability and SDGs in business models. It also created awareness among various business owners, investors and other stakeholders through case study pertaining to sustainability and SDGs in Indian context. Further discussion was carried out on the regulatory frameworks on the sustainability landscape for India and across the globe and various initiatives taken by central, state governments and authorities in fostering sustainability. Methods to help in fostering innovative ideas for stakeholders through deliberations, experiences and ideas, by successful players and policy makers were successfully carried out. It fostered collaboration between different societal, environmental and economic players for facilitating sustainable development.

4. "8th International Congress on Computational Mechanics and Simulation (ICCMS 2022)" from 09.12.2022 to 11.12.2022 was organized by Indian Institute of Technology (IIT) Indore, Indore. The conference was planned to create a stage for sharing the latest advancements in computational research, new ideas and exchanging the new simulation techniques for complex physical phenomenon. Further, ICCMS 2022 provided an effective platform for inspiring international and interdisciplinary exchange at the forefront of Computational Mechanics.

5. "III International Conference on Advancements in Automation, Robotics & Sensing (ICAARS-2022)" from 09.12.2022 to 12.12.2022 was organized by Department of Robotics, & Automation Engineering, PSG College of Technology, Peelamedu Coimbatore, Tamil Nadu. The conference on Advancements in Automation, Robotics & Sensing (ICAARS 2022) brought together leading academic scientists, researchers and research scholars to exchange and share their experiences and research results about all aspects of Robotics, Automation and Sensing. It also provided the premier interdisciplinary forum for researchers, practitioners and educators to present and discuss the most recent innovations, trends, and concerns, practical challenges encountered and the solutions adopted. It also covered topics to foster institutional capacity and to enhance existing knowledge in the field of robotics. The ultimate aim of the conference was to bring advances in technology to India and establish India as a supplier in global scale. The conference hosted in India was structured to provide many opportunities for participants from all over the world to form professional networks and to learn through active participation.

6. "Net-zero Emission Technologies for Sustainable Development: Challenges and Opportunities (N0ET - 2022)" from 12th -13th December 2022 was organized by IIT(ISM) Dhanbad to understand the current national and global scenario of carbon emission, techno-economic challenges for reducing carbon footprints in rural as well as urban areas, possibilities/ feasibilities for sustainable low-to-zero carbon solutions, and opportunities for the development of indigenous technologies to mitigate climate change. The event was attended by 210 participants from industries such as TEXMiN Foundations- India, NTPC, Reliance Industries Ltd, Schneider Electric-India, and Maithon Power Ltd and academia such as Chalmers University of Technology-Sweden, University of Alberta, Instituto de Ciencia De Materiales de Barcelona (ICMAB-CSIC), IITs and R&D centres like NCL Pune, CSIRCIMFR, CSIR-IMMT, CSIRO Australia, etc. The outcomes of the event were: i). A fruitful collaboration/ MoU between IIT (ISM) Dhanbad and industries such as IOCL, BPCL, CIL, HPCL, Reliance, Tata Steel, Schneider Electric systems India Pvt. Ltd., and other industries; ii). Research collaborations with top academic institutions and research organizations (public/private) to work on projects related to emission control and climate change mitigation; iii). Creation of a worldwide network of experts working on sustainable development through climate change mitigation; iv). Creation of a common platform for knowledge sharing among experts working in the area of 'Clean Energy Innovation', 'Carbon Capture, Utilization and Storage (CCUS)', 'Hydrogen Production, Storage and Utilization', 'Energy Storage System', and 'Solar Energy System'; v). Detailed technical discussions on state-of-the-art technologies related to emission control to achieve net-zero goal; vi). Creation of awareness on collective responsibility; vii). Discussion on the future roadmap for achieving net zero emission through technological advances and policy changes and viii). Publication of conference papers in reputed proceedings.

7. VII International Conference on "Sustainable Energy and Environmental Challenges (SEEC)" was organized by Department of Chemistry, Indian Institute of Technology (BHU), Varanasi, from 16.12.2022 to 18.12.2022. This conference aimed towards promoting research and outreach programs in India and abroad through scientific deliberations like technical presentations, keynote addresses,

panel discussions, oral and poster presentations. The conference brought together engineers, scientists, researchers, students, managers, and other professionals to address and discuss emerging sustainable energy and environmental issues. This conference covered the important research areas related to energy, the environment, and biotechnology, which benefitted the researchers, academicians, students and Industry. The participation of faculty and researchers from different IITs, NITs, and other reputed institutes of India and abroad provided an interactive platform for the students and faculty members. Around 300+ national participants and 50+ participations from abroad participated in the event.

8. International Seminar and Workshop on "CRISPR/Cas-based Plant Functional Genomics and Computational Modelling (ISWCPC-2023)" from 17-21 January 2023 was organized by CSIR-North East Institute of Science and Technology (CSIR-NEIST), Jorhat, Assam. The conference aimed to promote research and outreach programs through scientific deliberations such as plenary talks, panel discussions, and presentations. The objective of the seminar and workshop was to aid the understanding of the nuances of this cutting-edge technology, many scientists presented detailed talks and delivered hands-on training to the young minds. Both the conference and the workshop were intended to accomplish the following goals: i) To provide a platform for sharing the knowledge and expertise of distinguished speakers and resource persons from India and abroad in different areas of Genomics, Computational Biology and Data Science, Systems and Synthetic Biology, CRISPR/Cas Genome Editing Technology, and CRISPR Therapeutics; ii) To create an opportunity for young researchers and students to gain training and hands-on expertise in the application of advanced molecular biology and functional genomics tools such as Next Generation Genomics, Computational Modeling and CRISPR/Cas genome editing; iii) To strengthen the R&D and capacity building of CSIR-NEIST, and North East Region (NER) of India in these areas through collaboration with research institutes, Biotechnology based Industries, and start-up establishments that will take part in the event; iv) To provide an opportunity for young and aspiring entrepreneurs to interact and listen to the know-how of entrepreneurship from mentors of Biotechnology Industry and start-up establishments. The event was graced by esteemed Chief Guest and thirty other eminent speakers and resource persons from India and abroad to address about 400 participants, both offline and online. The esteemed dignitaries released the souvenir of ISWCPC-2023 as well as a CRISPR/Cas-based genome editing book that was an effort of the Director, CSIR-NEIST. Two days (18-19 January 2023) of the event were devoted to the technical session of the seminar with deliberations by the invited speakers on the thematic areas of CRISPR/Cas-based computational modeling and Genomics, CRISPR/Cas-based computational modeling, genomics, and biotechnology, Biotechnology-based Entrepreneurship/ Industry prospects in India and CRISPR/Cas-based plant genome editing. This was followed by the two-day's workshop (20-21 January 2023) that was meticulously designed to dissipate maximum knowledge related to the computational aspect of CRISPR/Cas technology which included the selection of a target gene, guide RNA design, analysis, and interpretation of editing data; and Functional Genomics that included the CRISPR construct designing and Agrobacterium-mediated plant transformation; and Sanger sequencing and NGS data analysis. Various instruments were demonstrating to the participants during workshop. The event concluded with valedictory remarks by Director, CSIR-NEIST, Jorhat.

9. Conference on "Women in Academia, Research and Management of Food Safety and Toxicology (WARM-FOST)" from 24.02.2023 to 25.02.2023 was jointly organised by CSIR – Indian Institute of Toxicology Research (CSIR-IITR) Lucknow in association with Association of Food Scientists and Technologists (India) (AFSTI) Lucknow Chapter. The conference was attended by more than 200 participants and around 25 women

leaders from various fields of academia, research and management, & entrepreneurs. The session covered all aspects of women in Academia, Research and Management of Food Safety and Toxicology and success stories of women from farming to corporate sectors. The panel discussion on National Conversation on WARM, deliberated on motivation to choose STEM as career, avail the resources & opportunities, and subjects such as gender equality and entrepreneurship were discussed at length. WARM-FoST inspired and inculcated enthusiasm & the spirit of leadership and togetherness in the young minds of future.

10. "International Conference on Current Technologies and Opportunities in Biosciences (CTOB-2023)" was held from 27.03.2023 to 29.03.2023 and organized by Department of Biotechnology, College of Agriculture, Karekere, Hassan, Karnataka (College Under University of Agricultural Sciences (UAS), Bangalore). The conference brought together students, researchers, scientists, entrepreneurs, start-ups, industry, academic institutes from various parts of India & Overseas. Also, participants were from private institutions and research organizations and entrepreneurs. It also effectively addressed & disseminated information on Plant Biotechnology, Animal Biotechnology, Microbiology, Molecular Biology, Bioinformatics, Remote-Sensing in Agriculture & Forestry, Usage of Drones in Agriculture, AI in agriculture from various parts of country, East Africa, Sudan, Egypt. The participation of researchers, scientists from the scientific community, universities, industries provided an overview of different applications in the Agricultural Biotechnology. The conference sensitized about the importance of use of newer & applied technologies in Biosciences.

11. "International Conference on Artificial Intelligence of Things" from 30th -31st March 2023 was organized by Chandigarh Institute of Technical Teachers Training & Research (NITTTR), Chandigarh. The workshop aimed to bring together leaning Academicians, Scientists, Researchers and Research Scholars to exchange and share their experiences and research on all aspects of Artificial Intelligence application in IoT in the field of Industrial and Consumer Electronics, Smart Grid and handling of Big Data. It also provides a premier interdisciplinary platform for researchers, practitioners, and educators to present and discuss the most recent innovations, trends, and concerns as well as practical challenges encountered and encountered and solutions adopted in the fields of AI algorithms implementation in IoT Systems. About 100 participants which were scientists, industry experts, scholars, attended the conference. Under the Conference, presentation was made by the research experts and scientists.

12. National conference of Gau-Vigyan (NCGV) in Modern Life and Medical Science from 20th to 21st May 2023 was organized by IIT Guwahati. The conference promoted sustainable socio-economic and agricultural systems for the new generation, with cows and traditional practises in focus. Cows and Gau-Vigyan are considered vital in India and Indian culture for their economic, religious, environmental, and nutritional importance. Over 200 participants, 60 papers, 25 invited lectures, 10 small and medium enterprises and farmers were part of this conference. Major institutes and colleges that participated were Ayurvedic colleges and hospitals, IITs, NITs, Central universities, National Dairy Research Institute, Veterinary research institute, agricultural universities and training centers. A special feature of this conference was that a number of farmers also attended and interacted with experts in local languages. Key talks included insights on the potential benefits of the urine of indigenous cows in the treatment of liver, stomach and skin diseases, along with the prevention of cancer. Urine of indigenous cows and bulls was presented as an immunomodulator. The production of A2 milk from indigenous breeds of cow and its health benefits was discussed. Health benefits of panchagavya therapies were outlined along with case studies. The presentations also highlighted the promising applications of cow dung in bioremediation and environmental clean-up. The usage of cow dung

as manure and coating agents for agricultural and storage applications, respectively, was reviewed.

13. International Conference on "Nanotechnology for Better Living NBL -2023" was organized by NIT Srinagar during 25-29 May 2023 at NIT Srinagar with a focus on breaking research ideas in nanotechnologies and to provide an interface between academia and industries, showcase their research and innovative ideas in nanotechnologies and contemporary area both in oral and poster form by the young scientists and scholars and nnetworking opportunities to participating delegates, particularly faculty about the thrust areas of research. Total 500 participants which included 10 International, 10 Industries, 70 Senior Scientists, 20 Scientists from IITs/NITs/IISERs, research scholars and students participated in the conference. The conference provided the platform to researchers and scientists across globe for interaction with subject experts of nanotechnology for Better Living. Also, this scientific gathering provided an ample opportunity to young students to learn about new inventions in this new and interdisciplinary field. The endeavor will put Jammu and Kashmir region into scientific map of the country and beyond.

14. The SIDSET-neist 2023 International Conference was organized by Bhilai Institute of Technology, AICTE IDEA Lab from 16.08.2023 to 18.08.2023. This annual conference fostered collaboration and knowledge exchange among academic scientists, researchers, and scholars. It highlighted Smart and Innovative Trends in Science, Engineering, and Technology, showcased IDEA Lab activities, and promotes national and international collaboration. The conference featured distinguished keynote speakers who shared insights into their respective fields, including Dr. Miroslav Langer (Technical University of Ostrava, Czech Republic), Prof. Sabriye (Doyurum) Yusan (Ege University, Turkey), Dr. Amitanshu Pattnaik (DRDO, Ministry of Defence), and Dr. Deepak Garg (Vice Chancellor, SR University, Warangal, Telangana).The three-day conference commenced with IDEA-FEST'23, a pre-conference workshop where approximately 150 students engaged in ideation and prototype building. The Ideation category saw 25 teams presenting their innovative ideas via poster presentations, while the Prototype category featured 20 teams demonstrating working prototypes designed to address real-world challenges. Evaluation parameters included creativity, feasibility, and real-world applicability. The participants from different parts of globe submitted a total of 160 research papers, with 77 papers selected for presentation after a rigorous peer-review process. These selected papers were further processed for inclusion in AIP Conference Proceedings. Over the course of the conference, two full days were dedicated to paper presentations across three different tracks, with a total of 50 papers presented on the second day and 27 papers on the third day. Each session commenced with a keynote address delivered by distinguished speakers. Outcomes of the International Conference SIDSET-23 were to provide: (1) A common platform, where academia, delegates from industry, and representatives from various Government, Private Universities & Institutions can showcase their innovative concepts and novel research conclusions under the global limelight, (2) A broader understanding of recent trends through professional keynote addresses, presentation and discussion sessions coupled with real-life practical applications, (3) A common forum for students, professors, researchers and industry professionals to socialize with one another and discuss new research, theories and developments in their field, (4) Delegates with major networking possibilities, which may lead to a range of profitable professional prospects.

15. "National Symposium on Crosstalk Between Animal Research & Alternatives" NSARA 2023, & One day Training cum Workshop on Laboratory Animal Science & Alternative Tools" was held at Department of Biological Science and Technology Division, CSIR-North East Institute of Science and Technology (CSIR-NEIST) Pulibor, Jorhat, Assam from 07.09.2023 to 09.09.2023. The conference was organized by CSIR-North East Institute of

Science and Technology (CSIR-NEIST) Pulibor, Jorhat-785006, Assam. The main objective of the conference was (i) To provide a platform for sharing the knowledge and expertise of distinguished speakers and resource persons from India and abroad in different areas of Animals in Research: Importance, Animals as Tool for Basic Research, New generation animal models in research, Alternative tools and application, Emerging scenario & Future prospects in animal research; (ii) To create an opportunity for young researchers and students to gain training and hands-on expertise in the laboratory animal handling and management; (iii) To strengthen the R&D and capacity building of CSIR-NEIST, and North East Region (NER) of India in these areas through collaboration with research institutes, Biotechnology based Industries, and start-up establishments that will take part in the event and (iv) To provide an opportunity for young and aspiring researchers to interact and listen to the mentors of Animal Research on laboratory animals as a tool for basic research, emerging scenario, alternatives and start-up establishments from academia, industry and research organization. The conference was attended by 273 participants, which includes 42 delegates, 6 keynote speakers, 17 speakers, 8 resource persons & 200 registered participants. The Symposium aimed at sharing and disseminating scientific information in the area of pre-clinical drug discovery and research using animal models as well as other alternative tool for biomedical research. This event encompassed salient observations, experiences and contributions made by researchers and laboratory animal professionals. Besides being serving as a platform for interactive discussions on animal research and experimentations, alternative to animal research with computational applications to rationalize the use of animals in research, the program was also beneficial for other stakeholders including animal welfare officers, IAEC members and the CCSEA personnel to revamp their thoughts on humane use of animals in research and testing and deduce a future road map to bring out refinement in methods and practices of animal research and ethics. The scope of the proposed symposium and training cum workshop had set a platform for the first time in North East India, to share the knowledge and expertise of distinguished speakers and resource persons in the areas of biomedical research involving animals as tools, available alternative methods as well as in-silico computational modeling and simulations to rationalize the animal usage in research. The National Symposium saw a significant contribution to the advancement of knowledge, collaboration, and growth in various fields.

16. National Conference on "Medicinal Plants, Natural products and Indian System of Medicine (NAMP)" was organized by V Sivaram Research Foundation, Bangalore at ICAR-Central Agroforestry Research Institute (CAFRI), Jhansi on 8th and 9th September, 2023. The theme of the conference was "Herbal Medicine in Health Care". The main objective of the conference was to provide a forum for the research scientist, traditional health practitioners, academicians, representatives from the medical and pharmaceutical industries, conservation biologist, biochemists, NGOs. Policy makers, farmers, Government agencies etc. to discuss and share the advanced information and experiences on NAMP 2023.

17. The International Conference on "Advancement in Sustainable Materials for Energy and Environment (ASMEE 2023)" from 6th-7th October, 2023 was organized by CIPET, Raipur. The conference promoted scientific information, interchange of research advances and technologies by addressing emerging trends and challenges for the generation of new ideas and establishing research and/or business links for progressive advances in sustainable material for energy and more importantly environment issues relevant to Sustainability in line with G20 theme. The conference covered total 2 no of plenary lectures, 20 no of invited lectures (including international speaker) 10 no. of oral session and 2 no. of poster sessions. 22 speakers from India and abroad addressed to the participants and shared their knowledge and rich experience in the field of

sustainable energy and environment. The conference implemented a rigorous peer-review process for all submitted manuscripts consequently 43 papers were chosen for oral presentations and 29 abstracts for poster presentations. Other than presenters 140 participants attended the conference as scientists, academicians, Industry experts, scholars.

18. A national Conference on Sustainable and Emerging Technologies for Food Safety and Environmental Toxicology (SET-FEST) was held from 12.10.2023 to 13.10.2023 at S H Zaidi Auditorium, CSIR- Indian Institute of Toxicology Research (CSIR-IITR), Lucknow. The conference was organized by CSIR-IITR, Lucknow in collaboration with The Association of Food Scientists and Technologists of India (AFSTI), Mysuru. The aim of this conference was a) To discuss the current challenges and cutting-edge solutions to sustainable practices in food safety and environmental toxicity, b) To provide a platform for researchers, academics, policy-makers, industry professionals, and students to exchange knowledge, share experiences, and advance their understanding of how emerging technologies can be effectively used to address the crucial issues in the area of food, environment, and public health, c) To bring in researchers and young entrepreneurs on a platform for inspiring young minds to venture into start-ups, d) To promote interdisciplinary collaboration between researchers, industries, and entrepreneurs to foster innovative approaches for achieving a sustainable future. The conference was attended by 246 participants from sectors such as academia, industry, research, and entrepreneurs. This includes researchers, technologists & academics (faculty and students) (140), Keynote, plenary, invited speakers & guests (60), industry sponsors (14), entrepreneurs and incubatees (12), host and collaborative organizers and volunteers (20). The conference aimed at exchanging of ideas, scientific collaborations, networking, and creating awareness about global challenges, such as food safety and environmental toxicology. This event encompassed salient observations, experiences, and contributions made by food technologists, nutritionists, environmental toxicologists, and entrepreneurs. This conference was a platform that focused on the detection of adulteration in food and contamination in the environment employing sophisticated mass spectrophotometry to AI-based detection tools such as i-tongue, i-nose, and e-nose; creating contamination databases; impact analysis on environment and health; bioinspired engineering; regulation and policy decisions, and improving nutritional efficacy of food and food products. This conference besides being a platform for the interactive discussions by young minds, technologists, and entrepreneurs in the multidisciplinary areas of food safety, toxicology, public health, technology, and entrepreneurship was also beneficial for stakeholders such as FSSAI, CPCB and MoHFW for laying out the future roadmaps with sustainable approaches to address food, environment and health issues. This conference has made a significant contribution to the advancement of sustainable technologies in the areas of food safety, nutrition, health, and food security.

19. International Conference on "Petroleum, Hydrogen, and Decarburization (ICPHD) 2023" from 03rd Nov. 2023 to 05th Nov. 2023 was organized by Indian Institute of Technology, Guwahati. The conference was aimed to – i) bring together students, researchers, academics and industry professionals under one roof to interact and discuss latest advancements, challenges and opportunities in petroleum, hydrogen, and decarbonisation; ii) provide a stimulating forum for scientific discussions, professional networking, research collaboration, interdisciplinary education and dissemination of the most recent scientific advances to academia as well as to the industries; iii) feature number of plenary sessions, keynote addresses, invited talks and contributed oral & poster presentations focusing on specific areas of petroleum, hydrogen, and decarbonisation to exchange the knowledge in global platform and iv) cater around 400+ participants (100 registration)

from various organizations, like IITs, NITs, CFTI and foreign universities, and from Petroleum Industries Like, OIL, ONGC, NRL IOCL, BPCL etc. The event was successfully organized by IIT, Guwahati.

20. "International Conference cum Exhibition on "Aerospace & Aviation in 2047" on the occasion of completion of 75 years" from 18.11.2023 to 19.11.2023 was organized by CSIR – National Aerospace Laboratories (CSIR – NAL)," jointly with AeSI at Yashobhoomi Convention Center, New Delhi. The Aeronautical Society of India has celebrated 75 years of excellence in aerospace through International Conference cum Exhibition on "Aerospace & Aviation in 2047" organized jointly by CSIR-National Aerospace Laboratories (NAL). The event focused to aim the future with excitement and anticipation, envisioning the advancements and innovations to shape the aerospace and aviation industries in the year 2047. This event has brought together industry leaders, experts, and enthusiasts from around the globe to discuss cutting-edge technologies, sustainable practices, and the limitless possibilities that lie ahead. The Hon'ble President of India Smt. Droupadi Murmu inaugurated the exhibition & conference as chief guest, presided by Shri. Jitendra Singh, the Hon'ble Minister of State (I/C) S&T, MoS PMO, MoS PPG&P, DoS & DAE. The event was delighted by the visionary talks from Shri. S Somanath, Chairman ISRO, Dr. N Kalaiselvi, Secretary, DSIR & DG-CSIR, and other pioneers in the field of aerospace from DRDO, HAL, MOCA and TASL. The session was chaired by Dr. V K Saraswat, Hon'ble member of NITI Aayog. The conference had spread over two days with technical sessions and panel discussions, competitions for startups and students. The conference concluded with Prize Distribution and address by Chief of Air Staff, Air Chief Marshal V R Chaudary. It was a glittering show at the exhibition with latest and cutting-edge technologies from ISRO, DRDO, HAL, CSIR, ADA, IAF, TASL, Adani Group and other industries. The exhibition has also witnessed the success stories high ambitions of startups. An appreciable fact is that free space and stall was offered to all startup participants to create an opportunity of collaborations. CSIR-NAL led the exhibition by representing CSIR in the field of aerospace and took along its sister labs, viz., CSIR-CMERI and CSIR-CGCRI. CSIR showcased RTA cockpit, which stood as the main attraction of the event while other aircraft models, viz, SARAS, Hansa-NG, apart from Wankel engine, NaviMet, SRV and special materials for radome. The event has facilitated and created an opportunity for the business deliberations and collaborations to be taken forward.

21. CSIR-North East Institute of Science and Technology (NEIST), Jorhat organized 10th Convention of Society for Enthno-pharmacology, India-cum-National Seminar on "Ethnopharmacology for Bio-economy: The New Paradigm" (EBNP-2023) from 28th - 30th November, 2023. The main objective of the Seminar was to promote the sharing of traditional knowledge from diverse cultures regarding the use of plants and natural resources for medicinal and economic purpose and explore the contribution of ethno-pharmacology on the development of a bioeconomy, which involves using renewable biological resources for various applications, including pharmaceuticals, cosmetics, food etc. Seminar provided a platform for researchers, scientists, and scholars to present their latest findings and advancements in the field of ethnopharmacology.

22. CSIR-National Institute of Science Communication and Policy Research (NIScPR), in collaboration with Unnat Bharat Abhiyan (UBA), Vijnana Bharati (VIBHA) and Jawaharlal Nehru Rajkeeya Mahavidyalaya (JNRM) jointly organized a two-day Workshop cum Training on **"Making Value Added Products Using CSIR Technologies in Andaman Region"** at Jawaharlal Nehru Rajkeeya Mahavidyalaya (JNRM), Port Blair, Andaman & Nicobar Islands, from 11-12 January 2024. The workshop aimed towards providing training and exposure to farmers, women Self-Help Groups (SHGs) and aspiring entrepreneurs, on various CSIR Technologies like making valueadded

products from Pandanus fruit using technology developed by CSIR-Institute of Himalayan Bioresource Technology (IHBT); Decentralized Solar Thermal Dryer for Hygienic Drying of Food Products developed by CSIR- Central Salt and Marine Chemicals Research Institute (CSMCRI), Dehumidified Dryer Technology by CSIR-NIIST Trivandrum and Managing Fungus Problems in Betel Nuts technology developed by CSIR-Institute of Himalayan Bioresource Technology (IHBT). The program also provided exposure to participants about CSIR AROMA & Floriculture Mission being managed by CSIR and various schemes of DSIR. They were briefed about how to write effective project proposals for applying for funding from Government Organizations like NABARD. Presentations were also made about various initiatives being undertaken under Unnat Bharata Abhiyan coordinated by IIT Delhi. In the concluding session Dr. Archana Singh, General Manager, NABARD, Port Blair, informed about the achievements of NABARD and its initiatives for rural development in various areas of Andaman & Nicobar Islands. The event witnessed an overwhelming participation of more than 90 local participants which included 5 members from Community Resource Persons (CRP) and 12 Self Help Groups (SHGs). The participation was dominated by young women aspiring entrepreneurs, SHGs, FPOs etc.

23. The International Conference on "Emerging Trends and Innovations in Biotechnology: Biospectrum-2023" was scheduled from November 30 to December 2, 2023, as the seventh biennial event in the BIOSPECTRUM series by Mar Athanasios College for Advanced Studies, Tiruvalla, Kerala. The conference was co-sponsored by Kerala State Council for Science, Technology and Environment (KSCSTE), Thiruvananthapuram, and co-organized by the Biotech Research Society, India, School of Biosciences, MACFAST, Centre for Energy and Environmental Sustainability, Lucknow, and the Biotech Research Society. The event provided the platform for addressing national challenges, fostering collaborations, promoting knowledge transfer, driving economic growth and developing policies. The objective of the conference was to serve as a platform for the global dissemination of cuttingedge knowledge, facilitating the exchange of ideas, networking and Awareness: About 200 participants from faculty, research scholars, student and others participated in the conference.

24. An international conference on "Sustainable Energy and Environmental Challenges" (SEEC 2023) was organized from December 4th - 6th, 2023, at the Malaviya National Institute of Technology Jaipur, India, under the auspices of the International Society for Energy, Environment and Sustainability (ISEES). The conference intended to promote high-quality research in the broad areas of energy, environmental, sustainability and biotechnologies through scientific deliberations. The SEEC-2023 bought together engineers, scientists, researchers, students, and other professionals to address and discuss emerging sustainable energy and environmental issues. 75 keynote addresses and invited talks were delivered by eminent speakers like Prof. Edgard Gnansounou, Prof. Emmanuel M. Papamichael, Prof. Susan Grace Karp, Prof. G D Yadav etc. from prestigious institutes all over the world. More than 200 delegates participated in the conference and presented their research. The conference was inaugurated on December 4th, 2023 by Dr. G. Satheesh Reddy, President, Aeronautical Society of India and Scientific Adviser to Raksha Mantri, Dr. V. K. Saraswat, Member of NITI Aayog, Prof. Avinash Kumar Agarwal, Chairman, ISEES, Prof. Ashok Pandey, General Chair, VIII SEEC and Prof. Dilip Sharma, Conference Chair, VIII SEEC. The function was presided over by Prof. N. P. Padhy, Director, MNIT Jaipur. The conference concluded with suggestions for sustainable development. The Valedictory session was chaired by Dr. Nalin Singhal, Chairman BHEL on December 6th, 2023.

25. "9th International and 30th All India Manufacturing Technology, Design, and Research (AIMTDR-2023)" from 8th to 10th December, 2023 was organized by Mechanical Engineering Department at IIT BHU, Varanasi. Under the

visionary theme, "Inclusive Manufacturing: A Paradigm Shift," the conference reshaped the narrative around manufacturing, placing a spotlight on its societal impact. The three-day extravaganza, marked by insightful sessions and vibrant cultural events, solidified AIMTDR's commitment to advancing manufacturing excellence. AIMTDR 2023, with its holistic approach, stands as a memorable milestone, setting the stage for inclusive manufacturing's transformative journey. In AIMTDR 2023 held at IIT (BHU), a total of 355 participants registered for paper presentations. The number of registrations for accompanying persons was 22 and 80 sessions were held successfully chaired by renowned faculty members and scientists from IITs, NITs and other premier organizations. Moreover, 29 invited lectures, 12 keynote lectures and 2 memorial lectures were organized successfully in AIMTDR 2023. In addition to this, 6 industry talks were organized and a separate session for industry experts was held. Around 20 stalls from different industries [] were present at AIMTDR 2023 showcasing their cuttingedge technologies and meeting different participants of the conference thereby developing an enriching environment. AIMTDR 2023 was also supported by various sponsors, attracting more than 20 number of sponsorship support from various industries, premier government organizations and MSMEs. Overall, close to 800 participants have attended the AIMTDR 2023 held at IIT (BHU) making it a huge success.

26. The 17th International Conference on "SPSI-MACRO 2023 (17th International Conference on Polymer Science & Technology)" was organized jointly by IIT Guwahati, The Society of Polymer Science, India, Tezpur University and CSIR-NEIST, India during December 10th-13th, 2023 at IIT Guwahati. Over 600 participants and more than 260 speakers including well-known delegates from academia & industry, distinguished scientists, professors, post-doctoral fellows, scholars and young scientists from India, USA, UK, Nepal, Saudi Arabia, Thailand. Australia, Taiwan, Canada, Ireland, Japan, Sweden, Belgium and Germany. Twenty-eight parallel sessions featured 20 Awards cum Plenary lectures, 100 Invited Lectures, 30 Keynote Lectures and 112 Oral Presentations covering various themes such as Advanced Polymer Synthesis, Polymer Rheology & Processing, Polymer Nanostructures & Nano Composites, Functional & Smart Biomaterials, polymers for biomedical applications, Biodegradable Polymers, polymers in Energy applications and many more. We also witnessed Pre-Conference Workshop on Polymer-based Additive manufacturing on December 9, 2023 with the mission to sensitize MSMEs about the biodegradable products development which is the mandate of IITG-CRTDH funded by DSIR. Prof. Jeng-Ywan Jeng, NTUST Taiwan; Prof. Vimal Katiyar; Dr. Biranchi Panda and Dr. Ajeet Kumar from IIT Guwahati and Mr. Rajiv Gupta- HP Inc. Additive Manufacturing India; Mr. Swapnil Sansare- Divide by Zero Technologies; Mr. Deepak Saligram- Intech Additive Solutions Inc.; and Mr. Deepak KumarMarkforged India have delivered the talk during this workshop. The main idea behind conducting this workshop was the need for introducing IITG-CRTDH activities among the stakeholders and building collaborations between academia & industry. It is noteworthy to mention that CRTDH at IITG would lead to a comprehensive understanding of polymer-based additive manufacturing, catering to both beginners & those looking to deepen their knowledge in the field. This would also create an ecosystem for polymer-based additive manufacturing and 3D printing in Assam and the other north eastern state.

27. National Conference on "Recent Technologies and Innovations in Electronics and Photonics: Towards Atmanirbhar Bharat" by the Dr. Vishwanath Karad MIT World Peace University, Pune, Maharashtra, India was organized from February 9-10, 2024, at the Dr. Vishwanath Karad MIT World Peace University, Pune, India. The event provided a platform for academic and industry experts to exchange views, discuss emerging trends, and explore opportunities for India to enhance its competitiveness in the global photonics and

electronics industry including the upcoming areas of semiconductors, photonic integrated circuits, quantum optics, etc. By focusing on a wide range of recent technologies and innovations in Electronics and Photonics, the conference aimed to drive advancements in these sectors, aligning further with economic aspects driving India's goal of self-sufficiency and indigenous technological progress in these fields. Over 130 abstracts were received for presentation overall with over 25 plenary speakers and session chairs for over 15 sessions of research paper presentations. The inaugural session was held on 9th February 2024 at the iconic Swami Vivekanand Hall at MITWPU campus with the Chief Guest being Dr. Sujata Chaklanobis, Scientist 'G' & Head (CRTDH, PACE & A2K+ schemes), DSIR. The Guest of Honour was Mr. Sanjit Singh Bhatia, Head of Optical Fiber Glass Plant at Sterlite Technologies, Aurangabad, Maharashtra. The ceremony provided informative and enlightening insights, setting a tone of knowledge and inspiration for the audience. The session held during the event underscored the pivotal role of photonics in shaping the future and fostering the concept of Atmanirbhar Bharat (self-reliant India), highlighting its efficiency in data transmission through optical fibers and contrasting its attributes with electronics in terms of weightlessness, reach, absence of edging effect, speed, and thermal power.

28. The 9th edition of the International Food Convention (IFCoN), organized by the Association of Food Scientists & Technologists (India) was held at CSIR – Central Food Technological Research Institute, Mysore campus and unfolded from December 7th to 10th, 2023 in Mysuru, Karnataka. This collaborative event featured partnerships with CSIR-CFTRI, DRDO-DFRL and CSIR-IITR as co-organizers. The Event was partially funded by DSIR, New Delhi under the A2K+ Events Program. The conference cantered around the theme "TRIMSAFE – Technology Re-engineering for Innovation and Mitigating Risk for a Safe, Sustainable, Affordable & Secure Food Eco-system." This emphasized the pivotal role of technological advancements in safeguarding the safety, sustainability, affordability, and security of the worldwide food ecosystem. The commencement of the 9th International Food Convention (IFCoN) in 2023 marked a historic beginning for four days dedicated to advancing the frontiers of food science and technology. The event was graced by the esteemed presence of luminaries, including Dr. N. Kalaiselvi, Secretary of DSIR (Department of Scientific and Industrial Research) and Director General of CSIR. Dr. S Somnath, Chairman of the Indian Space Research Organisation (ISRO); Her Highness Smt. Parmoda Devi Wadiyar; Dr. N Bhaskar, President of AFST(I) and Organizing Chairman of the 9th IFCoN; Dr. Sridevi Annapurna Singh, Director of CSIR-CFTRI, Mysuru. The Unveiling of the theme, "TRIMSAFE," set the stage for profound discussions during the, technical sessions that followed. The event further gained momentum with a prestigious award function, featuring recognitions such as Fellow AFST(I), Young Scientists Award, Dr. D B Wankhede Excellence Award, and other accolades, making the inauguration session a truly impactful and memorable occasion. The conference successfully hosted around 24 technical sessions spanning four days, showcasing the expertise of 90 distinguished speakers 4 key note speakers globally and nationally renowned in the fields of research, academia, industry, government, and autonomous bodies. Each session delved into specific facets within the intricate landscape of the food industry, offering focused explorations. The major sub-themes addressed contemporary challenges and innovations, providing a dynamic platform for collaborative solutions. This amalgamation of diverse expertise solidified the 9th International Food Convention (IFCoN) as a central hub for advancing knowledge and shaping the future of global food science and technology. IFCON 2023 garnered an enthusiastic response with 2600 registered delegates.

CHAPTER 6: ASIAN PACIFIC CENTRE FOR TRANSFER OF TECHNOLOGY (APCTT)

ASIAN PACIFIC CENTRE FOR TRANSFER OF TECHNOLOGY (APCTT)

1.0 PREAMBLE

The Asian and Pacific Centre for Transfer of Technology (APCTT) is a regional institution of the United Nations Economic and Social Commission for Asia and the Pacific (ESCAP) servicing the Asia-Pacific region. APCTT promotes an enabling environment for innovation, transfer and commercialization of technologies in 53 member states and 9 associate members of ESCAP. All member states and associate members of the United Nations ESCAP are de facto members of APCTT.

The Department of Scientific and Industrial Research (DSIR), Ministry of Science and Technology, Government of India has been the national focal Department, on behalf of India, for APCTT. Matters pertaining to APCTT and ESCAP are dealt in cooperation with the Ministry of Commerce and Industry and the Ministry of External Affairs, Government of India. DSIR plays an active role in APCTT's functioning, particularly relating to its work programmes and initiatives. India, being the host country for APCTT, has been providing institutional support to the APCTT since its inception in 1977.

2.0 INTRODUCTION

1. The Asian and Pacific Centre for Transfer of Technology (APCTT) promotes an enabling environment for innovation, transfer and diffusion of technologies in the member States for achieving the Sustainable Development Goals.

2. The APCTT fosters inclusive partnerships between governments, research and development institutions, academia, international organizations, private sector and civil society for innovation, transfer, adoption and diffusion of technologies for achievement of the Sustainable Development Goals in the Asia-Pacific Region.

3. The activities of the APCTT contribute towards Goal 7 (Ensure access to affordable, reliable sustainable and modern energy for all), Goal 9 (Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation), Goal 11 (Make cities and human settlements inclusive, safe and resilient and sustainable), Goal 13 (Take urgent action to combat climate change and its impacts), and Goal 17 (Strengthen the means of implementation and revitalize the global partnership for sustainable development).

4. The APCTT commenced the implementation of its Strategic Plan (2023-2027) with a vision for 'enhanced regional cooperation for innovation, adoption, diffusion and transfer of innovative and emerging technologies in the Asia-Pacific region for addressing climate change and achieving SDGs'.

3.0 SUMMARY OF ACTIVITIES IN 2023-24

5. During 2023, the APCTT's primary focus areas were: (a) Strengthening regional technology cooperation, transfer and strategic partnerships for advancing climate mitigation and adaptation and air pollution control technologies; (b) Capacity building and enhanced knowledge on innovative technologies for climate resilience, disaster risk reduction, control of air pollution, and technology cooperation with focus on green innovations and fourth industrial revolution technologies; and (c) Enhancing technology intelligence through production and

dissemination of knowledge products on new and innovative technologies for climate change and sustainable development.

6. During the reporting period, the APCTT delivered and actively contributed to 19 demand-driven activities (hosted by Bangladesh, China, India, Thailand and Uzbekistan) in cooperation with 71 partner institutions. The activities included regional consultation meetings, expert group meetings, international conferences, capacity building workshops, national stakeholder consultations, and knowledge products including periodicals and analytical reports. The list of partner institutions, who worked with the APCTT in delivering various activities are provided inAnnexure-10.

7. The APCTT's demand driven activities benefitted nearly 1000 participants comprising representatives from governments, technology promotion agencies, technology transfer intermediaries, academia, research and development institutions, city authorities, industrial enterprises, technology-based start-ups and financial institutions.

8. The APCTT benefited from participation of experts and participants from 20 Asia-Pacific member States namely Australia, Bangladesh, China, Fiji, India, Indonesia, Japan, Nepal, Pakistan, Palau, Philippines, Sri Lanka, Samoa, Tonga, the Republic of Korea, Russian Federation, Singapore, Thailand, Uzbekistan and Viet Nam. The experts shared their knowledge, experiences, and best practices with the target participants. The APCTT's activities also benefited from participation of experts from international organizations including Asian Infrastructure Investment Bank, Asian Institute of Technology, Economic Research Institute for ASEAN and East Asia, Secretariat of the Pacific Regional Environment Programme, and United Nations' Ten-Member Group supporting Technology Facilitation Mechanism for Sustainable Development Goals.

9. The APCTT's online periodical 'Asia-Pacific Tech Monitor' provided latest information on technology trends and developments, technology and innovation policies, technology market, technology transfer and adoption, intellectual property management, fourth industrial revolution technologies, innovative technologies for air pollution control, and regional technology cooperation and transfer. The 4 special issues of the Asia-Pacific Tech Monitor focused on themes such as: (1) Affordable and sustainable clean energy technologies, (2) Technologies for de-carbonizing transport systems, (3) Innovative technologies for disaster risk reduction, and (4) Partnerships and regional collaborations with integrating climate finance with the technology mechanism for climate change (Annexure-11).

10. The APCTT entered a formal partnership with Climate Technology Centre and Network through Letter of Exchange to jointly support member States in the development and transfer of climate technologies for energy-efficient, low-carbon and climate-resilient development in the Asia-Pacific region.

11. The APCTT contributed to strengthening the capabilities of stakeholders from countries with special needs such as Cook Islands, Fiji, Nepal, Palau, Samoa, Tonga and Tuvalu.

12. The APCTT continued to receive voluntary contributions from host country and other member States. These contributions are used for funding the APCTT's capacity-building programmes and activities as well as administrative expenses.

4.0 DETAILS OF ACTIVITIES CARRIED OUT BY APCTT IN 2023-24

A. Regional technology cooperation strengthened

13. The APCTT facilitated 5 regional consultative meetings to strengthen technology cooperation among member States in key areas. Following are the key activities carried out and/or contributed by the APCTT:

(a) Pacific Perspectives on Accelerating Climate Action, 15 May 2023, Bangkok, Thailand (Hybrid): The APCTT organized this event, jointly with the Governments of the Cook Islands and Tuvalu, the Secretariat of the Pacific Regional Environment Programme, and ESCAP Sub-regional Office for the Pacific, on the sidelines of the seventy-ninth session of ESCAP. It brought together participants and speakers from the Pacific Small Island Developing States, the Council of Regional Organizations of the Pacific and other agencies. The event deliberated on climate action related policy conversations, including key linkages across various dimensions of climate policy, especially in the context of connectivity, finance and capacity building. Key recommendations are strengthening regional policy support for national development priorities; and providing increased assistance for the implementation of climate action.

(b) Scaling up climate change adaptation technology applications for a resilient future in Asia and the Pacific, 19 May 2023, Bangkok, Thailand (hybrid) (side event of CS79): The APCTT jointly organized this event with the Department of Scientific and Industrial Research, Ministry of Science and Technology, Government of India on the sidelines of the seventy-ninth session of ESCAP. The event brought together 34 participants from China, India, Indonesia, Malaysia, Pakistan, Philippines, the Republic of Korea, Thailand, and Uzbekistan. The participants included representatives from the APCTT's Governing Council members, national climate change offices, national hydro-meteorological services, relevant sub-regional organizations, policymakers and experts involved in climate change adaptation in the Asia-Pacific region. Solutions and good practices in technologies and their applications for climate adaptation and resilience including hazard monitoring were discussed along with the opportunities to enhance regional cooperation to upscale them in Asia and the Pacific.

(c) Expert Group Meeting on Innovative Technologies and Applications for Urban Air Pollution Control in Asia and the Pacific, 25 May 2023 (virtual): The APCTT organized this meeting to discuss innovative technologies and their applications to control air pollution in cities across the Asia-Pacific region. The meeting was attended by 20 participants including policymakers, technical experts and relevant stakeholders involved in city air pollution control from Bangladesh, China, India, Nepal, Philippines, the Republic of Korea, Thailand and Uzbekistan. The experts shared their experience and good practices in scaling up and adoption of innovative technologies for air pollution control in cities. Key recommendations include rational planning of urban industries, adopting multiple technology interventions such as electric vehicles and bioethanol, and conducting evaluation of air pollution control

technologies for their efficiency, economic viability and suitability for local conditions.

(d) Harnessing Technology, Data and Capacity for Climate Resilient Development, 20 February 2024, Bangkok, Thailand (hybrid): The side event of the 11th Asia Pacific Forum on Sustainable Development (APFSD) was jointly organized by the five Regional Institutions of ESCAP, namely Asian and Pacific Centre for Transfer of Technology (APCTT), Asian and Pacific Training Centre for Information and Communication Technology for Development (APCICT), Asian and Pacific Centre for the Development of Disaster Information Management (APDIM), Centre for Sustainable Agricultural Mechanization (CSAM) and Statistical Institute for Asia and the Pacific (SIAP).The session deliberated the strategic integration of policymaking and planning, technology, effective use of data and statistics, capacity building, and regional cooperation in combating and adapting to climate change. The experts and practitioners discussed on (a) the role of technology cooperation and transfer in mitigating climate impact; (b) integrating data and statistics to turn climate data into actionable insights; and (c) enhancing human and institutional capacities for a deeper understanding and more effective action against climate change.

(e) Stakeholder Meeting between APCTT and Technology Agencies of Thailand for Promoting Regional Cooperation, 21 February 2024, Bangkok, Thailand (hybrid): The sstakeholder meeting was jointly organized with the Ministry of Higher Education, Science, Research and Innovation (MHESI), Government of Thailand, and Thailand Institute of Scientific and Technological Research (TISTR). The meeting brought together 21 participants including senior policymakers and experts from Thailand. They represented 7 key STI-related ministries, departments and national agencies and universities of Thailand including Ministry of Higher Education, Science, Research and Innovation (MHESI), Thailand Institute of Scientific and Technological Research (TISTR), National Science and Technology Development Agency (NSTDA), National Innovation Agency (NIA), Geo-Informatics and Space Technology Development Agency (GISTDA), King Mongkut's University of Technology Thonburi (KMUTT), and Kasetsart University (KU).The participants shared perspectives and priorities of their respective organizations for regional technology cooperation. The meeting provided a platform to identify potential areas of collaboration with APCTT for regional cooperation.

B. Innovation and technology transfer capacity enhanced

14. The APCTT organized 5 capacity building activities to enhance the knowledge and skills of stakeholders on innovation, transfer, adoption and diffusion of technologies with focus on climate resilience, air pollution control, and fourth industrial revolution and green technologies.

15. The APCTT organized the following capacity building activities:

(a) Advancing Climate Action and Resilience of Cities in the Asia-Pacific Region - renewable energy and air pollution control, 30 March 2023, Bangkok, Thailand: The APCTT jointly organized this panel discussion as a side event of the 10th Asia Pacific Forum

on Sustainable Development, with the Sustainable Urban Development Section of ESCAP. The event brought together experts and participants from the Asia-Pacific region to share insights and discuss strategies and actions for climate resilient cities through adoption of innovative and affordable technology solutions for renewable energy and air pollution control. The participants comprised of policymakers and relevant stakeholders involved in urban governance, renewable energy applications, control of city air pollution, and climate resilient cities. The participants deliberated and shared perspectives and good practices of innovative and affordable technologies for renewable energy transition and air pollution control in urban space. Key recommendations include conducting technology needs assessment, aligning needs of countries with availability of their energy resources, identifying innovative and affordable solutions for scaling up and large-scale application in cities, capacity building and training for measurement of emissions data.

(b) Building the resilience agenda through technology, 27 July 2023, Bangkok, Thailand (hybrid): The APCTT organised this session to generate actionable recommendations and strategies by leveraging technologies for disaster risk reduction contributing to the resilience of communities. This was a collaborative effort of the United Nations Satellite Centre and the Asian and Pacific Training Centre for Information and Communication Technology for Development of ESCAP. The participants identified technology innovations including those in artificial intelligence, satellite imagery, machine learning, and earth observation data for building resilience to disasters and climate change. The experts discussed strategies and best practices to strengthen the use of technology for effective reduction in the impact of disasters and climate hazards. The session was attended by government officials, experts, researchers, and private sector stakeholders involved in technology for disaster risk reduction and climate change adaptation.

(c) International Conference on Air Pollution, Perspective, Prediction, Prevention, and Control, 31 August 2023, Bangkok, Thailand: The conference was jointly organized with Thailand Institute of Scientific and Technological Research in conjunction with ASEAN Sustainable Energy Week 2023. International and national experts shared experiences, success stories and challenges of prediction, prevention and control of air pollution. Experts from Indonesia, Thailand and Viet Nam presented country perspectives on policy and good practices to address air pollution. They also discussed strengths and challenges of city level action plans for adopting technologies for air pollution control in Bangkok. The conference brought together 95 participants from 5 member States (namely Indonesia, Malaysia, Sri Lanka, Thailand and Viet Nam). They included policymakers, experts, and representatives from international organizations, research and development institutions, private sector and civil society organizations. Key recommendations are developing stricter emission standards, monitoring systems and enforcement mechanisms, providing incentives (e.g., tax breaks, subsidies, and grants) to encourage cleaner technologies and practices, facilitating collaboration between

government and businesses to find practical solutions, and engaging citizens in air quality monitoring and control efforts.

(d) International Conference on Scaling Up and Adoption of Fourth Industrial Revolution Technologies for Climate Resilience, 15 September 2023, Guangzhou, China (virtual): The Center organized this conference in cooperation with the Asia-Pacific Regional Innovation Knowledge Network for Fourth Industrial Revolution Technologies, Guangzhou University, People's Republic of China. The conference brought together 78 participants from twelve member States namely China, India, Indonesia, Japan, Malaysia, Pakistan, Russian Federation, Singapore, Thailand, the United Kingdom, the United States and Viet Nam. The participants included policymakers and government officials, representatives from the academia, national laboratories, research and development institutions, industrial and research organizations and enterprises. The experts deliberated on the priorities, strategies and good practices for scaling up and adoption of fourth industrial revolution technologies for addressing climate change, and explore potential opportunities and modalities of cross-border collaboration. Key recommendations are assessing the readiness and requirements of countries to adapt Industry 4.0, facilitating skill development workshops and Public-Private-Partnerships to promote fourth industrial revolution technologies for climate resilience, and providing policy and technical support to member States.

(e) International Conference on Green Technologies for Climate Action and Resilience, 05 December 2023, Tashkent, Uzbekistan (hybrid): This international conference was organized to explore and promote the ways to scale up green technologies to address climate change and enhance resilience. The conference was jointly organized with Agency for Innovative Development, Ministry of Higher Education, Science and Innovations, Republic of Uzbekistan. It brought together 135 participants from Bangladesh, China, India, Indonesia, Malaysia, Nepal, Pakistan, Philippines, Republic of Iran, Republic of Korea, Russian Federation, Thailand, Uzbekistan, and Vietnam. The participants were from the APCTT's Governing Council members and other member States of ESCAP, including policymakers, government officials, international experts, researchers, industry leaders and professionals, academia and civil society organisations. The conference deliberated on the interface between green technologies and climate change, frontier innovation pathways for green technology development, and cross-sector collaboration across sectors, industries, and governments to drive sustainable and green technologies to combat climate change.

16. During the reporting period, the APCTT provided substantive contributions to 3 capacity building activities organized by external institutions.

(a) Strategic Planning Meeting of Regional Alliance of Technology Transfer and Adoption Centers under South-South and Triangular Collaboration Programme on Science, Technology and Innovation among Cambodia, Lao PDR, Thailand and Vietnam, 9 February 2023, Hanoi, Vietnam: The APCTT contributed to this meeting by sharing information about the APCTT's mandate, work

programme and activities in technology cooperation and transfer in support of member States of the region. Based on its regional experience, the APCTT provided guidance to the development of strategic plan, including theory of change and action plan for the proposed Regional Alliance of Technology Transfer and Adoption Centers. The meeting was attended by 15 participants from Cambodia, Lao People's Democratic Republic, Thailand and Viet Nam. The meeting was jointly organized by the Ministry of Science and Technology of Viet Nam and the Trade Investment and Innovation Division of ESCAP.

(b) The 9th East Asia Summit New Energy Forum, 29-30 June 2023, Kunming, China (hybrid): The APCTT contributed to this event through a keynote presentation and shared its regional perspectives and experience in promoting innovative and emerging technologies for sustainable development with focus on energy and climate resilience. The APCTT highlighted key considerations for creating efficient and balanced innovation ecosystems including translation of low innovation inputs into higher innovation outputs, and increasing the efficiency of processes in national innovation systems. The forum was jointly organized by the Department of International Cooperation, Ministry of Science and Technology of China and the Yunnan Province Science and Technology Department of China.

(c) 4th Forum on China-South Asia Technology Transfer and Collaborative Innovation, 15-19 August 2023, Kunming, China: The APCTT contributed to this forum through a keynote presentation on regional technology cooperation and transfer to achieve the Sustainable Development Goals in Asia and the Pacific. The APCTT shared its regional experience and modalities for facilitating cross-border technology cooperation and transfer. The forum was organized by the Department of International Cooperation of the Ministry of Science and Technology of China, Yunnan Province Science and Technology Department, and China-South Asia Technology Transfer Center.

C. Project: Enhanced capabilities to adopt innovative technologies for city air pollution control in select countries of the Asia-Pacific (Funded by Korea-ESCAP Cooperation Fund)

17. Under this project, the APCTT implemented planned activities to achieve two major outputs such as (i) improved availability of technical knowledge regarding technologies, innovations and good practices, and better understanding of technology needs and gaps for air pollution control in the selected cities, and (ii) increased awareness and capacity of city officials and stakeholders to strengthen action plans for adoption of innovative technologies to control air pollution in three selected cities, namely Dhaka (Bangladesh), Gurugram (India), and Bangkok (Thailand).

17.1 Improved availability of technical knowledge

The APCTT implemented 3 activities towards improved availability of technical knowledge for city officials and stakeholders regarding technologies, innovations and good practices for control of air pollution.

(a) Compendium of air pollution control technologies: The APCTT developed a compendium of good cases of innovative technologies for air pollution control

implemented at city level in Asia. The compendium provides examples of best cases around the world so that cities can implement these technologies for meeting their clean air targets. It is expected to enhance the knowledge and understanding of stakeholders of target cities and help them to adopt relevant technologies for air pollution control. The compendium would be used by city planners and officials, policymakers and stakeholders to increase their knowledge and awareness of innovative technologies for air pollution control in cities.

(b) City-level assessment studies on air pollution control: The APCTT conducted city level studies in Dhaka, Gurugram and Bangkok on assessment of (1) the technological interventions and gaps/needs for air pollution control; and (2) city level action plan (and its alignment with the national plan), and the strengths and challenges related to the strategies for adopting technologies for air pollution control. Based on the studies, assessment reports have been prepared for the three target cities. The reports recommend relevant technologies and approaches to reduce air pollution as well as policy gaps, challenges and supports needed for adopting air pollution control technologies in the identified sectors such as transportation, building construction, industry including brick kilns, agriculture among others.

(c) Comparative study on city level air pollution control: The APCTT conducted a comparative study between the three city level assessment outcomes for Dhaka, Gurugram and Bangkok. The study was carried out to draw lessons and understand opportunities and good practices for technology adoption to control air pollution. The outcomes and recommendations of the study would support in improving the availability of technical knowledge regarding air pollution mitigation technologies, innovations, and good practices from different cities across Asia and the Pacific; and to better understand the technological needs and gaps for air pollution control in the three cities. The report draws lessons from the city-level technological interventions and action plans and recommends future opportunities that can be explored to address the gaps and requirements in the adoption of innovative technologies for air pollution control.

17.2 Increased awareness and capacity

The APCTT organized9 capacity building events including a study tour to the Republic of Korea for enhancing the knowledge and awareness of city officials on innovative technologies and city action plans and strategies for air pollution control.

(a) Technical Consultation Meeting on Air Pollution Control Studies in Dhaka City, 27 March 2023 (virtual): This consultation meeting was jointly organized with Ministry of Science and Technology of Bangladesh, Local Government Division of Ministry of Local Government, Rural Development and Cooperatives, Bangladesh, Dhaka North City Corporation, and Dhaka South City Corporation, Bangladesh. The meeting was organized to seek suggestions from relevant stakeholders for city level assessment studies in Dhaka on technological interventions and gaps/needs for air pollution control, city level action plan and its alignment with the national plan of Bangladesh, and strengths and challenges related to the strategies for adopting air pollution control technologies. The meeting was attended by 12 experts and government officials from Bangladesh who provided valuable suggestions for the assessment studies. Key recommendations include focusing on air pollution from brick kilns, road transport and municipality waste, conducting source apportionment study to develop appropriate policies and actions, and setting up air purifier technology to reduce air pollution in the Dhaka city.

(b) Project Inception Meeting Sharing Session: perspectives towards the air pollution control for the good quality of life, 25 April 2023, Bangkok, Thailand (virtual): The inception meeting was jointly organized with the Ministry of Higher Education, Science, Research and Innovation, Thailand, and Thailand Institute of Scientific and Technological Research which is implementing the project activities in Bangkok city. The meeting was attended by 38 experts and participants from Thailand and international. The experts shared perspectives on air pollution control in Bangkok and assessment of gap between policies and practice, and need of technologies to be developed for sustainable pollution control and management. Key recommendations are developing innovative technologies to control air pollution, achieving efficient and effective technologies for air pollution control, adopting supportive and preventive measures to minimize air pollution, and raising participation of communities and stockholders to achieve positive results.

(c) Consultation meeting with stakeholders (Gurugram), 7 June 2023, New Delhi, India: The meeting was jointly organized with the Department of Scientific and Industrial Research, Ministry of Science and Technology, Government of India to seek suggestions from experts and stakeholders for conducting the city level assessment studies in Gurugram on technological interventions and gaps/needs for air pollution control, city level action plan and its alignment with the national plan of India, and strengths and challenges related to the strategies for adopting air pollution control technologies. The meeting was attended by 16 participants including experts and government officials from city authority, pollution control boards, Ministry of Environment, Forest & Climate Change, and Department of Scientific and Industrial Research, Ministry of Science and Technology, Government of India. The experts brainstormed and provided key suggestions for consideration under the assessment studies. Key recommendations include identifying technology-based solutions to mitigate air pollution, introducing stringent air quality standards, and district level mapping of hot spots of air pollution.

(d) Study Tour on Innovative Technologies and Good Practices for Air Pollution Control for City Officials to the Republic of Korea, 18-21 September 2023: The study tour was jointly organized with ESCAP Subregional Office for East and North-East Asia for 10 city officials from Bangkok (Thailand), Dhaka (Bangladesh) and Gurugram (India). The APCTT facilitated technical sessions and site visits to relevant organizations and air pollution control facilities in Incheon and Seoul, including: Incheon and Seoul Metropolitan Councils; Environmental Satellite Monitoring Centre at National Institute of Environmental Research; Sudokwon Landfill site, Incheon and Resource recovery facility of Seoul Metropolitan Government in Gangnan; Transportation Pollution Research Center, Incheon; Korea Environment Corporation, Incheon; and Incheon Free Economic Zone Control Room. Key learnings for participants include the Republic of Korea's approach to monitor and control air pollution, through innovative strategies, urban planning techniques, city action plans, and advanced technologies for air pollution control. The participants learned about innovative technologies such as pollutant removal systems for gas turbines using catalysts, satellite-based monitoring of air pollutants, real-time automobile management system for tracking polluting vehicles, vehicle emission testing and treatment systems, landfill designs, waste management techniques.

(e) Training Workshop for City Officials of Gurugram for Capacity Building on Air Pollution Control, 19 October 2023, Gurugram, India: The workshop was jointly organized with Gurugram Metropolitan Development Authority, India. The workshop was attended by over 125 city officials including field staff responsible for air pollution monitoring and control and waste management. The outcomes of the two city-level assessment studies were shared with participants including technical presentations on the status, measurement and actions, understanding dispersed sources of air pollution and role of urban local bodies in fighting air pollution in Gurugram city. Key lessons learned from the study tour to the Republic of Korea were also shared with city officials. The participating officials and stakeholders shared their perspectives, challenges and suggestions which would be valuable inputs to the assessment reports on Gurugram.

(f) The KECF Air Pollution Control: A Multi-stakeholder Consultation Workshop, 26 October 2023, Bangkok, Thailand: The workshop was jointly organized with Thailand Institute of Scientific and Technological Research to discuss the outcomes of the city-level assessment studies conducted by the APCTT and develop recommendations for strengthening city level action plans for the adoption of enabling mechanisms for innovative technologies. The meeting was attended by 30 participants including officials from Thailand government, Bangkok city, industries, academia and other relevant agencies and institutions. The participants shared their perspectives on air pollution issues, policies, strategy options, technologies, and good practices.

(g) The KECF Air Pollution Control: A Training Workshop, 27 November 2023, Bangkok, Thailand: The workshop is jointly organized with the Thailand Institute of Scientific and Technological Research to increase the knowledge and understanding of Bangkok city officials and relevant stakeholders for the adoption and implementation of enabling mechanisms for innovative technologies in air pollution control, and to strengthen cooperation among participating organizations. The workshop covers key topics including review of air pollution problem in Bangkok, air quality forecast and assessment of air pollution reduction technologies for Bangkok city. The workshop brings together about 150 participants from district offices (Environment and Sanitation Section) and Department of Environment of Bangkok Metropolitan Administration, and relevant stakeholders such as policymakers, pollution control authorities, departments, and institutions involved with air pollution management and control.

(h) Training Workshop on Air Pollution Control for City Officials, 25 Oct to 10 Nov 2023, Gurugram, India: Training Workshop comprising a series of sessions (six) across the administrative divisions of Gurugram city were jointly organized with Gurugram Metropolitan Development Authority for capacity building of city officials on the innovative technologies and monitoring methods to control air pollution. The training sessions were attended by about 180 participants including officials, technical and field level staff of Gurugram city. The training sessions covered are topics related to air pollution including impacts, policies, technologies, actions plans and good practices.

(i) Regional Knowledge Sharing Workshop on Innovative Technologies and City Action Plans for Air Pollution Control, 21 December 2023 (virtual): The regional workshop was organized for sharing of project findings, experiences, and learnings from the target cities with policymakers and stakeholders from ESCAP member States for wider dissemination and adoption. The workshop deliberated on the key learnings from various

project activities and outcomes such as the Compendium of good cases of innovative technologies for air pollution control, city-level assessment in Dhaka (Bangladesh), Gurugram (India) and Bangkok (Thailand), comparative assessment between the selected cities, technical and stakeholder consultations, study tour and capacity building workshops. The project focal points from the three countries also shared their respective experiences during the project implementation. The workshop brought together 52 participants from member States including Bangladesh, India, Indonesia, Philippines, Thailand and Viet Nam. The participants included APCTT's national focal points, policymakers, project focal points and representatives from target cities and countries such as Dhaka (Bangladesh), Gurugram (India) and Bangkok (Thailand), technical experts and relevant stakeholders involved in city air pollution control in the Asia Pacific region.

D. Technology intelligence enhanced through knowledge products

18 The APCTT brings out knowledge products including periodicals, reports and publications to enhance the knowledge and awareness of stakeholders from member states on relevant areas and issues covered by its work programme. The list of the APCTT's periodicals and publications during the reporting period is provided as Annexure-11.

19 The APCTT disseminated information on recent technological trends and developments through its online periodical Asia-Pacific Tech Monitor (https://www.apctt.org/techmonitor). The Asia-Pacific Tech monitor features articles on the latest technology trends and developments, technology policies, technology market, innovation management, technology transfer and innovative technologies.

20 The APCTT published four issues of the Asia-Pacific Tech Monitor focussing on special themes such as: Affordable and sustainable clean energy technologies (Oct-Dec 2022), Technologies for de-carbonizing transport systems (Jan-Mar 2023), Innovative technologies for disaster risk reduction – Successful cases and good practices from Asia and the Pacific (Apr- Jun 2023), Partnerships and regional collaborations: integrating climate finance with the technology mechanism for climate change (Jul-Sep 2023), and Innovative technologies for air pollution control (Oct-Dec 2023).

21 The APCTT shared its online periodicals with readers from the member countries and outside the region as well. During the reporting period, the web-version of the Asia-PacificTech Monitor was distributed to 1989 stakeholders and e-subscribers from the member States. The APCTT also disseminated the e-periodicals through social media platforms such as Twitter and Facebook.

22 The APCTT provided substantive inputs to the "Compendium of multi-hazard early warning cooperation" prepared by ESCAP as a knowledge partner of G20 Working Group on Disaster Risk Reduction under Priority 1: Early warning for all. The compendium identifies county-specific challenges and good practices of cooperation arrangements to strengthen forecasting capabilities, early warning coverage, and systems to act on them.

E. Support to inter-governmental meetings of ESCAP

23 Seventy-ninth session of ESCAP, 15-19 May 2023, Bangkok, Thailand: The APCTT provided substantive support and submitted the report on the eighteenth session of its Governing Council, held in Bangkok, Thailand. The following are the outcomes

of the 79th Commission session on the APCTT's work programme:

(a) The Commission endorsed the report of the Governing Council of the Asian and Pacific Centre for Transfer of Technology on its eighteenth session (ESCAP/79/15). (Decision 79/4).

(b) The Commission took note of the overview of partnerships, extra-budgetary contributions and capacity development(ESCAP/79/22) and expressed its appreciation for the following contributions pledged by members and associate members for 2023. They are Bangladesh - $7,000, India - $870,000, Macao, China - $5,000, Malaysia - 6,000; People's Republic of China - $27,000, and Republic of Korea - $22,431, Thailand - $15,000. (Decision 79/10).

24 Committee on Trade, Investment, Enterprise and Business Innovation, First session, 22– 24 February 2023, Bangkok, Thailand: The APCTT provided substantive support to the session, and presented the agenda item 6 document titled 'Promoting regional cooperation in new and emerging technologies to achieve sustainable development' (ESCAP/CTIEBI(1)/7). The following are the outcomes of the deliberations of agenda item 6.

(a) The Committee Trade, Investment, Enterprise and Business Innovation, recognizing the importance of new and emerging technologies for the achievement of the Sustainable Development Goals, recommends that the secretariat enhance its provision of support to members and associate members through policy and analytical support, capacity-building and technical assistance, technology demonstration and market intelligence for the scaling up of innovations and adoption of technologies, as appropriate. It also calls for enhancing cooperation for the development, diffusion and scaling up of new and emerging technologies in the region. (Recommendation 6)

25 Nineteenth session of the Governing Council of Asian and Pacific Centre for Transfer of Technology, 6-7 December 2023, Tashkent, Uzbekistan (hybrid): The APCTT organized and serviced the nineteenth session of its Governing Council held in hybrid mode on 6-7 December 2023. The session was attended by the representatives from ten member States of the Governing Council: Bangladesh, People's Republic of China, India, Islamic Republic of Iran, Philippines, Republic of Korea, Russian Federation, Thailand, and the Republic of Uzbekistan. In addition, the representatives of Malaysia, Nepal and Viet Nam attended as observers. The following are the key outcomes of the Governing Council session:

(a) The Governing Council requested the APCTT to continue providing demand-driven policy advice, analytical and capacity building support to strengthen national innovation systems and promote regional technology cooperation and transfer, with focus on innovative and emerging technologies to address climate change and support sustainable development in Asia and the Pacific.

(b) The Council invited non-contributing Governing Council member States to consider providing voluntary contributions to the APCTT. Other member States may consider enhancing their level of support to strengthen the APCTT's activities and for its long-term sustainability. The indicative levels of the annual contribution are US$30,000 for developing countries and US$5,000for least developed countries

(c) The Council invited members and associate members to consider contributing national experts in the mandated fields to work at the APCTT as Non-Reimbursable Loans or as fellows under its fellowship programme. This arrangement could also foster South-South cooperation.

(d) The Council requested the APCTT to include concrete proposals on areas of cooperation with the APCTT, presented by the members as well as observers into the report on its nineteenth session.

(e) The Council requested the evaluation consultant to consider incorporating the suggestions and recommendations of the Council in the draft evaluation report of the APCTT.

(f) The Council adopted the proposed programme of work of the APCTT for2024.

(g) The Council requested the APCTT to take into the account of the recommendations of the Conference when designing the future activities.

(h) The Council decided that the 20thsession of the GC will take place in Tehran, Islamic Republic of Iran during 27-28 November 2024 and the 21stsession of the GC will take place in Moscow, Russian Federation during 4-5December 2025.

(i) The Council adopted the report of its nineteenth session on 7th December 2022.

F. Cooperation with international organizations and other partners

26 The APCTT entered into a formal partnership with Climate Technology Centre and Network through Letter of Exchange to jointly support member States in the development and transfer of climate technologies for energy-efficient, low-carbon and climate-resilient development in the Asia-Pacific region.

27 During this reporting period, the APCTT invited resource persons and speakers from key international organizations including Asian Infrastructure Investment Bank, Asian Institute of Technology, Economic Research Institute for ASEAN and East Asia, South Pacific Regional Environment Programme, and the United Nations' Ten-Member Group supporting Technology Facilitation Mechanism for SDGs for the regional consultations, expert group meetings, capacity-building activities such as conferences and workshops.

G. Digital outreach

28 The APCTT continued to extend its outreach to stakeholders, policy makers and institutions through digital tools (e.g., website, technology databases), and social media including Facebook (facebook.com/UNAPCTT), Twitter (@ UNAPCTT) / Twitter) and LinkedIn (Asian and Pacific Centre for Transfer of Technology/ LinkedIn). APCTT has posted over 50 social media posts with an engagement of over 2000 followers. The APCTT developed its inaugural half yearly newsletter on activities and developments undertaken by APCTT disseminated among member States, UN agencies, partners institutions and stakeholders in the region. With the advisory and technical support from the Communications and Knowledge Management Section of ESCAP, the APCTT's enhanced its brand, reputation, and outreach through adoption of new digital tools and media approaches.

CHAPTER 7: INFORMATION TECHNOLOGY AND e-GOVERNANCE (ITeG)

INFORMATION TECHNOLOGY AND e-GOVERNANCE (ITeG)

1.0 Introduction

Information Technology and e-Governance (IT-eG) group was formed during mid of the 10th Plan period in order to create an IT enabled work environment in the Department through accelerated usage of various Information Technology opportunities. Primary aim of ITeG was to convert the existing procedures and processes into citizen centered. IT-eG division implements e-Governance in the Department progressively that needs be in conformance to the National e-Governance Action Plan. IT-eG Division operates on a separate IT Budget Head under Secretariat Economic Services during FY 2023-2024 for the implementation of activities carried out by the division.

2.0 IT Action Plan

For IT and e-Governance activities a comprehensive IT-Action Plan in the department as formulated in line with the Government directions issued from time to time.

- Infrastructure Development: Provide and maintain Personal Computers (PCs) and other essential IT- equipment and software to all the functionaries.
- Networking: Upgradation, extension and maintenance of Local Area Network (LAN).
- Office Automation: Implement various applications software that not only maintain records of receipt, issue of letters and movement of files but also offer enhancement in accountability, responsiveness and transparency in governance.
- IT Training: Provide relevant training courses to the officers/ staff that enable them to work on computers by using application software developed.
- e-Reports: Convert the Acts, Rules, Circulars and other published materials of interest or relevance to the public in the electronic form.
- DBT Mission: Online integration of schemes of DSIR with DBT Mission portal
- Website: Enrich the contents of the DSIR website by including downloadable forms and guidelines relevant to various citizen services that Department provides.

During this period under report Department has successfully implemented the followings;

3.0 Migration to DSIR CMS Website

Department has successfully developed a New CMSbased website available at URL https://www.dsir.gov.in (English) and https://www.dsir.gov.in/hi.(Hindi).It is hosted at NIC data centre. The website is envisaged to meet the requirements of ISO/IEC 23026 and national requirements (NIC guidelines) including W3C/WAI e-Accessibility guidelines for level A.

4.0 Integration of STQC certificate with DSIR website

Standardisation Testing and Quality Certification (STQC) Directorate, an attached office of the Ministry of Electronics and Information Technology, Government of India, provides quality assurance services in the area of Electronics and IT through countrywide network of laboratories and centres. The services include Testing, Calibration, IT & e-Governance, Training and Certification having National / International accreditation and recognitions in the area of testing and calibration.

During this period under report DSIR has received the STQC certificate for the new CMS website which is valid from 06th April 2023 to 26th April 2026.

5.0 Integration of Google Analytics with DSIR website

Google Analytics is a web analytics service offered by Google that tracks and reports website traffic and also the mobile app traffic & events.

During this period under report Department has successfully integrated the Google Analytics with DSIR new CMS website. The website has been regularly updated and has been visited more than 2.08 Lakhs times since 23rd May 2023.

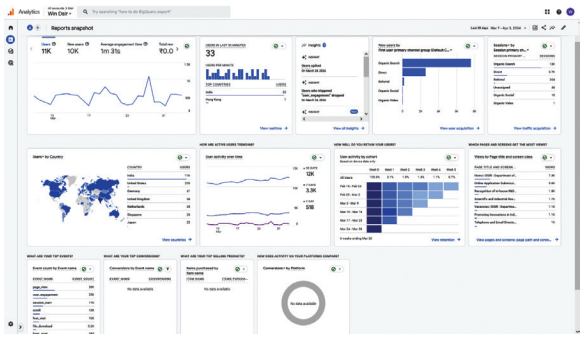


Fig : Google Analytics report of DSIR website from 23rd May, 2023 to 31st March, 2024

- **Development of e-file submission applications in Service-Plus portal**

Service-Plus is one of the software applications envisaged as part of Phase II of the e-Panchayat MMP. Service-Plus is a generic application to provide an electronic delivery for all the services. As articulated in the Vision Statement of NeGP. Service-Plus "Make all Government services accessible to the common man in his locality, through common service delivery outlets, and ensure efficiency, transparency, and reliability of such services at affordable costs to realize the basic needs of the common man".

- During this period under report DSIR developed/ integrated application form (e-file submission) and process flow in Service-Plus portal for different schemes of DSIR i.e. SIRO fresh and renewal application, PFRI and A2K+studies.

CHAPTER 8: IMPLEMENTATION OF RTI ACT 2005

IMPLEMENTATION OF RTI ACT 2005

The Right to Information Act 2005, enacted on 15th June 2005, has been implemented successfully in the department. As per the provisions of the RTI Act 2005, following officers are designated:

Appellate Authority	Shri Narender Kumar Gupta, Scientist 'F' Department of Scientific and Industrial Research Room No 525, Technology Bhawan New Mehrauli Road, New Delhi-110016	Tel: 011 26529681, 26590661 Fax: 26960629 narender[dot]gupta[at]nic[dot]in
Transparency Officer	Dr. Prabhat Kumar Dutta, Scientist 'G' Department of Scientific and Industrial Research Room No. 524, Technology Bhawan New Mehrauli Road, New Delhi-110016	Tel: 26534823, 265903658 Fax: 26960629 pkdutta[at]nic[dot]in
Nodal Officer and Central Public Information Officer	Shri M. C. Beniwal, Under Secretary Department of Scientific and Industrial Research Room No 504, Technology Bhawan New Mehrauli Road, New Delhi-110016	Tel:29512324 mc[dot] beniwal[at]gov[dot]in

The proactive disclosures under Section 4 (1) (b) of the RTI Act 2005 enacted on June 15, 2005 are regularly updated [Last Updated on 14/12/2022] and available on the DSIR Website at http://www.dsir.gov.in. DSIR has complied with the directives received from Central Information Commission. RTI Requests and First

https://www.dsir.gov.in/right-information-act-2005

https://www.dsir.gov.in/hi/right-information-act-2005

Appeals received and their responses are available on DSIR Website.

DSIR has received 217 Applications during 01/01/2023 to 31/03/2024 and all the Applications were registered and out of them 212 were disposed off and 05 are under process on RTI Request & Appeal Management Information System at https://rtinonline.gov.in/RTIMIS. During 01/01/2023 to 31/03/2024, 04 applications were registered and disposed off as first appeal.

The Division provided technical support by way of lectures and online demonstrations covering Overview of RTI Act 2005, Proactive Disclosures, Exemptions under RTI Act, RTI Online Portal, CIC Portal, Transparency Audit etc during:

Programme on RTI on the topic 'RTI: Mandatory Disclosure' organized by Council of Scientific and Industrial Research-Human Resource Development Centre (CSIR-HRDC), Ghaziabad on 09.11.2023 through MS Teams.

DSIR has been effectively using various IT applications like RTI Request & Appeal Management Information System at http://rtionline.gov.in/RTIMIS, RTI Annual Return Information System at https://dsscic.nic.in/users/pn-login wherein returns were uploaded regularly.

CHAPTER 9: AUTONOMOUS BODIES

AUTONOMOUS INSTITUTION

1.0 Council of Scientific and Industrial Research (CSIR)

1.1 Significant S&T Contributions

1.1.1 Biological Sciences

(i) Wastewater/Sewage surveillance

Weekly surveillance is being done extensively by CSIR-CCMB in the city of Hyderabad. 467 samples have been tested in 2023-24 so far. The continuing focus is on SARS-COV-2 monitoring (through both RT-PCR & viral sequencing), but efforts to address & assess other pathogens & Anti-microbial resistance profile prevalent in around 18 cities in the country is ongoing. In addition, a multi-institutional study helps understand COVID-19 pathology better. The study shows a strong interferon system can protect from severe SARS-CoV-2 infection and pathology including inflammation-induced neuropathology. The study has been done in mice.

(ii) Loss of PERK function promotes ferroptosis by downregulating SLC7A11 (System Xc-) in colorectal cancer

Ferroptosis, a genetically and biochemically distinct form of programmed cell death, is characterised by an iron-dependent accumulation of lipid peroxides. Therapy-resistant tumor cells display vulnerability toward ferroptosis. Endoplasmic Reticulum (ER) stress and Unfolded Protein Response (UPR) play a critical role in cancer cells to become therapy resistant. Tweaking the balance of UPR to make cancer cells susceptible to ferroptotic cell death could be an attractive therapeutic strategy. To decipher the emerging contribution of ER stress in the ferroptotic process, team at CSIR-CDRI has observed that ferroptosis inducer RSL3 promotes UPR (PERK, ATF6, and IRE1α), along with overexpression of cystine-glutamate transporter SLC7A11 (System Xc-). Exploring the role of a particular UPR arm in modulating SLC7A11 expression and subsequent ferroptosis, it has been noticed that PERK is selectively critical in inducing ferroptosis in colorectal carcinoma. PERK inhibition reduces ATF4 expression and recruitment to the promoter of SLC7A11 and results in its downregulation. Loss of PERK function not only primes cancer cells for increased lipid peroxidation but also limits in vivo colorectal tumor growth, demonstrating active signs of ferroptotic cell death in situ. Further, by performing TCGA data mining and using colorectal cancer patient samples, it has been demonstrated that the expression of PERK and SLC7A11 is positively correlated. Overall, experimental data indicated that PERK is a negative regulator of ferroptosis and loss of PERK function sensitizes colorectal cancer cells to ferroptosis. Therefore, small molecule PERK inhibitors hold huge promise as novel therapeutics and their potential can be harnessed against the apoptosis-resistant condition.

(iii) CLUH functions as a negative regulator of inflammation in human macrophages and determines ulcerative colitis pathogenesis.

Altered mitochondrial function without a well-defined cause has been documented in patients with ulcerative colitis (UC). In efforts to understand UC pathogenesis, CSIR-CDRI observed reduced expression of clustered mitochondrial homolog (CLUH) only in the active UC tissues compared with the unaffected areas from the same patient and healthy controls. Stimulation with bacterial Toll-like receptor (TLR) ligands similarly reduced CLUH expression in human primary macrophages. Further, CLUH negatively regulated secretion of proinflammatory cytokines IL-6 and TNF-α and rendered a proinflammatory niche in TLR ligand-stimulated macrophages. CLUH was further found to bind to mitochondrial fission protein dynamin related protein 1 (DRP1) and regulated DRP1 transcription in human macrophages. In the TLR ligand-stimulated macrophages, absence of CLUH led to enhanced DRP1 availability for mitochondrial fission, and a smaller dysfunctional

mitochondrial pool was observed. Mechanistically, this fissioned mitochondrial pool in turn enhanced mitochondrial ROS production and reduced mitophagy and lysosomal function in CLUH-knockout macrophages. The studies in the mouse model of colitis with CLUH knockdown displayed exacerbated disease pathology.

(iv) Phenolics of Browntop Millet Extracted in Solvents with Varying Polarities

The Browntop millet (Urochloa ramose L.), commonly known as "Dixie signal grass", is one of the ancient minor millets belonging to the family Poaceae, majorly cultivated in Southeast Asia and Africa for forage and also it serves as the main source of food in the region. Phenolics of browntop millet extracted in solvents with varying polarities [water, methanol, acetone (80%), ethanol (70%)] were comparatively assessed for their phenolic profiles, antioxidant activities, DNA damage protection and enzyme inhibitory properties at CSIR-CFTRI. The different extraction solvents and their polarities significantly influenced the total phenolics, individual phenolic compounds, antioxidant activities and enzyme inhibitory properties of the millet. The 80% acetone and 70% ethanol were the most effective solvents for extracting millet phenolics and their antioxidant activities. Gallic, caffeic, and ferulic acids were the major phenolic acids, myricetin and kaempferol were the most abundant flavonoids detected in all the extracts of browntop millet. Furthermore, these phenolic extracts also efficiently protected DNA from oxidative damage and inhibited enzymes relevant to hyperglycemia. The extraction ability of solvents with varying polarities distinctly affected phenolic content and composition.

(v) Process for Production of Trans glycosylating α- Glucosidase using Novel Fungal Strain

Isomaltoligosaccharides (IMO) are oligosaccharide mixture consisting of slowly digestible and non-digestible components which serve as an alternative (lower calorie) sweetener and bulk filler in the food sector. During the industrial production of IMO, a key enzyme, transglycosylating α-glucosidase serves as a processing aid along with other starch degrading enzymes. In this process, the production of transglycosylating α-glucosidase has been established using a fungal fermentation platform by CSIR-CFTRI. The strain belonging the Aspergillus spp. is safely deposited and can be procured from the culture collection centers (NCIM and MTCC). Also, the medium is starch based (tapioca or potato starch) with optimal salt and mineral composition. The process technology for transglucosylating α-glucosidase is divided into upstream and downstream processing. The upstream primarily involves rejuvenation of fungal culture and preparation of inoculum (10%) for the production scale. Here the fermentation process is established at 100 L scale. The medium has been mathematically optimized for increased α-glucosidase. The operational parameters such as RPM, pH, agitation and aeration have been optimized for improved enzyme production. After harvesting, the culture broth undergoes series of downstream processing. This enzyme powder can be used as the processing aid for production of isomalto-oligosaccharides. The fungal genome has been checked for presence of toxin synthetic gene clusters (in-silico) and also the fungal broth has been evaluated in-vitro for the aflatoxin release. From both these studies it has been demonstrated that the fungus does not produce any toxins. The fungal spores were tested for safety using in-vivo animal studies. The waste water from the UF unit has been analyzed from NABL accredited lab. It was observed that the BOD and COD levels were within the prescribed limits and heavy metals were found below detection limits. The enzyme is stable in the lyophilized powder for more than a year when stored at 4oC.

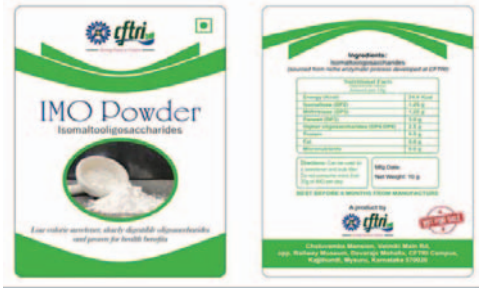


Fig 1.1.1 (v)

(vi) Modification of pearl millet flours using dry heat and ultrasonication to increase the resistant starch content

Pearl millet (Pennisetumglaucum) is a major millet crop grown in the Indian subcontinent and Africa. Pearl millet is rich in protein, essential fatty acids such as linoleic acid, iron and zinc when compared to other cereal grains. It also has higher starch content and considered as a good source of energy in the human diet. Lifestyle-related disorders such as obesity and diabetes increased in recent years forcing researchers to modify the properties of starch to make it beneficial to health. Pearl millet flour was subjected to dry heat (thermal), ultrasonication (non-thermal) and evaluated for thermal, pasting, crystalline, and in-vitro starch digestibility properties at CSIR-CFTRI. The dry heat treatment of pearl millet flour altered its thermal, crystalline, and pasting properties with an increase in resistant starch content and reduced the glycaemic index significantly. The ultrasonication treatment for lesser duration increased the formation of slowly digestible starch. The combination of ultrasonication followed by heat also modified the crystalline regions of starch. Among the treatments, dry heat treated pearl millet flour had the highest resistant starch content. These modified pearl millet flours using green technologies with higher resistant starch content could find application in low GI food products for targeted population and probiotic industry.

(vii) Tagging of Collagen with Red Emissive Ru(II) complex for biological assays

Labelling of biomolecules have attracted more attention due to its ability to study the biological events that occurs inside the cell. CSIR-CLRI has explored the use of red emitting Ru(II) polypyridyl complex as probe for tagging the collagen. The conjugation of Ru(II) complex with collagen was carried out using EDC/NHS procedure. Using micro scale thermophoresis, the binding affinity (Kd) of gallic acid (a polyphenol) to Ru modified collagen was determined and found to be 3 nM compared to 0.6 nM of native collagen which clearly indicates the Ru conjugation did not impact the binding of the polyphenol. Further, the binding affinity of collagenase to Ru-collagen was determined and exhibit the strong binding compared to native collagen. The present data clearly demonstrates that red emissive nature of Ru-collagen offers a potential solution for imaging as well as substrate for determining the binding affinity of small molecule directly either through fluorescence or micro scale thermophoresis technique.

(viii) Preparation and characterization of the antimicrobial footwear materials

Surface functionalised fabrics (Jute, banana fiber, cotton and wool) materials were prepared at CSIR-CLRI using engineered natural herbal oils and subjected to antimicrobial studies. The complete death of the applied microbes inferred the added antimicrobial property of the fabrics.

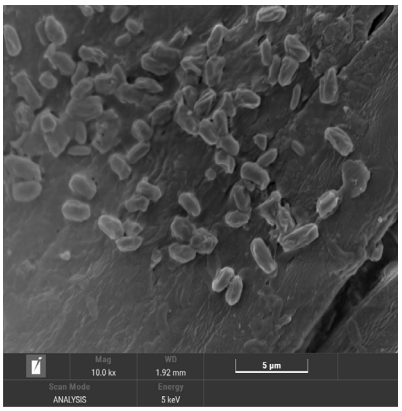


Fig 1.1.1 (viii)

(ix) Seaweed Cultivation Potential and Ecological Safeguards

A joint study was taken by CSIR-CSMCRI by cultivating Gracilariaedulis (an agar yielding seaweed) in Eranthurai (Gulf of Mannar) and Thonithurai (Palk Bay) regions for five culture periods. The highest biomass yield (7.43±0.50 kg FW m2) of G. edulis was observed in Eranthurai, Gulf of Mannar, during the early stages of summer (March-April, 2023). Among the five cycles, the fifth cycle (March-April, 2023) reported a higher

DGR (6.52±0.62 % day-1) followed by the second cycle at Eranthurai. Another site (Thonithurai) reported nil biomass due to high wave action, high surface water temperature, and epiphytic loading in the first three cycles, and 1.08±0.27 and 2.22±0.18 kg FW m2 were reported during the fourth and fifth cycles, respectively. Clear cut growth differences was observed between G.edulis cultivation between Gulf of Mannar and Palk Bay region. The recorded DGR values at both sites, even after eighteen years, did not deviate from the earlier report values. The cultivation site, which belongs to the Gulf of Mannar, has been found ideal for G. edulis cultivation.

(x) Pan India Seaweed Cultivation prefeasibility studies

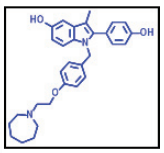
CSIR-CSMCRI has surveyed 16 sites across six districts in Odisha for seaweed cultivation feasibility studies, selecting 8 for pre-feasibility studies. In Ramachandi, Puri District, 12 fishermen received seaweed cultivation training, and cultivation activities commenced in Daluakani and Ramachandi, utilizing methods like tube net, RAFT, and net bag for Kappaphycusalvarezii, Gracilariaedulis, G. salicornia, and G. deblis. CSMCRI has also surveyed 71 sites in Andhra Pradesh, initiating pre-feasibility studies in 16. In West Bengal, 22 sites were surveyed, and 8 were chosen for pre-feasibility studies by CSMCRI. This initiative falls under the CSIR-funded project "Identification of potential Locations across India for Seaweed Cultivation and their valorization".

Fig 1.1.1 (x)

(xi) Umifenovir Derivatives

Umifenovir is used for the treatment of influenza and COVID infections in Russia and China. Umifenovir derivatives were prepared at CSIR-IICB to overcome the drawback associated with Umifenovir for SAR-CoV-2.

Compound	EC50 (μM)	EC90 (μM)
TND-2-173	0.04 ± 0.02	0.7 ± 0.1
TBT-2-155	0.2 ± 0.08	ND
TBT-2-63	0.005 ± 0.003	0.06 ± 0.02
VC104 (control)	0.3 ± 0.05	2.2 ± 0.8
Bazedoxifene	0.3	



Compound	EC50 (μM)	EC90 (μM)
TIH-2-136	0.002 ± 0.05	0.02 ± 0.04
TIH-1-202	0.1 ± 0.04	9.68 ± 3.8
TIH-01-65	0.2 ± 0.004	3.0 ± 0.2
VC104 (control)	0.6 ± 1.8	6.6 ± 7.6
Umifenovir	4.11	

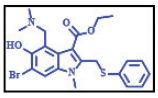


Fig 1.1.1 (xi)

(xii) National Reference Laboratory

CSIR-IITR is recognized as National Reference Laboratory by FSSAI under section 43(2) of the FSS Act, 2006 for chemical risk assessment.

(xiii) Chitosan-carbon nanofiber based disposable bio electrode for electrochemical detection of oxytocin

Bio electrodes with low carbon footprint can provide an innovative solution to the surmounting levels of e-waste. Biodegradable polymers offer green and sustainable alternatives to synthetic materials. CSIR-IITR has developed a chitosan-carbon nanofiber (CNF) based membrane and functionalized for electrochemical sensing application. The surface characterization of the membrane revealed crystalline structure with uniform particle distribution, and surface area of 25.52 m^2/g and pore volume of 0.0233 cm^3/g. The membrane was functionalized to develop a bioelectrode for the detection of exogenous oxytocin in milk. The chitosan-CNF membrane is ecologically safe and opens new avenues for environment-friendly disposable materials for sensing applications.

(xiv) Pan CSIR Cancer Research Program

CSIR-IIIM is coordinating a Pan CSIR Cancer Research Program making cancer care affordable empowering Women's health focusing on breast and gynecological cancer of India Relevance.

(xv) Detection of Diabetic Nephropathy

Diabetic nephropathy is a leading cause of end-stage renal disease. Hence, early detection of diabetic nephropathy is essential to mitigate the disease burden. Microalbuminuria, the currently used diagnostic marker of diabetic nephropathy, is not efficient in detecting it at an early stage. CSSIR-NCL has explored the utility of glycated human serum albumin (HSA) peptides for risk prediction of diabetic nephropathy. Three glycation-sensitive HSA peptides, namely, FKDLGEENFK, KQTALVELVK, and KVPQVSTPTLVEVSR, with deoxyfructosyllysine (DFL) modification were quantified by targeted mass spectrometry (MS) in a study population comprising healthy and type II diabetes subjects with and without nephropathy. Mass spectrometry, receiver operating characteristic (ROC) curve, and correlation analysis revealed that the DFL-modified KQTALVELVK peptide was better than other glycated HSA peptides and HbA1c for identifying diabetic nephropathy. DFL-modified KQTALVELVK could be a potential marker for risk prediction of diabetic nephropathy.

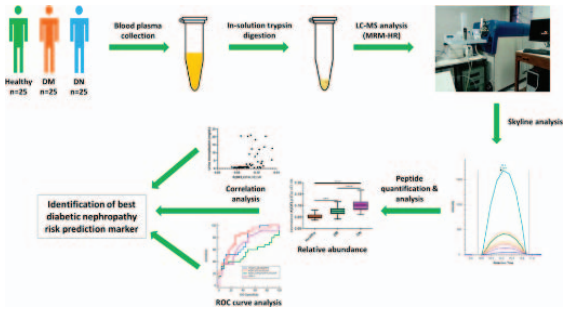


Fig. 1.1.1 (xv)

(xvi) Development of sustainable leather alternatives for animal and synthetic leather

CSIR-NIIST has developed an alternative to conventional leather materials with leather like properties using agricultural wastes, reducing the environmental issues associated with agriculture waste. The affordable technology developed has been transferred to Streekaya Pvt Ltd.

Fig 1.1.1 (xvi)

1.1.2 Chemical Sciences

(i) Steric and Electronic Effect in Unsymmetrical Squaraine Dyes for Dye-Sensitized Solar Cells (DSSCs)

Functionalizing the light harvesting sensitizers with additional electron-donating or -withdrawing groups is a potential approach to modulate the photo physical, and electrochemical properties which in-turn optimizes the driving force associated with the charge injection and dye-regeneration processes at the dye-TiO^2/electrolyte interface and the photovoltaic device performance in dye-sensitized solar cells (DSSCs). Further, in-built steric feature by introducing alkyl groups in the sensitizer is important in controlling the aggregation of dyes on the TiO^2 surface. Hence, to integrate both steric and electronic properties, a series of alkyl group wrapped unsymmetrical squaraine dyes (SQ-X) with electron-donating and -withdrawing groups have been designed, synthesized, and utilized for the DSSC device fabrication at CSIR-NCL. Enhanced photovoltaic performances have been obtained for the dyes containing electron donating groups, where dye with $-NPh^2$ group showed maximum of η 7.03%.

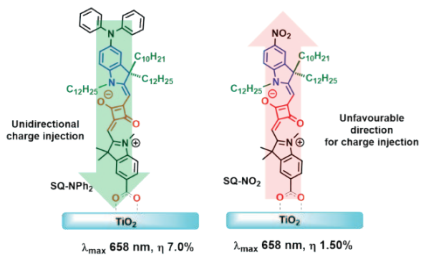


Fig. 1.1.2 (i)

(ii) Screening of Catalysts for CO2 to Value Added Products

CSIR-NCL has performed screening of various catalysts for CO_2 to value added products, MeOH to formaldehyde, and hydrogen production from methane. Validation of some of the predictions through experiments have been conducted.

(iii) Iridium-Catalyzed Enantioselective Allylic Substitution of Vinyl cyclopropanes by Carboxylic Acids

An efficient method for a highly regio- and enantioselective allylic substitution of vinylcyclopropanes using carboxylic acids as oxygen nucleophile via iridium catalysis has been developed by CSIR-CDRI. This represents a highly atom-economic approach for the synthesis of synthetically useful chiral building blocks in high yields. The practical utility of this method is demonstrated by the application of the products in useful transformations.

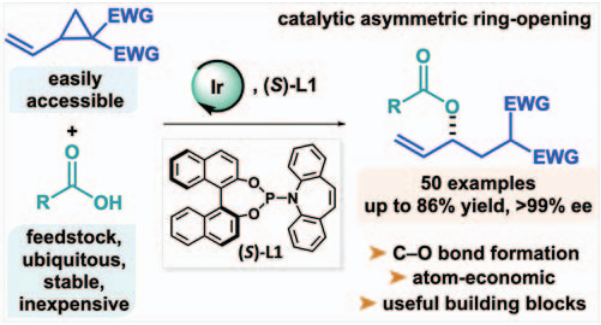


Fig. 1.1.2 (iii)

(iv) A Versatile Hybrid Photocatalyst for Dye Decontamination

For effective water decontamination, it is of utmost importance to develop a photocatalyst with enhanced activities. CSIR-CLRI has developed a hybrid catalyst $BiVO_4$-ZnO encapsulated gold-decorated reduced graphene oxide. The emission intensity in photoluminescence spectra revealed the charge carrier recombination order as ZnO> $BiVO_4$–ZnO> Au-rGO/$BiVO_4$–ZnO. The Au-rGO/$BiVO_4$–ZnO composite has been employed as photocatalyst in the degradation methylene blue dye under natural solar radiation. The degradation experiment has been repeated with bare ZnO and BiVO4–ZnO mixed oxide. The results revealed the enhanced photocatalytic activity of the Au-rGO/BiVO4–ZnO composite. This catalyst has a potential to be used in water purification.

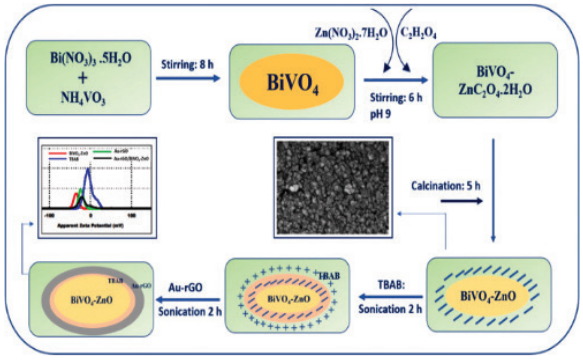


Fig. 1.1.2 (iv)

(v) Direct air capture of CO_2 using phase-change amines and adsorption

About 50% of CO_2 emitted in to atmosphere is from distributed sources such as transportation, aviation, etc. In net zero scenario, capturing CO_2 directly from air becomes very important. There are certain advantages as capture can be done at a place CO_2 is required avoiding transportation and other costs. However, as CO_2 concentration in air is very low (~412ppm) the existing direct air capture (DAC) processes are very capital and energy intensive resulting in high cost (USD250 – USD600 per ton of CO_2 captured depending on technology, etc.).

CSIR-CECRI is working to develop a cost effective DAC process employing phase change amines which includes objectives to develop and demonstrate a continuous DAC process using phase change amines with 10kg CO_2 capture per day (13.76 million litres of air per day processing), to develop novel phase change amines based on molecular modelling studies and generate process data using best phase change amines for designing of commercial DAC plant (ton scale) and synthesis & modification of novel adsorbent, design and fabrication of bench scale adsorption unit (1.79 tons of air capacity) for direct air capture

(vi) Halogen Bonded Organic Framework Material for Iodine Capture

Radioactive iodine isotope is major nuclear waste. Capture and storage of such iodine is a challenging environmental problem. CSIR-IICB has developed a novel and halogen bonded organic framework material (XOF) for efficient and reversible capture of iodine from atmosphere and water. The material can be readily accessible by simple grinding of readily accessible building blocks. The XOF captures iodine from the gas phase (3.23 gg−1 at 75°C and 1.40 g g−1 at rt), organic solvents (2.1 g g−1), and aqueous solutions (1.8 g g−1 in the pH range of 3–8); the latter with fast kinetics. The captured iodine can be retained for more than seven days without any leaching, but readily released using methanol, when required. The XOF also has utility in the sensing of nitro aromatics explosives and acid vapor.

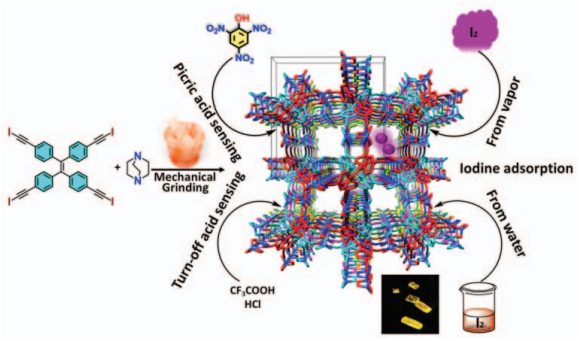


Fig. 1.1.2 (vi)

(vii) Indigenous Development of Processes and Materials for Highly Efficient and Stable Pervoskite Solar Cell Technology

CSIR-CECRI is developing different components for perovskite solar cells such as ETL, HTL, stable perovskite ink and carbon paste/ink. The team is developing ambient processed stabilized perovskite inks and thin-films by molecule engineering methods (additive engineering, grain boundary modification etc.). The team is also working on the low temperature processable phase pure TiO_2 for ETL on flexible substrates. Inorganic HTL layer CuSCN shows low dissolution in Di-propyl sulfide/Di-ethyl sulfide (30 mg/ml approx.) and to get desired thickness of the CuSCN layer multiple coating needed which cause the damage to the perovskite layer. The team is working on different additives to get better dissolution and to stabilize the perovskite thin-films. Further, perovskite material is highly sensitive to solvents which make the film degradation. The CECRI team is also developing low temperature curing carbon paste used as a back contact for the perovskite solar cells as a replacement to the gold evaporation. The team is also developing a Polyhedral oligomericsilsesquioxane based hydrophobic and transparent paint which can be used as an encapsulation for the solar cells in all weather conditions. Recently, CSIR-CECRI has developed the PSC with 10% power conversion efficiency using Cs mixed with $MAPbI_3$ material and CuSCN hole transport material (TRL =< 3) and ambient crystal stabilization of α-FAPbI3 perovskite by rapid annealing method. CSIR-CECRI is also involved in theoretical studies on the perovskite crystal structures and band gap calculations to minimize the interfacial recombination processes to optimize the cell efficiency. The development of inks for different components will lead to low cost fabrication of perovskite solar cells and together with import substitution, this technology will directly result in profound national, industrial and societal impact.

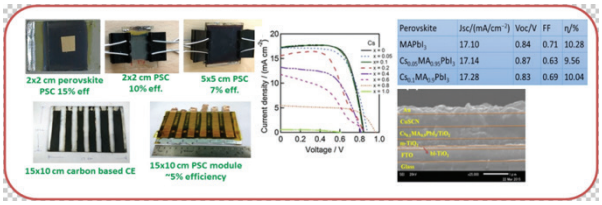


Fig. 1.1.2 (vii)

1.1.3 Engineering Sciences

(i) Design, Development and Demonstration of Bamboo Composite Structure "Baithak"

CSIR-AMPRI has been focusing on design and development of high-end value-added products utilising naturally available resource bamboo. The outcome is a product resembling teak wood with better dimensional stability, density, mechanical

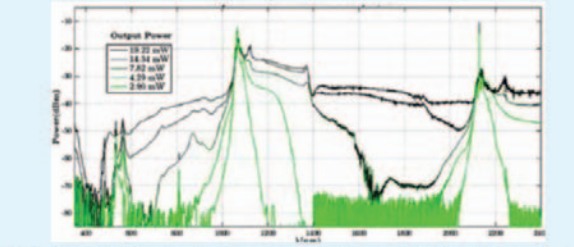
strength, fire and moisture resistance etc. CSIR-AMPRI has developed a knowhow of manufacturing environmental friendly multifunctional "Bamboo Composites for Modern Housing and Structures". This patented Knowhow Technology is transferred to two Industries- M/s Permali Wallace Pvt. Limited, Bhopal and M/s Ecological Fibre Pvt Ltd., Jabalpur. CSIR-AMPRI's Bamboo composites are commercialised and on industrial level these bamboo composites can be converted into panel boards, beams, pillars, truss, partitions, doors, window frames, roof, floorings etc. used mainly in the housing sectors & construction industries. For the first time ever, a "Demonstration Structure (AMPRI's Bamboo Composite Committee room "Baithak") which includes walls, roof, floor, beams, poles, door, and window frames of bamboo composites has been erected in the premises of CSIR-AMPRI, Bhopal which demonstrates the eco-friendly application of the developed bamboo composites. The plan of the "Baithak" is hexagonal in shape and has an inclined roof. The hexagonal base is erected with a peak height of 13' 8", a max span of 24'8", and a floor area of 253 sq. ft.

(ii) Evergreen Hybrid Composite of Parali (Agro waste)

CSIR-AMPRI transferred technology titled "Evergreen Hybrid Composite of Parali (Agro waste) and Industrial Waste" to M/s Amit Densified (Doors) Private Limited, Sonipat, Haryana, under brand of M/s Bhutan Tuff, New Delhi on 21st August 2023. Crop-residue has emerged as a threat to the environment. Every year, the burning of agro residues created severe air and smog pollution. Various approached have been adopted to tackle agro waste, however, to date, eco-friendly solution to tackle the agro residue especially paddy straw is still not available. In line with the spirit of waste-to-wealth on mission mode, CSIR-AMPRI came up with a green technology to manage the paddy straw (Parali) agro waste. A new class of materials Parali-based particle board as a wood substitute for building applications has been introduced so that consumption of timber in building and house construction can be minimized and Parali can be consumed in an eco-friendly manner. This technology also offers a potential solution for the effective utilization of other several agro and industrial wastes such as paddy straw, wheat straw, marble waste, and fly ash. The developed eco-friendly Parali board (evergreen hybrid wood), is cheaper and stronger than the conventional particle board and counterpart. The developed parali board is resistant to weather, corrosion, water, moisture and is a termite and fungus-free product.

(iii) Multicomponent Glass based Optical Fibers for Vis-MIR Photonic Application

Glass-based multi-components (Si, Ge, Al, Hf) fiber having SiO_2 content less than 25.0 wt% and transmission up to 3.1 micron has been developed at CSIR-CGCRI. Hydroxyl (OH-) content of the developed fiber glass was reduced to 1.5 ppm and it showed numerical aperture of 0.41 having refractive index (RI) difference of 0.06 with core diameter of 2.75 micron. Power of the characteristic broad band output spectra over visible to NIR region up to 2.4 μm was obtained to be 19.22 mW.



Output broad-band spectra of multicomponent glass based optical fiber obtained under pumping at 1550nm wavelength with variation pump power

Fig. 1.1.3 (iii)

(iv) Development of Novel Borosilicate Bioactive Glass Composition

Boro-silicate bioactive glasses with apatite forming ability within one day and acceptable cell proliferation with strong bactericidal action in comparison to commercially glasses have been developed at CSIR-CGCRI. Scaffolds had been prepared utilizing these thermally developed stable glasses adopting foam replication method. The bioactive glass coating on the surface of the metallic

implant significantly improves corrosion resistance and osseo-integration. A novel borosilicate based bioactive glass composition was developed that showed similar thermal expansion coefficient as like Ti6Al4V based medical prosthesis.

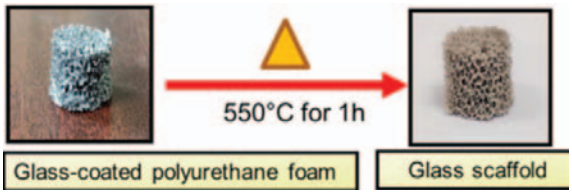


Fig. 1.1.3 (iv)

(v) Waterless Chrome Tanning Technology

CSIR-CLRI Regional Centre, Kanpur had undertaken the commercial scale demonstration and implementation of the Waterless Chrome Tanning Technology (WCTT) in Kanpur and Unnao Leather Cluster. The technology has been demonstrated in M/s Calico Impex and M/s Calico Trends Unnao. A batch of 5 ton of buffalo raw hides was taken for processing of chrome tanned leather (wet-blue) by using WCTT. The technology has been licensed to 14 leather processing units in Jajmau, Kanpur during 1st April to 31st October 2023.

(vi) Characteristic Analysis of Sisal Fabric and Cow Nubuck Leather for Developing Leather Lifestyle Accessories

With increased awareness of the environmental issues associated with synthetic polymers, eco-friendly biodegradable materials are in high demand. This study performed at CSIR-CLRI assesses sisal fabrics' physical, structural, and thermal properties and a blend of sisal and cotton fabrics for their suitability for use with cow nubuck leather in leather product applications. All the chosen sisal fabrics were found to have mechanical properties comparable to or even better than cow nubuck leather. The tensile strength of sisal fabric is far greater than cow nubuck leather. The strength of sisal fibers ranges from 400 to 700 Mpa, whereas cow nubuck leather ranges from 10 to 40 Mpa. On the other hand, cow nubuck leather outperforms all other fabrics in terms of elongation percentage. Scanning electron microscopic analysis provided convincing evidence for characteristic fiber patterns in the individual fiber bundles (yarn) and their blend fiber composition of sisal fabrics. Sisal fabrics have a higher thermal stability than cow nubuck leather, with a degradation temperature of 230°C. It has been concluded that the selected sisal fabrics can be used to make leather lifestyle products.

(vii) Laying and Performance of Cement Grouted Bituminous Mixes (CGBM) Pavements

Cement Grouted Bituminous Mixes (CGBM) is composite wearing course to overcome the primary failure modes of bituminous pavements through moisture induces damages and rutting. The CGBM layer is normally described as a porous bituminous layer (around 25 percent air voids) which is filled with a cementitious grout. Most of the void spaces in the porous bituminous layer are occupied with cementitious grout by the gravity force. The study conducted by CSIR-CRRI included evaluation of aggregate gradation, compaction effect, selection of bitumen content and degree of grout penetration. Micro-CT analysis was carried out to check the air voids in CGBM. Two Trial sections of about 200 mts were laid in Surat City, Gujarat in 2017, subsequently field performance was observed for 6 years. No sign of distress either rutting, fatigue cracking or pot hole was observed in the trial sections even after 7 monsoon seasons. This CGBM can be used for new Construction or for Maintenance of distressed pavement. The CGBM Pavement on NH-44 on Udhampur bypass for 1.6 km has been laid for the first time on National Highway in India in June 2023. Further, CGBM Pavement will be laid on Vadodara Waghodia Road, SH-5 in Gujarat for 4.1 km.

Fig. 1.1.3 (vii)

(viii) Development of Flaperon Test Box Assembly for AMCA

Aeronautical Development Agency (ADA) along with CSIR-NAL has successfully completed critical composites technology licensing to LCA Tejas Mk1 aircraft using standard modulus carbon composites. For the future forthcoming programs, ADA & NAL has jointly carried out characterization of high strength intermediate modulus carbon composites. Subsequently, the high strength composite material has been used in a realization of Flaperon structural assembly with co-cured technology. The flaperon assembly is ready for structural tests and has been handed over to ADA by NAL on 5th October, 2023. This will ensure ADA to take up the design of advanced medium combat aircraft (AMCA) with high strength intermediate modulus carbon composite materials to reduce the weight. Development of Flaperon Test Box Assembly for AMCA is shown in the picture.

(ix) High Altitude Platform Sub Scale (HAPSS)

CSIR-NAL is developing the High Altitude Platform Sub Scale or 'HAP SS' for lower altitude flight with shorter endurance. The design and analysis of the HAP SS (1:3) wing with aileron and Horizontal Tail (HT) with elevator have been carried out. An electrical system with lower performance has been chosen based on the inputs on aerodynamics, propulsion, energy management and avionics data. Static, dynamic and aeroelastic studies were carried out on the fully integrated FE model of HAP including non-structural masses for critical load cases. The flight model and design of control laws were developed during this year. The designed HAP SS has capabilities of rapid reconstitution, persistent 24/7, multi-mission, exchangeable/repairable/upgradeable payloads, easy re-tasking, low observability and is of lower cost than a satellite.

Fig. 1.1.3 (ix)

(x) Technology Development for Holistic Utilization of Red Mud for Extraction of Metallic Values & Residue Utilisation

CSIR-NML in association with CSIR-IMMT, JNARDDC as R&D labs; and HINDALCO, NALCO and VEDANTA as industrial partners is coordinating the project for development of holistic process to extract Al, Fe, Ti and REEs from various red mud samples and demonstration on 100kg batch per unit operation. Technology demonstration on 10 kg feed scale red mud has been given to NALCO, HINDALCO, VEDANTA on 16-17th February 2023 at CSIR-NML. The process validation is undergoing for 50kg scale.

(xi) Energy Storage Application of VO2(D)-Graphene Hybrid Material

A rare VO_2(D) phase plate-like structures and integrated with graphene (rGO/VO_2(D)) has been developed at CSIR-IMMT by facile hydrothermal route, and their activity has been explored towards supercapacitor application and has been validated by the extensive ab-initio simulations using Density Functional Theory (DFT) study. After successful synthesis, the samples have been characterized by various techniques to know its crystal phase, surface morphology and elemental composition.

(xii) Coal Characterization and Analysis

CSIR-NML's laboratory is recognised as a Referee Laboratory for Coal Analysis and is actively involved in the coal characterization and analysis such as band by band analysis, seam overall analysis

of coal sample received from various subsidiaries of Coal India Limited. CSIR-NML carry out quality assessment of both coking and non-coking coals through chemical characterization using its state-of-the-art coal characterization laboratory.

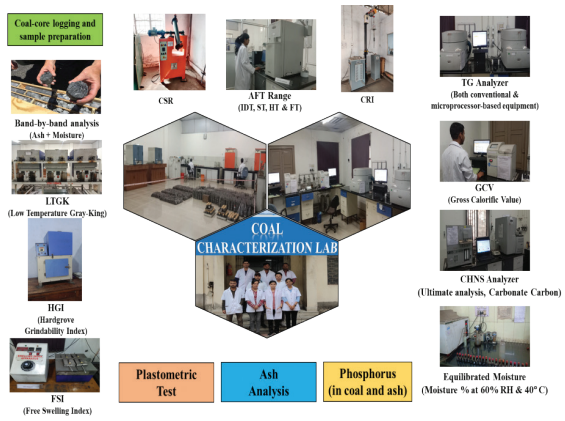


Fig. 1.1.3 (xii)

(xiii) Recovery of Nickel, Chromium and Iron from Chromite Overburden (COB)

Chromite overburden (COB) is a waste generated to the tune of 6-8 tons per ton mining of chrome ore. It contains metal values like iron, chromium and nickel along with other non-metallic oxides like silica, alumina etc. These metal values carry huge commercial value. Nickel percentage in COB ranges between 0.3-0.8 and it is also considered as lateritic ore of nickel. So far no commercially viable technology is available to extract these metals from COB. CSIR-IMMT has been working on development of process for recovery of nickel, chromium and iron from COB.

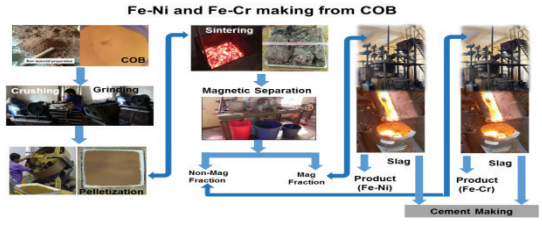


Fig. 1.1.3 (xiii)

1.1.4 Physical Sciences

(i) Installation of "Lead Free X-ray Shielding Red Mud Tiles at INS Kattabomman

CSIR-AMPRI has converted iron rich red mud (alumina industrial waste) into X-ray shielding tiles, which is suitable for shielding diagnostic X-rays (60 – 140 kV). The 12mm thick tile possess attenuation equivalent to 2mm lead at 100 kV. CSIR-AMPRI has supplied and installed successfully ≈650 ft^2 tiles through M/s Prism Johnson Ltd. to Indian Navy, INS Kattabomman, Tirunelveli, Tamil Nadu. The X-ray room is now ready for the installation of X-ray machine.

(ii) Probing the Lithospheric structure of the Ganga Basin by Magnetotellurics

Crustal structure of the Ganga Basin is largely unexplored. Studies undertaken by a series of Mangetotelluric (MT) profiles done by CSIR-NGRI covered across the basin over the past decade. A synthesis of MT results show conductance and buried block of Bundelkhand massif beneath Ganga basin. Existence of an electrical Moho at 40-45 km depth beneath the Bundelkhand massif was observed. The results showed concealed shear zone within the Bundelkhand massif beneath the Ganga Basin. The crustal structure beneath Ganga Basin obtained with Magnetotellurics is shown in the figure.

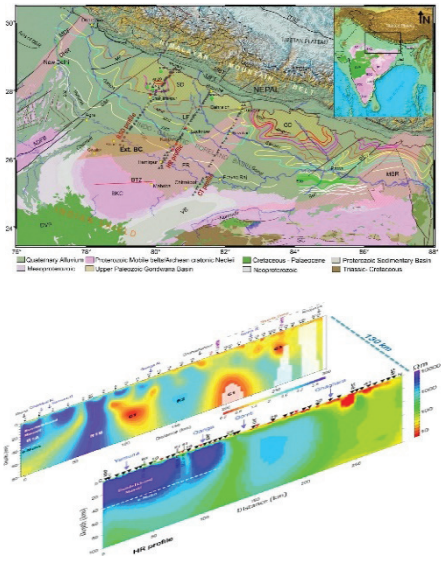


Fig. 1.1.4 (ii)

(iii) Understanding Joshimath Ground Deformation through Geological and Shallow

Subsurface Geophysical Mapping (Near Surface Geophysics)

CSIR-NGRI was called by National Disaster Management Authority (NDMA) and Uttarakhand State Disaster Management Authority (USDMA) for scientific studies in understanding the Joshimath land subsidence issues. CSIR-NGRI has launched integrated geophysical studies in various part of the affected regions and submitted report to NDMA. Further, NDMA requested CSIR-NGRI for continuous monitoring of the region for some more time for an enhanced observation.

(iv) Indigenous Development of InGaN/GaN Blue and White Light Emitting Diodes (LEDs)

CSIR-CEERI has developed the indigenous design and fabrication technology of InGaN/GaN Multiple Quantum Well (MQWs) based blue and white light emitting diodes (LEDs). LED structure was grown on c-plane patterned sapphire substrate (PSS). The grown LED structure consists of layers, namely: buffer layer of GaN (~ 2 µm), n-GaN (~ 2 µm, Si-doped), active region (InGaN/GaN MQWs), AlGaN (~ 20 nm) electron blocking layer and p-GaN (Mg-doped). Fabrication of blue LED chip includes chip design, epitaxial design, and unit process parameters such as photolithography, mesa, transparent conducting layer for uniform current spreading, n & p-contacts, passivation, wafer thinning, backside reflector, dicing, and packaging of chips. To convert blue light into white light, yellow phosphor with Ce-doped was coated on blue LED chip. The correlated colour temperature (CCT) of the white LED is mainly dependent on the quantity of yellow phosphor. This may vary from 3500 K to 10000 K. Images of fabricated wafer, packaged blue and white LED chips are shown.

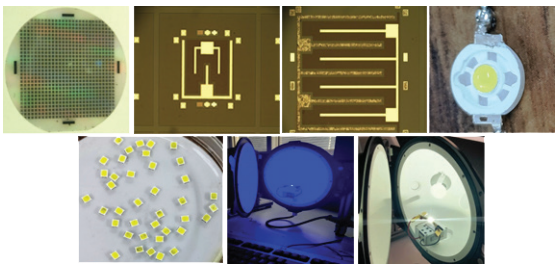


Fig. 1.1.4 (iv)

1.1.5 Information Sciences

(i) Impact Assessment of New and Emerging Waste Management Technologies on Human Life

The study conducted by CSIR-4PI include change in waste composition due to Covid 19 pandemic and the effects of pandemic on waste management and treatment technologies. A careful analysis of CPCB's January and May 2021 reports suggests that 22 of the 35 states and Union Territories generate more biomedical waste than they can handle. The capacity of facilities to treat biomedical waste is nearly saturated in Maharashtra, Goa, Manipur, Andhra Pradesh, Meghalaya, Rajasthan and others. The volume of the waste in May 2021 was massive at places. In Haryana, COVID-19 waste was responsible for 47% of the biomedical waste, followed by Chhattisgarh (42%), Himachal Pradesh (40%), Andhra Pradesh (40%) and Delhi (39%).

(ii) Analysis of heat wave over different physiographical regions in India

This study by CSIR-4PI represents the HW characteristics over the tropical country India mainly divided in three different landmasses, i.e. hilly, plains and coastal. This work presents the HW characteristic quantification based on the physiography of the regions in India assessed over a period of 70 years (1951–2020) using the Indian Meteorological Department (IMD) observed data. Mostly, the earlier studies are more focused on HW in the plains and coastal regions. HW in hilly region has been excluded by using single threshold for the whole Indian region, so based on the topographical features, three thresholds of daily maximum temperature (DMT), i.e. DMT > 40 °C (plains), DMT > 37 °C (coastal) and DMT > 30 °C (hilly), are being applied. The spatio-temporal analysis of HW shows its occurrence in hilly regions (J&K, Manipur, Mizoram and Tripura) since 1972 and maximum 10-day HW in the northern region. The coupled model intercomparison project phase (CMIP6) model output for 7 models has been assessed to quantify the performance in capturing the HW parameters compared to IMD observations. The ensemble

mean of 2 CMIP6 models, i.e. EC Earth3 and MPI LR, has been used to project future changes in HW properties over India under the different emission scenarios, i.e. SSP126 and SSP 585. The key finding of this study shows that for year 2050 onwards, a sharp increase in HW days, HW events and HW duration (average and maximum) will increase in hilly, coastal and plain region. Under SSP 585, the southern part will likely get more new hotspots of HW in India, and there will be significantly more longer, intense and frequent HW occurrence as compared to SSP 126. The results show the need of improvement in understanding of HW at regional scale and especially in hilly region. A schematic map showing the highest recorded daily maximum temperature associated with HW events during the period 1967–2012 and the possible HW mechanism in India is shown.

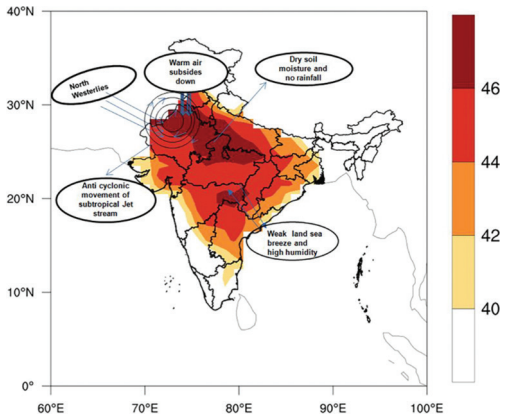


Fig. 1.1.5 (ii)

1.2 Contributions to Rural Sectors

(i) Leather material study for the handicraft leather sector

Leather sector from northern Karnataka region was chosen for this study conducted by CSIR-CLRI. Various clusters making sole leather, Khapsichappal, dog chews, harness and other leather products were identified from Bagalakote and Belagavi districts. The target artisans making leather and leather related products were interviewed for understanding the environmental sustainability of the sector in terms of leather and product making.

(ii) Solar Powered High Mast System

A stand-alone Solar PV White- LED High Mast Light consisting of white LED luminary of 4*40 Watt (LED + Driver) along with solar PV modules and battery is deployed at Ghoramara Island by CSIR-CMERI. The standalone high mast system operates the load from dusk to dawn to provide adequate light in the main marketplace (community center) of the island. it is expected to extend the current business hours until 9 PM in the evening.

(iii) CSIR-Aroma Mission

Under the third phase of Aroma Mission, CSIR-IHBT consolidated the area under aromatic crops to 429 ha extending cultivation in eleven states and two union territories. Eighteen lakh rooted plants and two tons of seeds were generated and supplied to the farmers. One field distillation unit is being installed in the farmers' fields for extraction of essential oils in the remote location of Aspirational District of Chamba (Himachal Pradesh).

CSIR-IHBT has contributed significantly under CSIR-Aroma mission in promoted creation of essential oil-based aroma industry in hill regions of India, which has greatly helped Indian industry, farmers, progressive growers and entrepreneurs for in job creation and income-enhancement.

During the year, the expected net income generation through sale of essential oil is estimated at 4 Crores. Eleven Awareness/Training Programs were conducted to support the farmers on the cultivation aspects of aromatic crops and extraction techniques for the production of essential oil from their own produce. Entrepreneurship development for supply of planting material was also promoted among the progressive farmers involved in production of aromatic crops.

(iv) CSIR-Floriculture Mission

CSIR has launched the Second Phase of Floriculture Mission program to boost floriculture industry and make it export oriented. With growing urban area, floriculture industry has become a profitable

venture and emerging as a major alternate for crop diversification in the agriculture scenario of the country.

CSIR Floriculture mission expanded the total agriculture area of 107.83 ha under the mission during the reporting period. A total number of 1182 of beneficiaries including farmers, SHGs, entrepreneurs etc were added in the mission. more than 10 lakh planting materials were distributed to beneficiaries during the reporting period.

To empower the rural youth, women and farmers, CSIR-NBRI under scientific social responsibility initiative, organized various thematic training session on gardening aspects including bonsai making, dry flower craft making, home gardening, etc., During the reporting period, a total number of 110 individuals were trained by the experts under training programmes. CSIR-NBRI is also working on Lotus Mission with aim to promote Lotus cultivation to improve livelihood of farmers. The major verticals of this ambitious mission are large-scale multiplication of 'Namoh 108' Lotus, its distribution to farmers through CSIR-Floriculture mission and training the farmers in lotus textiles, perfumery and nutraceutical products.

CSIR-IHBT organized fifteen training and awareness programs in which 540 farmers were trained. Ten lakh planting material of floriculture crops in form of corms and rooted plants was generated and supplied to the farmers of Himachal Pradesh, Uttarakhand, Punjab and union territories of Jammu & Kashmir and Ladakh. Tulip Garden in Himachal Pradesh at CSIR-IHBT, was inaugurated at CSIR-IHBT campus.

Fig. 1.2 (iv)

(v) Development of prototype for Honey Test

CSIR-NCL successfully developed a prototype NMR test specifically tailored for Indian honey varieties. It was demonstrated that the test, which involves sample preparation protocols, NMR parameters and statistical data analysis can determine presence of adulterants thus validating the authenticity and source of Indian honeys, thereby safeguarding their quality and origin. Furthermore, the two labs are working towards uncovering the key metabolites in honey which may perhaps be linked to their unique medicinal properties.

In a unanimous consensus, the experts from Khadi and Village Industries Commission (KVIC), Meghalaya Farmers Empowerment Commission (MFEC), North East Centre for Technology Application and Reach (NECTAR), National Bee Board (NBB), the National Dairy Development Board (NDDB), Forest-Based Industries and Institutes, Agricultural Universities, CSIR laboratories and various non-governmental organizations, agreed that this pivotal initiative opens the possibility of creating a Standard Honey NMR Master Database for Indian honeys. This effort will pave the way for the creation of robust testing protocols specific to Indian honey varieties, and the identification of unique or premium Indian honeys.

(vi) Development of Biodegradable Cutlery from Agricultural Waste and Underutilized Crops

Single use plastics are a global threat in terms of environmental hazards caused, and requires sustainable alternatives. With this regard, possible solutions were analysed with the development and validation of biodegradable cutlery from agricultural biomass. The developed technology by CSIR-NIIST could fetch additional income to the farmers, at the same time reduce the burden of disposal of agricultural waste. Technologies successfully transferred to two industries.

Development of biodegradable cutlery from agricultural waste

Fig. 1.2 (vi)

(vii) Atmospheric Water Generator (AWG)

Fifteen Atmospheric Water Generator (AWG) units, comprised of 60 litres per day capacity (10) and 150 litres per day capacity (5), were installed recently by a team of CSIR-IICT scientists in the remote community schools and colleges located in Dehradun, Rishikesh and Tehri districts of Uttarakhand, where the groundwater is scarce. These facilities have provided potable drinking water to school children (approx. 500).

(viii) Common Facility Centre for Silver Cluster

India is one of the world's largest silver markets, with a very traditional core in a diverse market. In the sculptures and the paintings can be seen the wide range of jewelry worn by king and commoner. It is the traditional cultural heritage of Indian society. The artisans are still following an age-old traditional process for making ornaments. Lack of innovation and modernization paves the way to a variety of problems ranging from raw material to the marketing of products. However, under the changing socio-economic environment, Government and non-government organizations are instrumental in assisting the sector. In order to this, Directorate of MSME, Government of West Bengal is coming forward to help the silver clusters. The artisans of this cluster form a co-operative society named "Jafarnagar Astha Silver Ornaments Artisan's Welfare Foundation".

Based on the inputs from General Manager (GM)/ Industrial Development Officer (IDO) of District Industry Centre (DIC), artisans, site survey, and discussion with vendors at their site as well as at CSIR-NML the intended Detailed Project Report (DPR) has been prepared which contains the basic details of the cluster, benchmark survey, proposed business model, machinery required, bill of quantity for civil estimation, commercial viability and demand and scope for diversification. Infra-facilities proposed for CFC to house the equipment and their accessories which also includes office building, operator's accommodation, boundary.

Fig. 1.2 (viii)

(ix) Decentralized and Modular Textile Reinforced Concrete Waste Water Treatment Plant for Rural and Semi-Urban Areas

The CSIR-SERC developed non-corrosive textile-reinforced concrete (TRC) for decentralized wastewater treatment modular units of 2.4m^3 capacity can be used in remote and rural regions and shall be transported to the communities for implementation on site. The application of TRC as

construction material opened up new opportunities of lightweight construction and the conserving of resources. One implementation has been completed in SamataVidyalaya, Pune, Maharashtra. Further, due to lightweight nature of the material TRC, it significantly facilitates the transport and implementation without use of any heavy-duty equipment.

(x) Deployment of Cost-Effective Toilet units

CSIR-SERC has developed technologies for cost-effective and durable toilet units with thin precast concrete segmental panels. The components of the toilet unit are precast, lightweight, highly ductile, have good corrosion resistance, are easy to transport, and are assembled at the site in few hours. The total cost of a toilet unit at the user end is around Rs.15000/- only. The developed technology is modular and can be made as a cluster of toilet units.

This technology was demonstrated by installing in two precast service core units at the Government panchayat middle school, MootaikaaranChavadi, Chennai. The inauguration has well reached to many stake holders and they have shown interest to adopt this for implementing to the other similar needy schools and public places.

CHAPTER 10: ASSISTANCE TO PUBLIC SECTOR ENTERPRISES

1.0 National Research Development Corporation

2.0 Central Electronics Limited

ASSISTANCE TO PUBLIC SECTOR ENTERPRISES

1.0 NATIONAL RESEARCH DEVELOPMENT CORPORATION

Introduction

National Research Development Corporation (NRDC) is a Government of India enterprise, under the Administrative control of Department of Scientific & Industrial Research (DSIR), established in 1953 under section 25 now section 8, of the companies act. The main objective is to promote, develop and commercialize technologies/ know how/ inventions/ patents/ processes emanating from various national R&D institutions. The Corporation offers its services through-out the country in improving the Nation's manufacturing base with innovative technologies specially suitable for our entrepreneurs and conditions. It acts as an effective Interface for translating R&D results into marketable products. Over the last seven decades of its existence, the Corporation has forged strong links with various R&D organizations both within the country and abroad and pursued bringing inventions and innovations to commercial fruition. The Corporation is recognized as a repository of a wide range of technologies and has licensed technologies to over 5100 entrepreneurs spread over almost all areas of industry and has provided assistance for filing of more than 2100 IP's.

Financial Results

The highlights of the performance and the financial result for the financial year ended on 31st March 2023 as per revised accounting policy are given below:

Performance Parameters	**2022-23** ***(Rs. in Lakhs)***	**2021-22** ***(Rs. in Lakhs)***
Gross Income	674.65	1189.41
Revenue from operations	649.76	1144.66
Other Income	24.89	44.75
Surplus Before Tax and extraordinary expenses	(371.73)	20.00
Extraordinary expenses / Prior Period expense	0.04	0.31
Surplus After Tax and Extraordinary Expenses	(371.87)	4.94
Paid up Share Capital	441.81	441.81
Reserves & Surplus	136.30	508.17
Net Worth	578.11	949.98

**The 75% Royalty share of DSIR i.e. Rs. 591.73 Lacs has not been shown in Revenue as per Accounting Standards.*

Visit of Union Minster for S&T (I/C) Dr Jitendra Singh at National Research Development Corporation (NRDC) Headquarters

Hon'ble Union Minister of State (Independent Charge) Science & Technology and Earth Sciences, Dr Jitendra Singh inaugurated "Incubation Centre" at National Research Development Corporation (NRDC), Delhi to provide multiprong support to Start Ups.

Chairman and Managing Director NRDC, Commodore (Retd) Amit Rastogi and his entire team welcomed Dr. Jitendra Singh, Minster for S&T (I/C) and pointed out that he was the first ever Minister for Science and Technology who has visited NRDC headquarters at Delhi, since its inception in 1953. Dr Jitendra Singh was glad to note that NRDC had reoriented itself to become the only National level PSU, which is providing its services for taking the lab scale technologies developed by Public Funded Research Institutes (PFRI) to Industry.

Hon'ble Minister for S&T (I/C), Dr Jitendra Singh pointed out that the Corporation is providing support to start-ups through its various activities like IP Filing support to Start-ups, Incubation Support for nurturing Start-Ups through its incubators at NRDC Hqrs, CSIR-NAL and CSIR-IMMT, Technology Development fund, Seed Funding to early stage

start-up, association with DPIIT for recognizing start-ups and finally association with IOCL for mentoring & monitoring of Start-ups.

CMD Commodore (Retd) Amit Rastogi informed that NRDC is working towards wholesome approach to establish a National level facility which should provide one-stop solution to all the needs of the ever growing Start-Ups ecosystem of the country. He added, it must house facilities like TRL assessment, IP exchange, Design clinic, Model Incubation facility etc. In order to find World market for Indian technologies, NRDC should aim to provide technology transfer services through hub and spoke model, specially to African and Asian Countries.

Hon'ble Minister for S&T (I/C), Dr Jitendra Singh said, as PSU under DSIR, NRDC is focused on securing and translating the IPR through various value addition activities carried out like Technology Evaluation, Basic Engineering, Market Surveys, etc. and providing its bit to make India truly "Atmanirbhar".

In the last one year, the Corporation has established three Incubation Centres and two Outreach Centre, one at Pune and another at Guwahati to promote start-ups in North-East. 10,000 Start-ups have received support in respect of IP filing, Incubation and start-up registration so far. NRDC has further forayed into the domain of defence and nuclear technologies for civilian application. With an aim to support Made-in-India, NRDC has established foreign collaboration with USPTO, AARDO etc. for exploring world market for Indian Technologies. Further, NRDC is proving to be a catalyst between R&D Institute & Industry and has signed MoU with 220 Research & development Institute and Universities in last five years. NRDC has also proved its credentials and its Vizag unit was awarded "Best Technology" and "Innovation Support Centre" in 2021 besides securing National IP award 2023. With an aim to set-up National Technology Transfer Organization to provide one stop shop to Start Ups and with setting up of International Marketing Division, NRDC is poised for grand scale up in future

1.1 Processes Assigned And Licence Agreements Concluded

The Corporation continued to lay emphasis on broadening and strengthening the technology resource base by nurturing long-term relationships with R&D institutions as well as Universities, technical organizations, industries and also individual inventors. This endeavour is reflected in the Corporation's signing of 22 MOUs/MOAs/ Agreements with Institutions/Organizations for intellectual property protection, technology commercialization, technology consultation and other value-added services. Some of the major institutions are as under:

1. Reva University, Karnataka
2. Agricultural and Processed Food Products Export Development Authority (APEDA), Delhi
3. Hindustan Shipyard Limited (HSL)
4. Mazagon Dock Shipbuilders Limited (MDSL)
5. Ministry of Heavy Industries (MHI), New Delhi

(i) Process Assigned

During the financial year 40 new processes/ technologies were received (assigned) to the Corporation for licensing. Some of the commercially important processes assigned to the Corporation from various research institutes, universities were:

- Process for extraction of Chitin/chitosan from pupalexuviae/spent pupae/moth scales of Mulberry silkworm (Bombyxmori L.) by submerged fermentation technology
- Auto Adjusted Obtuse Angle Cutting Machine for Silkworm Pupal Separation
- Silk Cocoon Cleaner (Hand Operated Silk Cocoon Cleaning Machine)
- Silk Cocoon Cleaner (Motorized-cum-Hand Operated Silk Cocoon Cleaning Machine

(ii) Major Technologies Licensed

As a result of Value addition, the Corporation managed to sign 20 license agreements with industry to undertake manufacturing during the year compared to 70 license agreements executed in the previous year. Some of the major processes/ technologies licensed by the Corporation in the financial year were:

- Auto Adjusted Obtuse Angle Cutting Machine for Silkworm Pupal Seperation
- Ayush SG
- Bioremediation of hydrocarbon by Marine hydrocarbonoclastic bacteria (Marine oil spill bioremediation)
- Mechanical Components of Met Ocean Buoy System Types - II
- Mechanical Components of Met Ocean Buoy System Types-I
- Saline Water Lantern
- Sea Surface Temperature sensor

(iii) Lumpsum Premia and Royalty

Corporation's consolidated Lumpsum Premia & Royalty income is ₹ 421.92 lakhs as compared to ₹ 951.97 lakhs in the previous year. The Royalty received was from both the NRDC licensees and PATSER projects.

1.2 MoU Evaluation

Corporation's performance has been evaluated on the basis of audited data by the concerned Syndicate Group of the Task Force constituted by the Department of Public Enterprises (DPE). We report that the rating awarded by the DPE as per the Memorandum of Agreement (MoA) signed with the Government of India during the year 2020-21 after annual evaluation was 'FAIR'.

1.3 Promotional Activities/Operations.

NRDC has been undertaking two promotional programmes of DSIR i.e (i) Programme for Inspiring Inventors and Innovators (PIII) and (ii) Programme for Development of Technologies for Commercialization (PDTC).

1.3.1 Programme for Inspiring Inventors and Innovators (PIII)

The programme is planned to encourage the innovators/inventors in developing new innovative technologies and products and tap these technologies for Corporation's business activities. To achieve this, Corporation carries out various activities like TDVC, IP Assistance and Incubation Services. The activities carried out under this programme are summarized below.

1.3.1.1 Implementation of the Technology Development Validation and Commercialization (TDVC) Program

The Corporation started implementing the TDVC program from the FY 2021-22 by providing support to Start-ups, MSMEs and incubatees in two phases. Based on the TDVC-APEX committee recommendations in March 2022, eight proposals were selected for availing funding support under TDVC. Support under the TDVC Program was extended to the first three recommended proposals in the FY 2021-22 as per budget allocated. In current FY 2022-23, the Corporation has provided the support under TDVC to the remaining five recommended proposal. As per the TDVC guidelines, the implementation period of each TDVC Project is 18 months. All the eight recommended proposals are ongoing and are implemented in the current financial year and will continue for a total period of 18 months from the date of release of sanction letter to each of the TDVC beneficiaries.

The Corporation has set-up an Internal Core Committee which oversees allocation of Technical Officials as process custodian/s (PC's) and co-process custodian/s (Co-Pcs') to each TDVC project, formulates the Terms of Reference (ToR) of Due Diligence (DD), TDVC Agreements, release of sanction letters, constitution of Project

Monitoring Committees (PMC) for each TDVC project, formulates ToR for the milestone project review, coordinates with PC/Co-PC and TDVC beneficiaries for visits and reviews by PMC, recommends management for release of funds based on milestone achievements etc.

During current FY 2022-23, the Corporation has entered into agreement with all the eight TDVC beneficiaries and released the sanction letters to all the beneficiaries. The Project Monitoring Committee (PMC) with one subject matter specialist (external) who serves as a Chairman and the PC & Co-PC as a convener and a member of all eight TDVC projects has been formed.

The PMCs are now monitoring all the ongoing TDVC projects by visits to the premises of the beneficiaries after the completion of each milestone and verifying the progress made in each project.

The list of on-going projects is as below:

1.3.1.2 Intellectual Property Promotion & Facilitation

IPR Activities

The objective of the National IPR Policy is to encourage creativity and innovation in the country which helps in generation of Intellectual Properties and also enables and facilitate protection of the same by securing Intellectual Property Rights. Instruments of IP Rights are considered to achieve economic, social and technological advancement for a country. The Corporation continued to provide financial, technical and legal support to protect inventions developed by various universities, R&D institutes, etc. by filing patent applications in India and abroad.

The various services provided and activities undertaken under the National IP Protection Scheme are:

Proposals Recommended by NRDC TDVC Apex Committee		
Sl. No.	**Title of the Proposal**	**Applicant Name**
1.	Multi-Spectral Imaging Device Combining Autoflourescence and Tissue Oxygeneration for AI based integrative assessment of Diabetic Foot Ulcers and Wounds	Adiuvo Diagnostics Pvt. Ltd., Chennai
2.	Heat Insulating & fire Insulating Materials and Process of their Development	Securefire Safety Industries Pvt. Ltd., New Delhi.
3.	Preclinical validation of 3D printed silicone breast implants	Prayasta 3D Inventions Private Limited, Bengaluru
4.	Wearable Methanol Fuel Cell Power Pack for Soldiers	Aatral Innovations Private Limited, Chennai
5.	TMSG-DC (Thermoelectric Module Static Generator – DC Power)	Prayogik Technologies Private Limited, Bhopal
6.	Reusable and Adjustable Surgical Osteotomy Guide for Fibula Free Flap Surgery in Mandibular Reconstruction	Precisurg Private Limited, Nagpur
7.	Aum Voice Prosthesis	Innaumation Medical Devices Private Limited, Bengaluru
8.	One Pot Synthesis of Solid and Liquid Bio-Nano (Ag/Cu/Zn) Materials	NSMR Private Limited, Roorkee

(a) IP Protection: The Corporation in its pursuit of protection of inventions and technologies developed by scientists, researchers, etc. has provided financial / technical assistance for filing of 66 IP applications received from various universities, R&D institutes, etc. The Corporation has provided technical and financial support for filing of 33 Patents, 28 Trademarks, 8 Copyrights and 1 Design registrations in the country. The efforts of the Corporation during the past several years have resulted in the grant of 37 Patents in diverse fields like chemical, mechanical, sericulture, dairy, food, drugs, etc. During the year, the Corporation has developed the expertise for in-house filing and prosecution of IP application and has initiated filing of IPs in the country. The Corporation also filed 55 IP applications under consultancy mode.

(b) Patent Search Facility: The Corporation has been catering to the requests received from various Universities, R&D Institutes, individual inventors, etc. for conducting the state of the art searches, the results of which are utilized for submitting research projects at university level. These reports enable the Scientists to submit novel R&D projects for funding from various agencies. It also helps in submission of the invention disclosures during the time of filing for IP protection. During the year 40 Prior Art Searches have been conducted by the Corporation.

(c) Patent Awareness: During the year NRDC-MoMSME-IPFC & TISC has organized and acted as resource persons for more than 66 webinars for promoting and creating awareness about Innovation, Technologies, Role of IPR and Management in National and International platforms.

1.3.1.3 Managing Incubation Centres

NRDC has taken up several initiatives to support and encourage the start-up eco-system in the Country. With this objective, NRDC has established and has started to manage incubation centers to nurture technology driven start-ups for maturation into commercial ventures.

NRDC has established 'Incubation Centre' to Nurture the technology driven innovations and to create the best possible environment for high impact entrepreneurs to start and grow their business. Through incubation centre, NRDC selects Start-ups and early stage companies and provides incubation facilities, who prima facie have the potential to develop into significant technical and commercial entities.

a. <u>For physical Incubation</u>

I. M/s Corrosion Intelligence Pvt. Ltd.

II. M/s Pratyaksha Pvt. Ltd.

III. M/s Prayogik Technologies Pvt. Ltd.

IV. M/s Muffin Health and Lifestyle Pvt. Ltd.

b. For virtual Incubation

i. M/s. Tapah Mechatronics Pvt. Ltd., Bengaluru

The extension of the NRDC Incubation Centre to accommodate 25 start-ups with proper infrastructure was formally inaugurated by Dr. Jitendra Singh, Hon'ble Union Minister of State (Independent Charge) Science & Technology at the NRDC-HQs on 31st December 2022.

In addition to the management of Start-up Incubation Centre at its Headquarters, the Corporation is also involved in the management of start-up and technology business incubation facilities at CSIR-IMMT (Bhubaneswar) and CSIR-NAL (Bengaluru) campus.

The Incubation Centre at CSIR-IMMT campus at Bhubaneswar managed by the Corporation is named as Innovative Technology Enabling Center (InTEC). This facility is encouraging incubation of start-ups working in the area of materials, mining and allied industry sectors.

The Corporation has formed a Section 8 company, Foundation for Aerospace Innovation Research and Entrepreneurship (FAIRE), during September 2020 along with Foundation for Innovation and Social Entrepreneurs (FISE), Bengaluru. Incubation Centre at CSIR-NAL campus at Bengaluru is named as mach33.aero. mach33.aero is a highly specialized start-up incubation facility created at CSIR-NAL Campus at Bengaluru in collaboration with CSIR-NAL and Foundation for Innovation and Social Entrepreneurs (FISE), Bengaluru. This incubation facility encourages incubation of start- ups in the Aerospace and allied industry sectors.

The Corporation is in dialogue with CSIR-Central Leather Research Institute, Chennai for creating and managing their Technology Business Incubator (TBI). Several rounds of discussion have been made with concerned officials at CLRI and a draft Memorandum of Agreement has been prepared. The TBI MoU is in advanced stage of approval by CSIR.

In addition, the Corporation has proposed management of TBI which will be created at National Institute of Ocean Technology (NIOT), Chennai. MoA is in the process of finalization and the TBI has been christened as Marine Gate Incubation Facility (MAGIC) which will have the objective of incubating start-ups that will be working on ocean/ marine based technologies or products.

1.3.1.4 NRDC Intellectual Property Facilitation Centre (IPFC), and WIPO Technology Innovation Support Centre (TICS) Vishakhapatnam

NRDC Visakhapatnam office was established in Visakhapatnam, Andhra Pradesh on January 28, 2017. Thereafter, the 3rd Technology and Innovation Support Centre (TISC) was established by World Intellectual property Organization (WIPO) and DPIIT, Govt. of India at NRDC Out Reach Centre, Visakhapatnam on February 25, 2018. The NRDC outreach Centre at Visakhapatnam aims to promote Technological Innovation, IP Promotion, IP Management and Technology Transfer in the region in view of knowledge intensive industrialization and Start- up ecosystem. The Centre has developed wide network with scientific and industrial community in southern India in a short span of time. In view of the above, NRDC Visakhapatnam bagged National IP award from Govt of India for the year 2021-22 as a Best Technology Innovation Support Centre (TISC). The Centre is working effectively towards achieving its objectives for which it was established including technologies licensing, IP facilitation, Capacity Building & Awareness programs. NRDC Visakhapatnam is focusing more on international collaboration initiatives and coordinated many national and international innovation and technology transfer programmes to make the entre generate international technology transfer opportunities and collaboration. During the year, the Centre has provided IPR and technology transfer services to various PSUs/Start- Ups/entrepreneurs and MSMEs including IPR consultancy services to ordnance factories. The activities carried out by NRDC Visakhapatnam during the year 2022-23 are mentioned below

S. N.	Activities Undertaken	Nos.
1	Patent Services facilitated with due diligence	48
2	Technology Transfer through licensing	11
3	Technologies Assigned	9
4	Trademark services facilitated & filed	37
5	Copy right services facilitated & filed	15
6	Industrial Design services facilitated & filed	10
7	MoU/MoA signed with Universities and Academia	7
8	National/International Workshops Conducted on IP & Technology Transfer reach out to all stakeholders	9
9	Organized & attended IP promotional activities/ webinars/awareness programs/ seminars/ exhibitions/ stalls/ EDP	70

1.3.2 Programme For Development Of Technologies For Commercialisation (PDTC)

The programme aims to add value to the lab-scale technologies developed by the universities / research institutes / organizations, dissemination of the information and promotion of entrepreneurship development and appropriate innovative technologies in rural and north-east regions. Under this scheme the Corporation carried out various activities like Development of Innovation Portal, Value addition through preparation of Basic Engineering Design Package (BEDP), Market Surveys, and dissemination of information through exhibitions/ seminars/workshops etc., promotion of indigenous technologies abroad through showcasing of indigenous technologies. The Corporation has provided seed funding to incubates and has started to explore opening Outreach Offices pan India. The details of the various programmes undertaken under this scheme are as follows:

1.3.2.1 Technology Value Addition

Technology upgradation for taking the Technology from Lab to Land provided to 58 technologies by conducting Market Surveys (MS), preparation of Basic Engineering Design Package (BEDP), Feasibility Reports (FR), Socio Economic Impact Assessment (SEIA), Techno-Commercial Support (TCS) and Priority Projects (PS) to various stake-holders I the country.

1.3.2.2 Basic Engineering Design Package (BEDP)

The preparation of Basic Engineering Design Package carried out by the Corporation is a very important value addition activity for high potential technologies that are assigned for commercialisation. The package provides information on the plant, equipment, raw material , utilities and features of the finished product etc. The data from BEDP report forms the basis for the preparation of feasibility study report and detailed project report. These reports enable the entrepreneur to prepare the detailed engineering project report for setting up of commercial plant The reports also help the Corporation in planning for marketing of its technologies.

During the year, BEDP on the following technologies were conducted through professional empanelled consultants:

- Graphene from Waste Plastic
- Protein Fortified Millet Flakes
- Lead Free X-Ray shielding tiles
- Evergreen hybrid composite of Parali (agro-waste) and industrial waste
- Process for production of Lutein
- BIO-MIX
- Hollow Fibre Membrane
- Synthesising Catalytic Form of Crystalline Multilevel Porous Zeolite'

1.3.2.3 Feasibility Reports

The feasibility report provides information on the investment to be made on plant and equipment, raw material and the product, etc. which helps the entrepreneurs in decision making as well as implementation of the project according to their investment capacity. It also helps the entrepreneurs to get loans from financial institutions by submitting the Feasibility Reports. With these reports, it becomes easy for the entrepreneurs to carry out detailed engineering for setting up the commercial plant and planning for investment strategy. The reports also help the Corporation in planning for marketing of its technologies.

During the year 2022-23, Feasibility Reports on the following technologies were conducted through professional empaneled consultants:

(a) Marine Oil Spill Bioremediation technology

(b) Protein Fortified Millet Flakes

(c) Process for production of Lutein

(d) Multi Millet Semolina

(e) Manufacture of Graphene from Agro-waste and tyre waste

1.3.2.4 Market Surveys

Market surveys are of considerable significance to the process of technology transfer. It helps ascertain the marketing potential and knowledge on prospective markets for the product manufactured using the technology transferred by the Corporation.

During the year 2022-23, 25 market survey were conducted through professional empanelled market consulting firms. Some of them are:

- Green Tamarind Spice Mix
- Ammonia Sensors (visual color change type)
- Biodegradable flexible film for active food packaging
- A versatile adsorbent for scavenging heavy metals from water
- A Highly efficient MRI contrast Agent
- A smart nanocatalyst for obtaining high quality bio-oil from Biomass

1.3.2.5 Socio Economic Impact Assessment (SEIA) of Technologies Licensed by NRDC

NRDC since its inception has commercialized technologies to various industry clientele pan India. it was felt that the socio economic impact of the technologies/products licensed by NRDC to the industries should be carried out for major technologies. Therefore, the activity has been started from current financial year 2021-22. The report is prepared based on the information of Licensee, production data and interaction with the end users of the product, their feedback, etc.

- Socio Economic Impact Assessment (SEIA) report was prepared for the following: Patent Assistance Scheme of NRDC
- Ayush-64 – Anti-malarial Drug
- Anti-arthritis- Herbal solution of Arthritis

1.3.2.6 Techno-Commercial Support to Scientists, Innovators and Students for Process Trial and Validation of Technologies

The core mandate of the Corporation is to commercialize technologies developed in the Indian R&D sector and over the years the Corporation has been acquiring several technologies from R&D institutions and individual innovators for commercialization. Most of the technologies acquired by the Corporation are at laboratory *I* bench scale with proven concepts and with IP protection. For up-scaling of the technologies, the Corporation has been inviting proposals from the Research Institutes/Individual Inventors, Universities, etc. for providing financial support through its program on "Development Projects and Value Addition for Priority Projects (DPVAPPY up to Rs.10.00 lakhs and Techno Commercial Support (TCS) up to Rs.2.00 lakhs which is a component of the PDTC Promotion Program funded by the Govt. of India.

The list of technologies being supported under Techno Commercial Support are asunder:

1. Validation of lateral flow based rapid assay for the differential sero-diagnosis of Mycobacterium tuberculosis complex (MTBC) infection in animals" from Centre for Vaccines and Diagnostic Research, GLA University, Mathura.
2. Preparation of know-how document of "A process of manufacturing of Graphene from Waste Plastics from Kumaun University, Nainital, Uttarakhand.
3. "Development and Standardization of Technologies for Extraction and Value Addition of Natural Fibers" from Centre for Indian Bamboo Resource and Technology (CIBART), New Delhi.
4. "Optimizing Helical Flow Drip Emitter through Lab Testing" from Mr. Venkata Ramamohan Ramachandrula, Individual inventor from Hyderabad.
5. "Advance Micro Ear Surgical Instruments Kit" from Sharada University, Greater Noida, UP.

6. "Adjustable Tapered Vice" from MLR Institute of Technology (MLRIT) (Autonomous), Hyderabad.

7. "Underwater Kikkisa and Weed Removal Cutting Machine for Irrigation canals and water drains" from Ramachandra College of Engineering, Andhra Pradesh.

8. "Fabrication of semi-automatic seed cube making machine" from Directorate of Seed Centre, Tamil Nadu Agricultural University (TNAU), Coimbatore- 641003.

9. "Development of Kodo Millet milk beverage powder" from Dept of Post Harvest Technology, Agri Engg. College & Research Institute, Tamil Nadu Agricultural University (TNAU), Coimbatore-641003.

10. "Preparation of Know- how document for technology Protein fortified Foxtail Millet Flakes" from Dr. Suresha K B from University of Agricultural Sciences (UAS) , Bengaluru.

11. "Preparation of Know- how document for technology Protein fortified Little Millet Flakes" from Dr. Suresha K B from University of Agricultural Sciences (UAS), Bengaluru.

12. "Preparation of Know- how document for technology Protein fortified Sorghum Flakes" from Dr. Suresha K B from University of Agricultural Sciences (UAS) , Bengaluru.

13. "Preparation of Know- how document for technology Protein fortified White Ragi Flakes" from Dr. Suresha K B from University of Agricultural Sciences (UAS), Bengaluru.

14. Preparation of Know-how document for technology "NIRMOOL – A Disinfectant composition against silkworm pathogens" from Director, Central Sericultural Research and Training Institute, (CSR&TI), Berhampore, West Bengal

1.3.2.7 Technologies supported under Priority Projects

1. l "Scalable Synthesis of Graphene and its Derivatives from Rice Straw Waste and their Applications in Energy Storage and water purification" from Kumaun University, Nainital, Uttarakhand

2. "Bio adhesive patch for buccal/ sublingual delivery of Insulin" from Department of Pharmacy from Central University of Rajasthan, Ajmer.

3. "Field testing of lime based microbial formulation for soil amelioration and disease management" from ICAR- Indian Institute of Spices Research, Marikunnu post, Kozhikode-673012, Kerala

1.4 Dissemination of Information on Science And Technology

Exhibitions and Publicity

The Corporation participates in various exhibitions for creation of awareness about the technologies available with the Corporation for transfer, explore avanues for technology assignment, etc. with this objective in view, the Corporation participated in 20 exhibitions in India organised by various agencies.

Publication of Magazines in NRDC for dissemination of information on Science and Technology for the Financial Year 2021-2022

NRDC continues to bring out its regular publications - Awishkar (Monthly Hindi S&T magazine) and Invention Intelligence (Bi-Monthly English S&T magazine). The main objectives of the magazines are to disseminate information and create awareness about new technologies, inventions, innovations, IPR issues, etc. amongst the masses and foster the spirit of inventiveness, innovativeness and entrepreneurship in the country.

During the year some of the important articles covered in *Awishkar* are: Digital Mission, Deep Ocean Mission, save soil, quantum computing,

health foods and an issue focussed on Millets.

During the year some of the important articles/ topics covered in *Invention Intelligence* are: Climate Change, Save Soil, Nobel prizes in science, bio-sensors etc.

1.5 Start-Up India: Seed Funding of Manufacturing Start-Ups in Incubation Centres.

NRDC provides Seed Funding to Start-ups incubated in state/central Govt. supported incubators. Under this Seed Funding scheme, the Corporation selects Technology based Start-Up and provides a part of the capital required as Seed funding which prima facie have the potential to develop into significant technical and commercial ventures. Seed Fund of Rs. 30 Lakhs is disbursed to an eligible startup against redeemable Optionally convertible debentures.

During the year the following start-ups have been supported under the scheme:-

Sr. No.	Title of the project	Company Name
1.	Dhivaramitra – Solar Power operated Floating device for fish & Prawn Farming	Thinkraw Innovative Solutions Pvt. Ltd., Odisha
2.	Retrokit- Electric Conversion Kits for Conventional Autorickshaws	Electromotion E-Vidyut Vehicles Pvt. Ltd.Raipur, Chhattisgarh
3.	Development of An Autonomous Underwater Vehicle For Civil Structure Inspection	Coratia Technologies Pvt Ltd. Rourkela, Odisha

1.6 NRDC OUTREACH CENTRES

During the year NRDC has established two more Outreach Cetres in Pune and Guwahati to expand its presence in new and potentially untapped areas. The details of Outreach Centres are :

Pune Outreach Centre: In order to increase its reach and enhance its visibility, Corporation has successfully operationalised its Outreach Centre at Agharkar Research Institute (ARI), Pune in December 2022. During the inauguration of the Outreach centre,Industry meet was organized and invited Start-ups, inventors across Maharashtra and nearby region to sensitize them regarding services being provided by NRDC in Technology Transfer and IP Portfolio management. Since then, NRDC Pune Outreach Centre has hosted hundreds of Start-ups, entrepreneurs and inventors, appraised and guided them regarding services offered by NRDC.

Guwahati Outreach Centre: This Outreach Centre was also operationalised in January, 2023 and manpower has been recruited and positioned at the centre. The talks have been initiated with various R&D institutes and Universities. The centre has also been actively conducting various IPR seminars and promoting NRDC technologies available for licensing.

1.7 CONSULTANCY

START-UP INDIA INITIATIVE: Assessment of Start-Up-India Applications for Tax-Exemption

"Start-up-India" is an initiative of Department for Promotion of Industry and Internal Trade (DPIIT), Government of India, designed for fostering innovations, create jobs and facilitate investments. Start-up India receives applications from all over India for getting recognition (as Start-ups) for further availing proposed benefits under this scheme including the three year tax benefits. DPIIT has given the responsibility to NRDC for technically assessing these applications for recognizing Start-ups and recommending the eligible Start-ups for tax exemption and other benefits. Till date total 99,380 Start-ups have been successfully received the recognition certificate. NRDC evaluates the applications on the basis of norms given by Start-Up India and submit the reports regarding the same to Inter Ministerial Board (IMB) for final decision. NRDC has evaluated 1200 applications in FY 2022-23. Based on the recommendation of assessment by NRDC the IMB has approved about 500 Start-ups for availing tax benefits till FY 2022-23.

Indian Oil Start-Up Scheme: Mentoring & Monitoring Start-Ups

Indian Oil Corporation, India's flagship National oil major, has launched a Start-up Scheme with a funding of ₹ 3.00 Crores to promote promising start-ups and nurture an eco-system conducive for innovations in the domestic hydrocarbons and allied sectors.

Driven by Indian Oils Research & Development Centre based at Faridabad, the scheme is supporting projects that aim to establish innovative technology and business process re-engineering ideas with significant business potential, social relevance and focused on environment protection. It will help them pursue their promising ideas right up to validated Proof of Concept (POC) by funding the incubation ecosystem and through intellectual mentoring. Indian Oil may further aid in the commercialization of selected validated PoCs through equity participation.

Based on Corporation's experience in working with Start-up eco system, IOCL entered into an agreement with NRDC for short listing and fixing of milestone from the proposals received from the start-ups for funding.

During the year Corporation provided mentoring and monitoring services to 12 Start-ups funded by IOCL to promote the Start-up culture in the country. Majority of the Start-ups are making good progress and are at various stages of completion. During the year a total of four patents applications, one design registration and one copyright application have already been filed.

Engagement of NRDC for management of Ministry of Heavy Industries (MHI) Capital Goods Scheme Phase-I and II:

The National Capital Goods Policy has been formulated by Ministry of Heavy Industry (MHI) with the vision to increase the share of capital goods contribution from present 12% to 20% of total manufacturing activity by 2025. The objectives of the scheme are as follows:-

- India to become one of the top capital goods producing nations of the world by raising the total production to over twice the current level
- To raise exports to a significant level of at least 40% of total production and become a net exporter of capital goods
- To improve technology depth in Indian capital goods from the current basic and intermediate levels to advanced levels.

MHI and NRDC have entered into an agreement for managing the projects that have been approved under Phase I and II of MHI Capital Good Scheme. NRDC being part of Project Review and Monitoring Committee of all the projects under Phase-I and Phase-II has been actively working with the PIO (Project Implementing Organisation) for identification of IP. NRDC is also part of the screening and apex committees for selection of projects.

ASEAN-INDIA INNOVATION PLATFORM (AIIP)

Technology Database:

NRDC has been entrusted with the responsibility of bringing technologies that are available in India and ASEAN countries (Member States) on one platform and make it available for commercialization for Indian as well as ASEAN entrepreneurs. After getting the direction from DST, NRDC designed, developed and launched the portal.

The Major highlights of the portal are extensive database of research work and Intellectual properties developed across the ASEAN and Indian R&D facilities, a single platform to access the technologies developed in India and ASEAN countries in almost all the sectors such as Health, Biotechnology, Food and Agriculture, Environment and Natural Resources, Mechanical etc. Currently the database has a total of 480 Indian technologies and 207 technologies from ASEAN MS. The portal

is regularly visited by entrepreneurs / start-ups looking for technologies and has received 2,26,578 hits since its launch.

Agricultural & Processed Food Products Export Development Authority (APEDA) project.

With joint mandate to infuse and disseminate technologies together by NRDC and APEDA in the areas of climate-resilient agriculture related to zero carbon emission farming to produce residue, carbon-free food for exports, following progress were made:

- Proposal made to Haryana Govt for carbon neutral food production in respect of horticulture crops.
- Test/Trials of Sea protocol of Mangoes are being conducted for Arab and UK market.
- International quality gift hampers of Millets were made for G20 foreign delegates.
- Proposal to MP Govt for carbon neutral food production in respect of horticulture crops

Engagement of NRDC as an IPR Consultant:

NRDC has been providing IPR consultancy services to NTPC, BEML, BDL, MIDHANI, Indian Navy etc. In addition to this during the financial year 2022-23, the Corporation has renewed its MoU with NIFTEM for Providing IP consultancy and Technology commercialisation services. The Institute has assigned technologies to the Corporation for the purpose of commercialisation. The corporation has also signed a MoU with CHARUSAT for IP consultancy and technology commercialization.

1.8 Major Achievements

Licensing of technologies: Licensed 20 technologies to industry for commercialization like Seaweed extract fertilizer, Poshan, Marine oil spill bioremediation technology etc. NRDC has taken steps through diversification of sources for technology assignment besides CSIR labs. NRDC signed 22 Memorandum of Understanding (MoUs) with various Universities / Research labs like Reva University, Karnataka; Agricultural and Processed Food Products Export Development Authority (APEDA), Delhi; Sri Krishnadevaraya University, Anantapur; Ministry of Heavy Industries (MHI), New Delhi, etc. to improve the basket of technology assignment. As a result of measures taken 40 new technologies were assigned for commercialization

(i) International Collaborations: In order to expand its horizon and areas of operation, NRDC has collaborated with the following reputed organizations:

a) United States Patent and Trade Mark Office (USPTO): NRDC and USPTO have signed a bilateral cooperation agreement with an objective to promote innovation, creativity and technological advancement among various stake-holders in the country.

b) African-Asian Rural Development Organization (AARDO): NRDC and AARDO have entered into an agreement to address the challenges through technological innovations, solutions and interventions and capacity enhancement to benefit and strengthen rural communities, farmers, executives, functionaries and policymakers of the member countries in Africa and Asia.

c) WIPO Green: NRDC Partnered with WIPO Green for promoting Indian technologies globally for sustainable development and contribute to climate-friendly innovation and technology transfer.

d) European Business & Technology Centre (EBTC) : NRDC had signed an MoA with EBTC on 18th October 2017 and further signed the addendum MoA with EBTC which is w.e.f. 18th October 2022. The main objective

of this collaboration is to create a robust framework that enables the identification, evaluation, and monetization of IP assets generated by Universities, Research Institutions, and Start- ups in Europe & India and to strengthen research and development (R&D) ties, promote knowledge sharing, and facilitate technology transfer between universities in both regions. NRDC will also focus on capacity building of Indian stakeholders in the Europe-India business corridor and can play a crucial role in accelerating the adoption of cutting- edge technologies in Europe and India

(ii) Expansion & Inauguration of NRDC Incubation space:

The capacity of incubation centre at Head Quarter has been enhanced from 9 to 25. The same was inaugurated during the maiden visit of Hon'ble Minister of State (Independent Charge) of the Ministry of Science & Technology. The Hon'ble Minister wrote in the NRDC Visitors' Book "NRDC doing commendable work, though remains somewhat under-rated. Deserves kudos for having turned out one of the Indian Unicorns. Looking forward to future growth to next level through wider integration and synergism. Must compliment Cmde. Amit Rastogi and his team for facilitating this visit." The press release from office of MoST stated that NRDC should take-on bigger role of setting-up a National Level facility having IP exchange, TRL facility, Design Clinic, Incubation Centre as its component.

(iv) NRDC Visakhapatnam received "IP Recognition Award" at 4th edition IPTSE Awards & IP Conclave on 19th April, 2022 from Hon'ble Judge of the Delhi High Court Justice Prathiba Singh for contribution towards strengthening IP ecosystem in the country.

(v) The Corporation received "9th edition of the Prestigious PSU Award" instituted by Governance Now in a glittering function organized at Aero City, New Delhi on February 16, 2023. Senior Officials of the Corporation received the award from Hon'ble Justice Dipak Misra, Former Chief Justice of India, Supreme Court. These Awards honor the efforts of Public Sector Undertakings that have been key to the country's growth.

(vi) Defexpo Logo : NRDC arranged the trade mark for the Defexpo Logo

1.9 New Initiatives Taken

In order to enhance revenue generation, NRDC took many new initiatives through diversifications of its operations in many new areas as mentioned below:

1. NRDC is actively involved in promoting millets through its various initiatives under its millet mission to help farmers in growing millets. Farmers are not interested in growing millets due to low market demand. Ongoing climate crisis and its huge impact on agricultural has made United Nations, at the behest of the Government of India, declared 2023 the International Year of Millets.

The major activities undertaken under NRDC Millet Mission are as follows:

a) Development of dedicated compendium for ready- to-transfer millet technologies for mass promotion

b) NRDC has shortlisted more than sixty promising millet ready-to-transfer technologies from govt. laboratories/ institutions for commercialization and prepared a dedicated compendium for the same for mass dissemination Enhancement of millet entrepreneurs in the nation through millet technology licensing/technology transfer's (ToTs)

NRDC has transferred five novel millet technologies to industries such as Instant

Ragi mudde mix, protein fortified foxtail millet flakes, protein fortified little millet flakes, protein fortified sorghum flakes and protein fortified White Ragi flakes.

c) Designing & development of unique promotional millet hampers for Govt. Organizations/Corporate eg. for Agricultural & Processed Food Products Export Development Authority (APEDA) & Dept. of Commerce & Industries

NRDC has received Work Order from APEDA/DoC for development of 4000 hampers to be distributed to foreign dignitaries in events such as G20 meetings etc.

d) Facilitation in setting up of Technology Demonstration Centre (TDC) for millets:

NRDC is in talks with Assam Govt. and HAFED (Haryana Govt.) for setting up of pilot scale millet TDC Centers

e) Social media campaigns on millets:

NRDC has launched dedicated millet campaigns through its (Millet Verse Gyanvardhak Series) to create millet education/awareness among masses.

f) Promotion of millets technologies

NRDC has participated in various millet & food events to promote millet technologies through showcasing/displaying these technologies via posters, standees and products with the aim to encourage millet technology transfer across nation. The response in Shree Anna Millet conference (21-22 March, 2023, Pusa, Delhi); 5th Fresh India Show (9-10 June, Aerocity, New Delhi) and Health Care Innovation Summit & Awards (22-23 June, New Delhi) was excellent

g) Preparation of dedicated millet promotional video

NRDC is bringing out a dedicated video on millet technologies for dissemination of information and creating awareness about millet food product.

h) Sessions on business opportunities in millet sector through speaker sessions and workshops etc.

Conducted Session on "Key Business Opportunities in Millet Processing Sector"- a webinar series with an overwhelming response from participants organized by GIET University, Orissa and co-organized by NRDC on 22nd February, 2023

i) Conduct of Millet Innovative Challenge

GIET University in association with NRDC organized Millet Innovation Challenges (from January-March) where NRDC extended its support in evaluation of proposals and interviewed participants for final selection. After strict evaluation three millet based projects have been awarded.

j) Organizing Food Canopy show displaying novel millet products developed by MSMEs under One District One Product (ODOP)

NRDC in association with NAFED promoted novel millet & allied products under PMFME scheme of Ministry of Food Processing & Industries via setting up of canopy show for two days 10-11 April, 2023.

In addition to the above following new initiatives were taken by the Corporation in compliance with directives/polices of the Govt. of India and also expedite delivery of services by the Corporation :

2) The IPR Committee was dissolved and concerned officials were authorized to submit recommendations to the Management on case to case basis for faster decision making.

3) Priority Partner Scheme was initiated for dissemination of information about NRDC and

generating business avenues in the areas where NRDC does not have direct reach.

4) Resolution Agents were empanelled to facilitate and assisting in the royalty collection by NRDC in different states of the country.

5) Online APAR – In line with govt. directives, online APAR system has been introduced in NRDC in addition to deployment of e-Tour management system in e-Office.

6) NRDC Mobile App has been introduced to enhance ease of doing business with NRDC.

7) TDVC Portal has been operationalised to receive online application for funding under the Scheme.

8) Under Swachta Abhiyan directives of the Govt. of India, old files were weeded out by installing an industrial shredder in the office premises itself and old library books in library were disposed off resulting in having a clean Library with current/ useful books and vacant space which can be utilised for other activities/functions of the Corporation or rented out to generate revenue.

1.10 Future Outlook

Established in 1953, the Corporation has been the oldest and only Central Public Sector Enterprise under Government of India which carries the mandate of technology commercialization.

The obligation of forming effective linkages between the various R&D ecosystem and the Indian Industries has been accomplished with paramount professionalism and ingrained operating procedures and systems conforming to the ISO 9001:2015 Standards.

NRDC intend to explore areas from a long term perspective and strengthen its activities by re-energizing its relationship with the academia and research institutions, as these bodies are working in new areas of technology development which can be major revenue earner for NRDC in the long run.

The effective implementation of the Innovation Promotion and Technology Development Programs has entrenched the Corporation to undertake larger than life roles for furthering the objectives of the Government of India in its determination to create an atmosphere that nurtures innovations in the country.

The Corporation has positioned itself to take on challenges to create congenial ecosystems and platforms to tap and facilitate the emerging innovations to reach all corners of not only the Indian society but globally too.

The Corporation entering in to collaborations with international agencies like African Asian Rural Development Organization (AARDO), United States Patent and Trademarks Office (USPTO), World Intellectual Property Organization (WIPO) Green, etc. is in the direction of creating world market for the Indian innovations and also to sensitize the stake-holders about the global opportunities.

The Corporation has leveraged every opportunity in aligning itself to all the innovative initiatives taken by the successive Central Governments including Atmanirbhar Bharat, Vocal for Local, Start-up-India & Stand-up India Digital India, Make in India, Made in India, Jay Anusandhan, Series of initiatives taken-up under the Azadi ka Amrit Mashotsav, International Year of Millets, etc. for significantly empowering the Indian Economy.

With an aim to acquire global outlook, all efforts shall be made to adopt contemporary business infrastructure and relocate to a business hub for improved reach and visibility to the Corporation. In the evolving Start-up based ecosystem it shall be endeavor of corporation to provide 3600 support to Start-ups. MSMEs, Individual Innovators. The gap areas identified in terms of strengthening activities related to IP/technology valuation, TRL assessment, IP exchange etc. is being worked upon.

The Corporation aims to live up to its motto of “Promoting Innovation-Transforming Lives”. The futuristic outlook of Corporation shall be based on:

(a) With an objective to achieve greater level of ease of doing business in line with Government of India policies, automation of all the processes to provide seamless services to the stake-holders and clientele.

(b) Augmentation of human resources to cater to enhanced business activities.

(c) Leveraging the outreach centres at Guwahati, Pune and Visakhapatnam to reach out to the R&D and industrial clientele in the region.

(d) Rephrasing and strengthening the agreements entered in to with the clientele.

(e) Devising frameworks and programs to support the Start-up ecosystem.

(f) Creating contemporary work spaces and facilities to promote and augment early adoption of innovations.

(g) Exploring implementation of projects of the Scientific Ministries and Departments of the Central and State Governments for facilitation of innovation and start-up ecosystems.

Diversification into allied business activities to strengthen the Corporation's financial position

1.11 Manpower (Human-Resource)

The real asset of any company is its human resource. The total regular manpower of the Corporation as on 31st March, 2023 was 54 viz. (Group A-33, Group B-03, Group C-17 and Group D-1) and 14 contractual engagements (viz 9 technical + 3 Non-technical + 2 Retired persons). The representation of reserved category of regular employees as on 31.3.2023 stood at SCs (25.92 % - (14 employees) ST (Nil % - No employee) OBC (11.11 % - 6 employees), PwD (Nil % - No employee), ESM NIL (No employees) and women representation (18.52 % - 10 employees) and Minority Community (3.70 % - 2 employees) respectively.

The Corporation is following all the instructions and Govt. directives relating to reservation of the above categories issued from time to time. In some areas, their representation could not be brought to the prescribed levels due to non-filling of vacant posts and the continuing rationalization of existing manpower. The employee-management relationship was cordial throughout the year.

1.12 Human Resource Development

Training and development of all levels of employees is given due priority by the Corporation to increase effectiveness. Special emphasis is given to organization building and shaping right attitudes, team building and work culture besides preparing employees to understand the trends in fast changing technology/switching over to latest technology for achieving higher results in productivity and profitability. Due to financial constraints, pandemic, and other reasons none of the officials of the Corporation were deputed to training programs this year. However, employees were exposed to in-house training in the subjects related to technology transfer, IP, Discipline Leave regulations, GeM procurement, RTI. etc. The thrust for better utilisation of Human Resources and improvement in work practice continued during the year.

1.13 Information Status of Complaint Mechanism for Women

NRDC has a 'Women's Cell' consisting of the all female members to look after the well-being and welfare of the female employees. The Women Cell is provided with requisite facilities. The Cell also shares awareness for all female employees on sexual harassment at workplace. The Cell also display posters to show the type of harassment act at work places. All the circulars pertaining to welfare/ protection of women's rights received from the Government Departments are brought to the notice of female employees for awareness. The Women Cell members also look into the grievances of female employees. There is a cordial atmosphere between male and female employees of the Corporation.

1.14 Right to Information

As stipulated under Section 4 of the Right to Information Act, 2005, every Public Authority is mandatorily required to display necessary information to citizens to secure access to information under the control of public authority in order to promote transparency and accountability in its working and functioning.

NRDC, being a responsible Central Public Sector Enterprise, has displayed essential information on its website under the head RTI. Apart from this, the NRDC Management has notified Nodal Officer, PIO, APIO, Transparency Officer and the First Appellate Authority (FAA) in compliance with the requirements of the RTI Act, 2005. Between April 01 , 2022 to March 31 , 2023, a total of 48 applications were received by NRDC and all of them were disposed-off by providing requisite information as per rules and stipulated time period. Apart from RTI applications, the Company also received 04 appeals against the information provided, which too were duly attended to and appropriately disposed-off by the First Appellate Authority. It is pertinent to mention that Central Information Commission (CIC) has not passed any adverse order against Corporation.

1.15 Technology Absorption, Adaptation Innovation & Conservation of Energy

Being a Section 8 company under Companies Act 2013, while a major objective of the Corporation is the promotion, development and commercialization of indigenous technologies, the Corporation itself does not carry out any R&D. However, it promotes and provides limited finances assistance for R&D on a meritorious & need basis to both laboratories and industries.

As the Company's operations do not involve any manufacturing or processing activities, the particulars required under Section 134(3)(m) of the Companies Act, 2013 read with Rule 8(3) of the Companies (Accounts) Rules, 2014 regarding conservation of energy and technology and absorption are not applicable.

1.16 Corporate Governance

NRDC is complying with the requirements of Corporate Governance as stipulated in the Companies Act, DPE Guidelines and other applicable Rules. One Board meeting in each quarter of the calendar year is being convened in compliance with DPE Guidelines wherein major decisions are being taken and thereafter implemented. NRDC is committed to sound principles of Corporate Governance with respect to all its policies, practices and procedures. The Company's policies clearly reflects its values of transparency, professionalism and accountability. NRDC constantly strives to uphold these values so as to generate long term economic value to all the stakeholders. NRDC was awarded "Excellent" rating during the financial year 2021-22 by Department of Public Enterprises.

1.17 Implementation of Official Language

The Corporation continued to make efforts to fulfil the targets prescribed by Govt. of India in the Official Language Act and Rules framed there in with regard to increase the use of Hindi Rajbhasha in office during the year 2022-23. Employees were motivated to use their working knowledge of Hindi in day to day official work. All the Standard Forms, Files etc. are bilingual. Significant progress has been made in the field of correspondence, noting and drafting in Hindi. All Hindi letters are being replied in Hindi only. The Annual Report of the Corporation is being published in digital form in both Hindi & English since 1986-87. The Corporation also publishes a popular Science & Technology monthly magazine in Hindi, entitled 'Awishkar'. To popularize the use of Hindi, the Corporation organized a "Rajbhasha Pakhwara" (14 - 30 September 2022). During the Pakhwara Hindi Essay writing competition was organized & cash awards were given to the winner. Cash Awards were also given to employees under "Rajbhasha Incentive Scheme". To enrich Hindi vocabulary of the employees of the Corporation as well as visitors, an English word with its Hindi meaning is written daily on a writing board as

'Today's Word' at the reception of the Corporation.

2.0 Central Electronics Limited

2.1 Introduction

Central Electronics Limited is a Public Sector Enterprise under Department of Scientific & Industrial Research (DSIR), Ministry of Science & Technology, Govt. of India. It was established in 1974 with an objective to commercially exploit the indigenous technologies developed by National Laboratories and R&D Institutions in the country. The company has commercialized number of products developed in collaboration with CSIR, DRDO and other institutions. The renewed mandate of CEL includes development and harnessing technology for (i) Solar Energy Systems and Solutions (ii) Strategic Electronic Components and Systems required for defense and other science and technology missions (iii) Signaling and safety in public transport systems and (iv) Security and surveillance in strategic establishments.

CEL has pioneered in Defense components and materials like Phase Control Modules (PCM) and CZT substrates, Solar Photovoltaic, Railway Safety & Signaling Equipment, and different types of PZT elements in the country. The company is a leading manufacturer of RDSO approved railway safety and signaling systems with a market share of 60%. These signaling systems are important equipment for public safety during the operation of trains. CEL is involved in commercialization of critical products for strategic applications for defense like, Ceramic Radome for Missile radar for Air force, Drishti Transmissometer for visibility measurement in Airports, Development of circulators & Isolators for ISRO. CEL is also working on failsafe new generation railway signaling and safety systems.

CEL has established partnerships and linkages with various stake holders and business associates in the areas of railways, power generation and distribution companies, service providers in the energy sector, public funded institutions and even rural communities through the state governments. CEL's programs and operations for production, business operations, distribution and marketing as well as support services are aligned with the programs being implemented by the central government of India.

2.2 Major Developmental Activities during 2023-24

During the year CEL has initiated many commercial activities of development and commercialization of Railway products. One of the developments was of Solid State Block Proving for Axle Counters (SSBPAC). Following activities were done during the year:

(i) Sub Modules of Central Evaluator - Developed

a. DC to DC Converter Card (Card No-01)

b. i-configuration card (Card No-02)

c. Input Card (Card No-03)

d. Central Controller Card (Card No-04)

e. Vital Output Card (Card No-05)

f. Power Supply card (Card No-06)

g. Non Vital Output Card (Card No-07)

h. Scrambler Card (Card No-08)

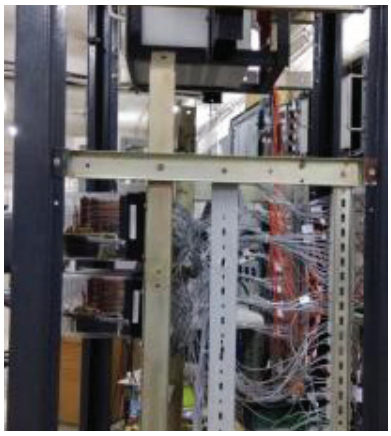
(ii) SM's panel - developed

a. VDU Reset Panel& SM's Reset Panel

b. Monitoring Unit

Central Evaluator

SM Panel

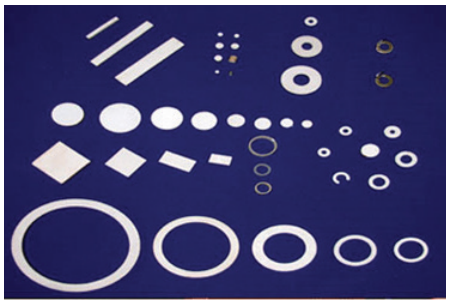


Relay Rack

The development of the Graphical User Interface (GUI) for SSBPAC is planned in collaboration with CSIR-CEERI, which commenced in August 2023. The objectives and specifications of the work were finalized by CEL and CEERI on October 25th, 2023. The product is likely to get commercial orders soon after approval.

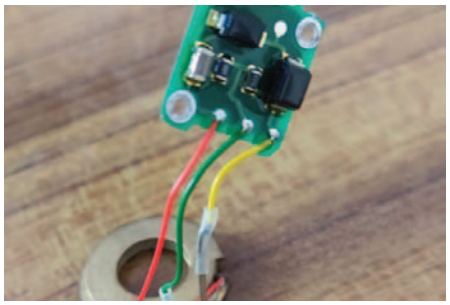
(iii) Electronic Ceramics Components

CEL has developed new designs and now manufacturing Lead Zirconium Titanate (PZT) crystal in the shape of Disc, Ring, and Rod etc. CEL has also, indigenously developed HEAT (High Explosive Anti Tank) Fuze for **84 mm Carl Gustaf Gun.**

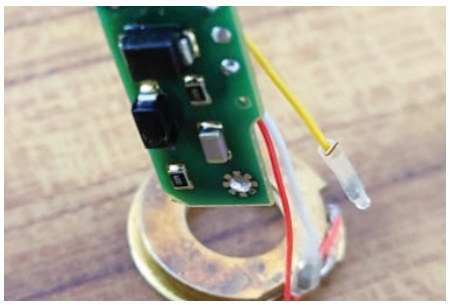


PZT CRYSTALS

HEAT 751 MC



HEAT 751 PC



HEDP 502

CARL GUSTAFGUN

(iv) Recent Key achievements of CEL:

Main Charge and Precursor Charge - HEAT 751(Developed-Under trail with OFK)

High Explosive Dual Program(HEDP) - 502 (Developed-Under trail with OFK)

Piezoelectric Body and Detonating Device Body of 125 mm HEAT round ammunition gun for T72 tank (Under Final Trial).

Several trail at different Ordinance factories were taken during the year and the product is likely to be approved finally by end of the year. Commercial value is expected to be achieved in next financial year.

(v) Commercial Production of New Multi Section Digital Axle Counter (new MSDAC)

MSDAC is a multi-section digital axle counter system used for detection of railway tract occupancy primarily in a station.

The current version of MSDAC being manufactured by CEL is a fail-safe, train detection system and caters to maximum of 40 Detection points suitable for larger installations. The new generation MSDAC is planned to come up with smaller configuration system for meeting railways requirement, to be price competitive, to tackle the component obsolescence in the existing system in compliance to RDSO EMI/ EMC specifications.

- EMI/EMC and climatic tests have been completed at TUV lab, Bangalore on 28th March 2023.
- Independent Safety Assessment activities of new MSDAC are completed and CEL received ISA Certificate from CSIR-NAL, Bangalore on 30th March 2023.
- ISA certificate has been submitted to RDSO for field trail and approval on 2nd April 2023.

CENTRAL EVALUATOR

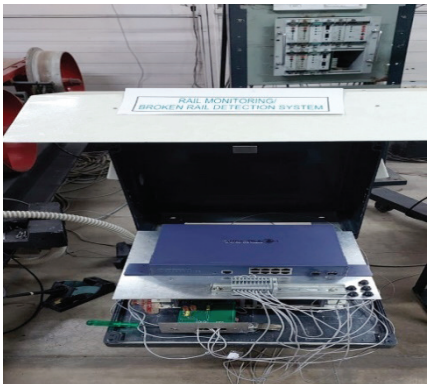
FIELD UNIT

AXLE DETECTORS

(vi) Broken Rail Detection / Rail Monitoring System for DMRC

CEL has signed MoU with DMRC for development of Broken Rail Detection / Rail Monitoring System for DMRC to detect rail breakage in Metro Lines installed with Driver less technology. This is an Inhouse smart IoT device developed for Alert / Alarm Generation. Earlier it has been deployed and commissioned on Magenta Line of DMRC between Jasola Vihar-Shaheen Bagh Metro Stations in 2021.

Last it was installed on DMRC track of 12 kms between Botanical Garden to Kalka ji Mandir, New Delhi.



Broken Rail Detection System

Prototype Broken Rail Detection System at Shaeen Bagh

(vii) Development of Products for Indian Railways

CEL's Railways Products were developed and came in to production during 1980s. Over a period of time, RDSO has proposed modifications on which CEL is developing products (S.No. i & iii below) in compliance to IEC standard (IEC 61000-4) for EMI/EMC.

i. Next Generation of Single Section Digital Axle Counter(ngSSDAC):

- CEL has completed Independent Safety Assessment (ISA) activities of ngSSDAC and received ISA certificate from CSIR-NAL, Bangalore on 30th March, 2023 which has been submitted to RDSO on 2nd April 2023 for ngSSDAC approval.
- The latest performance report from Indian Railways for the installed systems was submitted to RDSO on 2nd April 2023. Total 4 no. of ngHASSDAC systems (comprising of 8 ngSSDACs) are commissioned till date.

ngHASSDAC Evaluator

ii. VoIP Modernization in Railways

- VOIP based train control system has been commissioned at 16 stations of Mughal Sarai Division (DDU, U.P) in February 2020.
- VOIP System performance report has been received from railways on 8th May 2020 with suggestions regarding video integration in the system.
- Video Integrated VOIP system has been demonstrated to railways on 10th September 2020 at Pd. Deen Dayal Upadhyay (PDDU) division and appreciation letter was received from Indian Railways on 21st September 2020.
- The system is currently in use at PDDU division.

Station Controller for VOIP System

Fibre Backbone for VOIP System

iii. Solid State Block Proving by Axle Counter (SSBPAC)

- Interlocking and relay logic for Single line and Double line was developed and tested in August 2019. One prototype of SSBPAC was completed in January 2020.
- In covid period, Micro Controller used in Controller Card became long lead time of 84 weeks due to semiconductor crisis and is not available subsequently.
- Also, the availability of pin-to-pin compatible Controller IC was explored to serve as a Drop-in replacement. Since, the same could not be located, it was then decided to use new microcontroller IC.
- Subsequently, a new Controller Card was developed in June 2023 and assembly & testing was completed by August 2023.
- The software-hardware integration and testing shall be completed by January 2024. Subsequently, EMI/EMC test will be completed upto March 2024. Further RDSO approval including trials will be initiated for completion of the project.

2.3 Memorandum of Understanding (MoUs) Signed

1. ToT (Transfer of technology) agreement was signed between CEL & Defence Laboratory Jodhpur (DLJ), DRDO on **17.08.2023** for **"Microwave Absorbing Nickel Spinel Ferrite (MWA-NSF) Powder"**.

2. ToT (Transfer of technology) agreement was signed between CEL & ISRO- Vikram Sarabhai Space Centre (VSSC), Kerala on **09.10.2023** for **"Piezoelectric Vibration Sensor"**

2.4 Financial Achievements

I. Profit Before Tax and exceptional items of Rs.34.42 crore.

II. Highest ever net worth of Rs.133.27 crore as on 31.03.2023 after Dividend payout;

III. Declaration of Dividend by CEL of Rs. 7.30 crore for FY 2021-22 to Dr. Jitendra Singh, Hon'ble Minister (I/C) for S&T and Dr. N. Kalaiselvi, DG, CSIR and Secretary DSIR for the very first time in the history of CEL.

IV. Debt Free Company as on 31.03.2023.

V. Over Rs.50.70 Lakhs spent under Corporate Social responsibility (CSR) in FY 2022-23.

2.5 Financial details in comparison with previous years supported with Table/figure:

(Rs. in Crores)

Particulars	2022-2023	2021-2022
Production	268.69	251.58
Sales	262.30	253.34
Profit Before tax (PBT)	25.02	35.18
Net Profit after Tax (PAT)	17.49	23.78

2.6 CSR activity details with financials

As per Section 135 of the Companies Act, 2013 the Corporate Social Responsibility becomes applicable to your Company from 2016-17. During the year, the Company had spent Rs.50.70 Lakhs under CSR program (Towards Health Infrastructure in MMG Government Hospital and District Women's Hospital Ghaziabad and balance amount in "Heartfulness DIVYA JANANI" Foundation programme).

Manner in which amount spent through CEL CSR Trust, during the financial year is detailed below:

S. No	CSR project or activity identified	Project or programs	Amount outlay programs wise (Rs. in Lakhs)	Amount spent on the project or programs (Rs. In Lakhs)
1.	Health	Contribution of CSR fund spent on supply of medical equipment and ambulance to District Women's Hospital, Ghaziabad	Rs. 46.70 Lakhs	Rs. 46.70 Lakhs
2.	Education	Contribution of CSR fund spent on Anganwadi Workers Training Programme	Rs. 4.00 Lakhs	Rs. 4.00 Lakhs

Manpower details with OBC/SC/ST/PWDs details

The particulars of SC / ST and other categories of employees as on 31 March 2023, are as under:

Categories of Employee	As on 31.03.2023	
	Executives	Non Executives
SC	19	35
ST	-	-
OBC	14	10
PH	4	6
General	93	69

2.7 Information on PwDs:

The Company has 10 PwD employees against total strength of 236 employees. Further, company provides following below mentioned benefits to PwD employees:

1) Travel Allowance or Conveyance is provided to them at double rate

2) Accessible infrastructure and environment

3) Appropriate Grievance Redressal Mechanism is there to resolve their grievance

4) Special casual leaves are provided to them in case they need to attend any training or seminar related to disability

5) Provides equal opportunity policy for PwD employees in professional, academic and sports activities.

2.8 Implementation of Official language

The Meeting of official Language Implementation committee was organized in each quarter to review and improve implementation of official language policy. The first meeting of the Official Language Implementation Committee of CEL was held under the chairmanship of the Chairman and Managing Director. In the meeting, detailed discussion was held on the annual program for the year 2022-23 released by the Department of Official Language, Ministry of Home Affairs.

Hindi website of company was updated regularly. During the year, 04 Hindi workshop/training programmes were organized whereas 64 Executives and 46 Non-Executives were trained. Employees

were imparted training in usage at Hindi computer applications.

Annual Report of the company was published in Diglot form.

International day of yoga was organized at CEL on 21st June, 2022 from 7:00 am to 7:45 am and the circular was completely issued in Hindi. Therefore, the Officers/employees participated enthusiastically. The number of officers & employees was around 66.

To create awareness and knowledge among the employees about the Hindi language the company celebrated Hindi day on 14.09.2022 and Hindi Pakhwada was observed from 14.09.2022 to 28.09.2022.During this, various competitions, like Hindi Samanya Gyan Pratiyogita for Non-Hindi and all employees, Poetry and Hindi speech competitions were organised. Employees were encouraged to use Hindi in official correspondence.

CEL has confirmed its participation in organizing Hindi Diwas, 2nd All India official language Conference and Hindi Pakhwada for the year 2022 on 14th to 15th September 2022 at Surat (Gujarat).

The company continues to implement the official Language Policies of the Government through motivation and encouragement.

All these efforts were motivational tools in creating possibilities of better and progressive use of Hindi in the office.

A meeting & prize distribution ceremony was organized on 20.12.2022 under the aegis of the city official language implementation committee. In this meeting, CEL was awarded “Raj Bhasha Shield” Second prize for best implementation in the field of official language.

Industrial Safety week was celebrated in the office from 04.03.2023 to 10.03.2023. On this occasion slogan, essay and painting competition was organized in both Hindi and English languages. Ambedkar Jayanti & Sports meet was also organized in CEL to enhance the employee’s motivation. All these efforts were motivational tools in creating possibilities of better and progressive use of Hindi in the office.

2.9 Technology absorption, adaptation, innovation and conservation of energy

The particulars relating to conservation of energy, technology absorption, foreign exchange earnings and outgo, as required to be disclosed under the Act are as under:

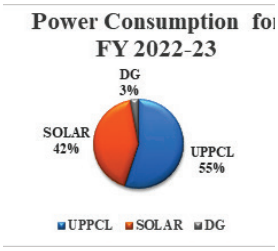
1) Power Factor Improvement

In power factor improved significantly by installing detuned reactors in APFC Panels and Harmonic Active Filter on HT& LT lines which has resulted in saving and conservation of electricity.

Presently, company has achieved power factor (PF) ≥ 0.99

2) Utilization of Solar Energy

CEL has installed & have been using multiple in-house solar PV plants having capacity around 1.5-MWp. CEL have also net metering system in company campus in which they are utilizing the solar power directly by load in working days and by exporting solar power to grid in non-working days. Billing is also done on the basis of net metering. This also helps to reduce the load on grid..



Solar proportion in our total electricity consumption was 42 % in FY 2022-23.

2.10 Implementation of RTI Act

Government of India has enacted the Right to Information Act (RTI) 2005 with a view to bring-

in transparency and accountability in the working of Public Authorities. Your Company has evolved necessary structure to facilitate implementation of the RTI Act in the Company.

Information Officer has been appointed and an Appellate Authority has been designated for smooth implementation of various provisions of the RTI Act. Necessary information has also been posted on the website of the Company www.celindia.co.in.

2.11 Human Resource Development

a) Welfare of the reserved categories-All Government directives relating to the reserved category such as SC, ST, Physically Handicapped, Ex-servicemen, etc. were continuously implemented during the year.

b) Industrial Relations and Human Resource Development: Industrial relations continued to be harmonious during the year. The Company has imparted training to the workmen and executives in their related fields, which has been helpful in development and growth of employees. Process of regular recruitments at various levels has been put in place which is aligned with the Company's growth and technology needs.

c) Status of Sexual Harassment of Women at Workplace : The Company has in place a Policy on Prevention, Prohibition and Redressal of Sexual Harassment of Women at Workplace. As per the provisions of the Sexual Harassment of Women at Workplace Prevention, Prohibition and Redressal Act 2013, an internal complaints committee has been set up, where any aggrieved female employee can lodge complaint. All concerned persons, as per the Act, are covered under the policy. During the year 2022-23, there was no complaint received/ disposed off.

2.12 Corporate Governance

The Company believes that Corporate Governance provides principled process and structure necessary for attaining the Objectives of the Company. Your Directors ensure that Govt. Guidelines/Directives are followed in full. Management Discussion Analysis and Corporate Governance report form part of the Directors Report.

The DPE guidelines on Corporate Governance for CPSEs provide that the CPSEs would be graded on the basis of their compliance with the guidelines. During 2022-2023 all the four quarterly self-evaluation reports have been "Excellent" and the Company expects to receive ''EXCELLENT'' grading from Department of Public Enterprises for the year 2021-2022.

2.13 MoU evaluation/performance

As per the evaluation made by Department of Public Enterprises, Central Electronics Limited was rated 'Good' in its MOU evaluation for the year 2021-2022.

CHAPTER 11 ADMINISTRATION & FINANCE

ADMINISTRATION & FINANCE

1.0 ADMINISTRATION

The Department of Scientific & Industrial Research (DSIR) was created in January, 1985. The Administrative Division of the Department, comprising Establishment Section, General Section and Vigilance Unit, looks after activities related to personnel, implementation of the Flexible Complementary Scheme (FCS) promotion mechanism meant for the Scientists (Group 'A'), foreign deputations of officers, vigilance matters, administrative reforms mechanism, work relating to CGHS facilities, staff welfare, coordination etc. During the year, DSIR organized several events such as Foundation Day of the Department, Hindi Pakhwada, Vigilance Awareness Week, Yoga Day, Constitution Day etc.

Further, Department of Scientific and Industrial Research (DSIR) successfully conducted Special Campaign 3.0 from 2nd October, 2023 to 31st October, 2023. The Campaign started by the Hon'ble Minister of Science and Technology with 'Shramdaan' on 2nd October, 2023 at CSIR Headquarter, Anusandhan Bhavan, New Delhi. 'Shramdaan' was also organized on 2nd October, 2023 in DSIR and CPSEs i.e. Central Electronics Limited (CEL) and National Research Development Corporation (NRDC) and all 37 labs of CSIR across the country wherein officers/staff participated in the cleanliness and plantation drive. The start of Campaign also featured the flagging-off the revolutionary "Recycling on Wheels Smart-ER Project" project by Hon'ble Minister of Science & Technology (I/C), Dr. Jitendra Singh. The Project is a novel initiative to collect and recycle electronic waste using smart vehicles.

The progress of the Campaign was reviewed with Nodal Officers of CSIR, NRDC and CEL at regular intervals. Some of the achievements of the Department during the Campaign are listed as under:-

a) Record Management: With the start of the Special Campaign this year, a total of 10,646 files of DSIR (Proper), NRDC, CSIR Headquarters and its laboratories across the country, were reviewed, out of which 1,882 files were weeded out. Besides, most of the files have been digitized in the Department.

b) Cleanliness Drive: Department and its organizations actively participated in the cleanliness drives organized during the period. 56 cleanliness

campaigns were conducted, total of Rs.18,610/- revenue was generated from scrap disposal in the Department of Scientific and Industrial Research, Council of Scientific and Industrial Research, PSUs namely Central Electronics Limited and National Research and Development Centre.

c) Disposal of Pending Matters: During the Special Campaign, Department of Scientific and Industrial Research (DSIR) has successfully achieved 100 per cent target of disposing of the pendency of MP references, PMO reference, public grievances and record management respectively

d) Space Freed: During the Special Campaign action taken for removal of junk items, scrap materials and old equipments to make available space. Total 1,590 Sq.ft. space area freed from CSIR Headquarters and its laboratories across the country during the campaign.

e) Best Practices: 'Recycling on wheels' an initiative of the Ministry which was inaugurated by Dr. Jitendra Singh, Hon'ble Union Minister of State (IC) for Science & Technology on 2nd October, 2023, has been adjudged as one of best practices in institutionalizing Swachhata under the Special Campaign 3.0.

1.1 Staff Strength:

The staff in position against the regular posts under different groups in the Department, other than Autonomous Bodies viz. Council of Scientific and Industrial Research (CSIR) and Public Sector Undertakings viz. National Research Development Corporation (NRDC) and Central Electronics Limited (CEL), as on 31/03/2024 is given below :

	General	**SC**	**ST**	**OBC**	**Total**
Group 'A' (Gazetted)	25	4	2	5	36
Group 'B'	11	4	2	6	23
Group 'C'	02	4	3	6	15
Total	**38**	**12**	**07**	**17**	**74**

2.0 FINANCE

The Financial summary giving AE 2022-23, BE 2023-24, RE 2023-24, AE 2023-24 (up to 31.03.2024) and BE 2024-25 for DSIR is given in Table 1.

3.0 RAJBHASHA SECTION

In order to ensure compliance with the constitutional and legal provisions regarding the official language of the Union and to promote the use of Hindi for the official purposes of the Union, an Official Language Section has been set up in the Department of Scientific and Industrial Research under the Ministry of Science and Technology. The Official Language Section is continuously making efforts to accelerate the use of Hindi in the official works of the Union. During the reported period, the Official Language Section has taken the following steps to ensure progressive use of Hindi in the Department and the Autonomous Bodies/Public Sector Undertakings under its administrative control :

- In compliance with Section 3(3) of the Official Languages Act, 1963, the provisions of this Act were fully followed and all documents, reports, monthly summaries, documents to be presented in Parliament, etc. were issued in bilingual form.
- The 34th meeting of the Joint Hindi Advisory Committee of the Ministry of Science & Technology and Earth Sciences under the chairmanship of Dr. Jitendra Singh, Hon'ble Minister of State for Science & Technology was successfully conducted by DST on 15/12/2024 at Aryabhatta Hall, Technology Bhawan, New Delhi.
- The Second Sub-Committee of the Committee on Official Language of Parliament inspected the offices/institutions under the control of Department: National Metallurgical Laboratory, Jamshedpur on 03/01/2023, National Chemical Laboratory, Pune and National Environmental Engineering Research Institute, Nagpur on 18/01/2023, Central Electronics Engineering Research Institute, Pilani on 27/02/2023, Central

Mining and Fuel Research Institute, Dhanbad on 08/05/2023, Central Leather Research Institute, Jalandhar on 13/05/2023, CSIR Headquarters Delhi On 26/05/2023, Central Building Research Institute, Roorkee and Indian Petroleum Institute, Dehradun, on 26/05/2023, Central Drug Research Institute, Lucknow and Indian Toxicology Research Institute, Lucknow on 22/06/2023, National Aerospace Laboratory, Bengaluru on 13/07/2023, Himalayan Bioresource Technology Institute, Palampur on 06/10/2023, Central Institute of Medicinal and Herbal Plants, Lucknow, National Botanical Research Institute, Lucknow on 30/11/2023 and National Chemical Laboratory, Pune on 18/01/2024 in Mumbai. Joint Secretary of DSIR and concerned officers of Official Language Section represented the department in above inspections.

- On the occasion of Hindi Day on 14/09/2023, Hindi Pakhwada (Fortnight) was organized in this Department from 14/09/2023 to 29/09/2023. As per the instructions of the Department of Official Language, Hindi Fortnight was started from Pune Conference in which the officers of Hindi Section of this Department participated. During the fortnight, seven Hindi competitions were organized in the office and the successful participants were given cash prizes and certificates by the Joint Secretary of the Department on the occasion of closing ceremony on 08/11/2023.

4.0 IMPLEMENTATION OF RIGHTS OF PERSONS WITH DISABILITIES (RPwD) ACT, 2016

i) Department has appointed a Liaison Officer in respect of PwD matters.

ii) Department is providing reservation to PwD candidates as per the policy of Government of India.

iii) Department and its PSUs identified the posts suitable for Persons with benchmark Disabilities as mentioned in RPwD Act, 2016 during 2021-22. Report of the Expert Committee has been published on the website of the Department.

iv) Representation of PwD employees in the department is provided as under :

Group	Number of Employees				Direct Recruitment							Promotion						
					No. of Vacancies reserved				No. of Appointments made			No. of Vacancies reserved			No. of Appointments made			
	Total	VH	HH	OH	VH	HH	OH	Total	VH	HH	OH	VH	HH	OH	Total	VH	HH	OH
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Group A	36	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Group B	23	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Group C	15	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	74	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Representations of the persons with disabilities as on 31st March, 2024

5.0 EXTRACTS OF AUDIT OBSERVATIONS

Audit paras pertaining to DSIR that appeared in the CAG report of 2023 are placed at Annexure-12

Table 1: FINANCIAL SUMMARY (RS. IN CRORE)															
Scheme	**Actual Expenditure 2022-23**			**Budget Estimates 2023-24**			**Revised Estimates 2023-24**			**Actual Expenditure upto 31.03.2024**			**Budget Estimates 2024-25**		
	Revenue	Capital	Total	Revenue	Capital	Total	Revenue	Capital	Total	Revenue	Capital	Total	Revenue	Capital	Total
DSIR - Secretariat	15.27	0	15.27	17.91	0	17.91	16.15	0	16.15	15.73	0	15.73	17.16	0.6	17.76
DSIR Building	0	0	0	0	0.56	0.56	0	0.35	0.35	0	0.22	0.22	0	0	0
Central Sector Schemes/Projects															
Industrial Research & Development(IR&D)															
PRISM	3.47	0	3.47	3	0	3	3	0	3	2.32	0	2.32	1.5	0	1.5
PACE (Grants)	0.04	0	0.04	0.15	0	0.15	0.15	0	0.15	0.06	0	0.06	0.1	0	0.1
PACE (Loan)	0	0	0	0	2.2	2.2	0	2	2	0	0	0	0	0.6	0.6
BIRD(CRTDH)	10.54	0	10.54	14.5	0	14.5	6.5	0	6.5	0	0	0	11.70	0	11.70
A2K+	2.92	0	2.92	3.45	0	3.45	2.95	0	2.95	0.95	0	0.95	2.6	0	2.6
Assistant to PSEs for other Scientific Research															
CEL (Grants)	0	0	0	3.03	0	3.03	0	0	0	0	0	0	3.5	0	3.5
CEL (Equity)	0	1.5	1.5	0	6.2	6.2	0	10.2	10.2	0	10.2	10.2	0	0	0
NRDC	8.75	0	8.75	12.5	0	12.5	12	0	12	8.25	0	8.25	12	0	12
Total Central Sector Schemes/Projects	**25.72**	**1.5**	**27.22**	**36.63**	**8.4**	**45.03**	**24.6**	**12.2**	**36.8**	**11.58**	**10.20**	**21.78**	**31.4**	**0.6**	**32.00**
Council of Scientific and Industrial Research (CSIR)															
National Laboratories-CSIR	5315.36	0	5315.36	5175.51	0	5175.51	5711.51	0	5711.51	5700.20	0	5700.20	5835.80	0	5835.80
Research Schemes Scholarships & Fellowship-CSIR	514.06	0	514.06	500	0	500	430	0	430	417	0	417	430	0	430
Total CSIR	**5829.42**	**0**	**5829.42**	**5675.51**	**0**	**5675.51**	**6141.51**	**0**	**6141.5**	**6117.20**	**0**	**6117.20**	**6265.8**	**0**	**6265.8**
APCTT (Contributions) UN Body	6.78	0	6.78	7	0	7	7.25	0	7.25	7.18	0	7.18	7.35	0	7.35
APCTT (Building) UN Body	0	0	0	0	0.5	0.5	0	0.47	0.47	0	0.33	0.33	0	0.5	0.5
Grand Total DSIR inclusive CSIR	**5877.19**	**1.5**	**5878.69**	**5737.05**	**9.46**	**5746.51**	**6189.51**	**13.02**	**6202.53**	6151.69	10.75	**6162.44**	**6321.71**	**1.7**	**6323.41**
Note: Actuals are as per elekha statement as on 31.03.2024.															

ANNEXURE-1

Statement of Recognition of In-house R&D units (Fresh Recognition)

Month	Receipt	Cumulative Receipt	Disposal	Cumulative Disposal	No. Companies Recognized	Endorsement of total recognized companies	New Companies recognized	Total R&D Units recognized
January, 2023	22	22	25	25	17	01	16	17
February, 2023	14	36	-	25	-	-	-	-
March, 2023	29	65	30	55	26	03	23	28
April, 2023	14	79	-	55	-	-	-	-
May, 2023	15	94	-	55	-	-	-	-
June, 2023	12	106	28	83	10	-	10	12
July, 2023	09	115	04	87	02	-	02	02
August, 2023	06	121	15	102	06	-	06	06
September, 2023	05	126	-	102	-	-	-	-
October , 2023	14	140	10	112	05	-	05	05
November, 2023	20	160	24	136	16	-	16	16
December, 2023	15	175	-	136	-	-	-	-
January, 2024	18	193	32	172	20	02	18	20
February, 2024	15	208	33	205	22	03	19	22
March, 2024	24	232	26	231	13	02	11	13
Total	232	232	231	231	137	11	126	141

ANNEXURE-2

STATEMENT ON RENEWAL OF RECOGNITION OF IN-HOUSE R&D UNITs HAVING VALID RECOGNITION UPTO 31.03.2024

Month	Year	Receipts	Cumulative Receipts*	Disposal	Cumulative Disposal*
January	2023	115	115	04	04
February	2023	92	207	14	18
March	2023	154	361	19	37
April	2023	55	416	47	84
May	2023	48	464	52	136
June	2023	16	480	77	213
July	2023	10	490	85	298
August	2023	10	500	51	349
September	2023	02	502	24	373
October	2023	06	508	41	414
November	2023	04	512	14	431
December	2023	03	515	48	479
January	2024	03	518	13	492
February	2024	00	518	08	500
March	2024	03	521	08	508

Note: A total of 13 applications are being processed currently in the department.
* Cumulative receipts and disposal include 40 applications with renewal validity upto 31.03.2022

ANNEXURE – 3

LIST OF IN-HOUSE R&D UNITS IN INDUSTRY REPORTING ANNUAL EXPENDITURE MORE THAN Rs. 5000.00 LAKHS

S.NO.	Name of the Company	R&D Expenditure Reported (Rs. In Lakhs)
1.	Mahindra & Mahindra Ltd.	259534
2.	Mylan Laboratories Ltd.,	81150
3.	Intas Pharmaceuticals Ltd.	55274
4.	Torrent Pharmaceuticals Ltd.	42998
5.	Alembic Pharmaceuticals Ltd.	40996
6.	Alkem Laboratories Ltd.	35912
7.	Hindustan Unilever Ltd.	21892
8.	Force Motors Ltd.	19257
9.	Escorts Kubota Ltd.	14963
10.	Orbicular Pharmaceutical Technologies Pvt. Ltd.	14389
11.	IPCA Laboratories Ltd.	13816
12.	Schneider Electric India Pvt. Ltd.	13813
13.	Baxter Pharmaceuticals India Pvt. Ltd.	13437
14.	Enzene Biosciences Ltd.	13322
15.	UNO Minda Ltd.	12971
16.	Rubicon Research Pvt. Ltd.	12833
17.	Biological E Ltd.	12000
18.	Novartis Healthcare Pvt. Ltd.	11986
19.	Havells India Ltd.	11026
20.	Unichem Laboratories Ltd.	11021
21.	SRF Ltd	10555
22.	International Tractors Ltd.	10523
23.	Larsen & Toubro Ltd.	10252
24.	Encube Ethicals Pvt. Ltd.	8771
25.	Indoco Remedies Ltd.	8729
26.	Asteria Aerospace Pvt. Ltd.	8182
27.	Ramco Systems Ltd.	6327
28.	Bharat Forge Ltd.	5993
29.	United States Pharmacopeia India Pvt. Ltd.	5980
30.	Aditya Birla Science & Technology Company Pvt. Ltd.	5946
31.	Eisai Pharmaceuticals India Pvt. Ltd.	5675
32.	Ashok Leyland Ltd.	5448
33.	Intox Pvt. Ltd.	5446
34.	Sedemac Mechatronics Pvt. Ltd.	5115

ANNEXURE – 4

LIST OF IN-HOUSE R&D UNITS IN INDUSTRY REPORTING ANNUAL EXPENDITURE IN THE RANGE OF Rs. 500.00 LAKHS TO Rs. 5000.00 LAKHS

S.NO.	Name of the Company	R&D Expenditure Reported (Rs. In Lakhs)
1.	Ind-Swift Laboratories Ltd.	4871
2.	Bharat Dynamics Ltd.	4814
3.	Lumax Industries Ltd.	4793
4.	Deepak Nitrite Ltd.	4458
5.	O2H Discovery Pvt. Ltd.	4426
6.	Biophore India Pharmaceuticals Pvt. Ltd.	4345
7.	Bayer Bioscience Pvt. Ltd.	4283
8.	Umedica Laboratories Pvt. Ltd.	4170
9.	Tata Hitachi Construction Machinery Company Pvt. Ltd.	4132
10.	Advanta Enterprises Ltd.	4113
11.	Kirloskar Brothers Ltd.	4080
12.	Turbo Energy Pvt. Ltd.	4076
13.	Deccan Fine Chemicals (India) Pvt. Ltd.	4052
14.	Meril Life Sciences Ltd.	4027
15.	Aether Industries Ltd.	3926
16.	Venco Research & Breeding Farm Pvt. Ltd.	3903
17.	Curadev Pharma Pvt. Ltd.	3854
18.	Enaltec Pharma Research Pvt. Ltd.	3670
19.	Lucas-TVS Ltd.	3536
20.	Global Calcium Pvt. Ltd.	3374
21.	Jain Irrigation Systems Ltd.	3315
22.	Napino Auto and Electronics Ltd.	3265
23.	Atul Ltd.	3239
24.	Engineers India Ltd.	2854
25.	Naga Ltd.	2828
26.	Exide Industries Ltd.	2786
27.	Honour Lab Ltd.	2728
28.	Lyrus Life Sciences Pvt. Ltd.	2687
29.	Fleetguard Filters Pvt. Ltd.	2571
30.	ADAMA India Pvt. Ltd.	2566
31.	NLC India Ltd.	2326
32.	Emami Ltd.	2285
33.	East West Seeds India Pvt. Ltd.	2280
34.	Wheels India Ltd.	2212
35.	Lakshmi Machine Works Ltd.	2204

S.NO.	Name of the Company	R&D Expenditure Reported (Rs. In Lakhs)
36.	Finoso Pharma Private Ltd.	2203
37.	Etico Life sciences Pvt. Ltd.	2198
38.	Star Wire (India) Ltd.	2197
39.	Shriram Pistons & Rings Ltd.	2161
40.	M.J. Biopharm Pvt. Ltd.	2150
41.	BASF India Ltd.	2102
42.	Varroc Polymers Ltd.	2089
43.	Godrej Consumer Products Ltd.	2066
44.	Venus Remedies Ltd.	2031
45.	Forbes Marshall Pvt. Ltd.	2016
46.	Nosch Labs Pvt. Ltd.	1979
47.	Sharda Motor Industries Ltd.	1974
48.	Concord Biotech Ltd.	1967
49.	Syngenta Biosciences Pvt. Ltd.	1906
50.	Monsanto Holdings Pvt. Ltd.	1900
51.	Genus Power Infrastructures Ltd.	1873
52.	Hindalco Industries Ltd.	1756
53.	Limagrain India Pvl Ltd.	1750
54.	Pandorum Technologies Pvt. Ltd.	1714
55.	Cohance Lifesciences Ltd.	1701
56.	JK Agri Genetics Ltd.	1640
57.	International Tractors Ltd.	1636
58.	Sud Chemie India Pvt. Ltd.	1565
59.	Navin Saxena Research & Technology Pvt. Ltd.	1546
60.	UCAL Fuel Systems Ltd.	1516
61.	Sphaera Pharma Pvt. Ltd.	1509
62.	Innovare Labs Pvt. Ltd.	1508
63.	Shivalik Rasayan Ltd.	1506
64.	SML ISUZU Ltd.	1485
65.	Lee Pharma Ltd.	1467
66.	Hindustan Zinc Ltd.	1456
67.	Cosmo First Ltd. (Formerly Cosmo Films Ltd.)	1430
68.	Sapala Organics Pvt. Ltd.	1331
69.	VerGo Pharma Research Laboratories Pvt. Ltd.	1286
70.	Grauer & Weil (India) Ltd.	1269
71.	Agappe Diagnostics Ltd.	1242
72.	Puniska Healthcare Pvt. Ltd.	1211
73.	Godfrey Phillips India Ltd.	1208
74.	Zen Technologies Ltd.	1165
75.	C.R.I. Pumps Pvt. Ltd.	1095
76.	Sona BLW Precision Forgings Ltd.	1086

S.NO.	Name of the Company	R&D Expenditure Reported (Rs. In Lakhs)
77.	Krish Biotech Research Pvt. Ltd.	1065
78.	Stabicon Life Sciences Pvt. Ltd.	1041
79.	Stempeutics Research Pvt. Ltd.	1040
80.	Stellapps Technologies Pvt. Ltd.	1027
81.	Signalchip Innovations Pvt. Ltd.	987
82.	Fiem Industries Ltd.	958
83.	Innovassynth Technologies (India) Ltd.	932
84.	Salzer Electronics Ltd.	929
85.	Procter & Gamble Health Ltd.	905
86.	Centum Electronics Ltd.	902
87.	HMT Machine Tools Ltd.	890
88.	ALP Overseas Pvt. Ltd.	888
89.	Nath Bio-Genes (I) Ltd.	888
90.	Bio Organics & Applied Materials Pvt. Ltd.	872
91.	Nelcast Ltd.	848
92.	Autometers Alliance Ltd.	841
93.	Synthite Industries Pvt. Ltd.	840
94.	J.K. Fenner (India) Ltd.	819
95.	Nosch Labs Pvt. Ltd.	815
96.	Dorf Ketal Chemicals India Pvt. Ltd.	801
97.	Eternis Fine Chemicals Ltd.	798
98.	Galore Networks Pvt. Ltd.	796
99.	Ind-Swift Ltd.	791
100.	Jayem Automotives Pvt. Ltd.	781
101.	Croda India Company Pvt. Ltd.	779
102.	Emerson Climate Technologies (India) Pvt. Ltd.	763
103.	Anupam Rasayan India Ltd.	760
104.	Cosmos Impex (India) Pvt. Ltd.	757
105.	India Japan Lighting (P) Ltd.	753
106.	Sea6 Energy Pvt. Ltd.	744
107.	Ashida Electronics Pvt. Ltd.	741
108.	Gowrie Research Pvt. Ltd.	733
109.	Almelo Pvt. Ltd.	725
110.	Privi Organics Ltd.	699
111.	Innova Captab Ltd.	695
112.	Sakata Seed India (P) Ltd.	692
113.	Balmer Lawrie& Co. Ltd.	674
114.	Triveni Turbine Ltd.	657
115.	Simson Life Sciences Pvt. Ltd.	657
116.	Progenerics Pharma Pvt. Ltd.	643
117.	CTX Lifesciences Pvt. Ltd.	639

S.NO.	Name of the Company	R&D Expenditure Reported (Rs. In Lakhs)
118.	Captronic Systems Pvt. Ltd.	635
119.	S. Kant Healthcare Ltd.	634
120.	Murli Krishna Pharma Pvt. Ltd.	629
121.	Laurus Bio Pvt. Ltd.	623
122.	Sarvotham Care Ltd.	611
123.	Dixon Technologies (India) Ltd.	602
124.	Janatics India Pvt. Ltd.	601
125.	Aristo Pharmaceuticals (P) Ltd.	583
126.	Sumitomo Chemical India Ltd.	581
127.	Mak Controls and Systems (P) Ltd.	566
128.	Zoetis Pharmaceutical Research Pvt. Ltd.	562
129.	Evonik Catalysts India Pvt. Ltd.	561
130.	Structwel Designers & Consultants Pvt. Ltd.	561
131.	Ador Welding Ltd.	551
132.	Gupta H.C. Overseas (I) Pvt. Ltd.	549
133.	HMT Machine Tools Pvt. Ltd.	548
134.	RV Lifesciences Ltd.	533
135.	Bajaj Electricals Ltd.	530
136.	Scie Gen Pharmaceuticals India Pvt. Ltd.	529
137.	E.I.D. Parry (India) Ltd.	527
138.	Hawkins Cookers Ltd.	527
139.	Ciron Drugs & Pharmaceuticals Pvt. Ltd.	523
140.	AAK India Pvt. Ltd.	520
141.	Munjal Kiriu Industries Pvt. Ltd.	518
142.	TVS Motor Company Ltd.	513
143.	Synergene Active Ingredients Pvt. Ltd.	508
144.	Rich Products & Solutions Pvt. Ltd.	501

ANNEXURE - 5

LIST OF IN-HOUSE R&D UNITS IN INDUSTRY REPORTING ANNUAL EXPENDITURE IN THE RANGE OF Rs. 200.00 LAKHS TO Rs. 500.00 LAKHS

S.NO.	Name of the Company	R&D Expenditure Reported (Rs. In Lakhs)
1.	Madras Engineering Industries Pvt. Ltd.	499
2.	Raj Petro Specialities Pvt. Ltd.	497
3.	Gujarat Alkalies & Chemicals Ltd.	493
4.	Sud Chemie India Pvt. Ltd.	485
5.	Colourtex Industries Pvt. Ltd.	482
6.	Dhanuka Agritech Ltd.	480
7.	Lumax Mannoh Allied Technologies Ltd.	457
8.	Smilax Laboratories Ltd.	452
9.	Shakti Pumps (India) Ltd.	452
10.	Concept Pharmaceuticals Ltd.	451
11.	Ross Lifescience, Ltd.	449
12.	ADM Joinflex India Pvt. Ltd.	447
13.	SMS Lifesciences India Ltd.	439
14.	Aarti Drugs Ltd.	435
15.	Tata International Ltd.	431
16.	Aastrid Life Sciences Pvt. Ltd.	430
17.	The Indian Hume Pipe Company Ltd.	430
18.	The Andhra Sugars Ltd.	427
19.	Filatex India Ltd.	420
20.	PPAP Automotive Ltd.	408
21.	Rasil Chemicals Pvt. Ltd.	404
22.	O/E/N India Ltd.	395
23.	Viruj Pharmaceuticals Pvt. Ltd.	382
24.	Shibaura Machine India Private Ltd.	378
25.	Gracure Pharmaceuticals Ltd.	376
26.	Fujifilm Sericol India Pvt. Ltd.	374
27.	Renu Electronics Pvt. Ltd.	370
28.	Anabond Ltd.	365
29.	Intelux Electronics Pvt. Ltd.	361
30.	Capital Power Systems Limited	360
31.	Voltas Ltd.	355
32.	J J Plastalloy Pvt. Ltd.	354
33.	Surya Roshni Ltd.	351
34.	Manatec Electronics Pvt. Ltd.	351
35.	Sandvik Mining & Rock Technology India Pvt. Ltd.	350

S.NO.	Name of the Company	R&D Expenditure Reported (Rs. In Lakhs)
36.	Banco Products (India) Ltd.	349
37.	Daewoong Pharmaceutical (India) Pvt. Ltd.	347
38.	Fluid Controls Pvt. Ltd.	341
39.	Brawn Laboratories Ltd.	335
40.	Johari Digital Healthcare Ltd.	326
41.	Eesavyasa Technologies Pvt. Ltd.	325
42.	Hical Technologies Pvt. Ltd.	325
43.	JDM Scientific Research Organization Pvt. Ltd.	322
44.	Anand Motor Products Pvt. Ltd.	320
45.	Huhtamaki India Ltd.	317
46.	Transpek-Silox Industry Pvt. Ltd.	314
47.	Unisem Agritech Pvt. Ltd.	313
48.	TTK Healthcare Ltd.	311
49.	Venkata Narayana Active Ingredients Pvt. Ltd.	311
50.	Paras Defence and Space Technologies Ltd.	306
51.	Star Engineers (I) Pvt. Ltd.	300
52.	Encore Healthcare Pvt. Ltd.	298
53.	SAARLOHA Advanced Materials Pvt. Ltd.	293
54.	HPL Additives Ltd.	291
55.	Psychotropics India Ltd.	291
56.	Winsome Textile Industries Ltd.	284
57.	Pratap Organics Pvt. Ltd.	283
58.	Uniphos Envirotronic Pvt. Ltd.	281
59.	TD Power Systems Ltd.	280
60.	Ruchi- Hi- Rich Seeds Pvt. Ltd.	277
61.	ITW India Pvt. Ltd.	276
62.	Pathgene Health Care Pvt. Ltd.	274
63.	Advy Chemical Pvt. Ltd.	271
64.	Prado, Preclinical Research and Development Organization Pvt. Ltd.	268
65.	The Metal Powder Company Ltd.	266
66.	Diamines and Chemicals Ltd.	264
67.	Privi Speciality Chemicals Ltd.	263
68.	Vasant Chemicals Pvt. Ltd.	263
69.	Crenza Pharmaceuticals Pvt. Ltd.	263
70.	Aditya Auto Products and Engineering (India) Pvt. Ltd.	259
71.	ITL Industries Ltd.	258
72.	Globela Pharma Pvt. Ltd.	255
73.	Vasu Healthcare Pvt. Ltd.	252
74.	Bhat Bio-Tech India Pvt. Ltd.	250
75.	Travancore Titanium Products Ltd.	250
76.	Lumis Biotech Pvt. Ltd.	243

S.NO.	Name of the Company	R&D Expenditure Reported (Rs. In Lakhs)
77.	Chembond Chemicals Ltd.	243
78.	Growel Feeds Private Ltd.	232
79.	Nichrome India Ltd.	231
80.	Frog Cellsat Ltd.	230
81.	Aries Agro Ltd.	230
82.	Aron Universal Ltd.	228
83.	GRP Ltd.	225
84.	Vimta Labs Ltd.	225
85.	Daftari Agro Biotech Pvt. Ltd.	222
86.	Sushen Medicamentos Pvt. Ltd.	219
87.	India Pistons Ltd.	217
88.	PHA India Pvt. Ltd.	217
89.	Nu-Cork Products Pvt. Ltd.	216
90.	Star Agrotech Pvt. Ltd.	212
91.	Natural Capsules Ltd.	212
92.	Talbros Automotive Components Ltd.	211
93.	Prabhat Agri Biotech Ltd.	211
94.	Banco Gaskets (India) Ltd.	208
95.	Bal Pharma Ltd.	205
96.	India Pesticides Ltd.	205
97.	Paushak Ltd.	200

ANNEXURE -6

List of Scientific & Industrial Research Organizations (SIROs) recognised by DSIR during the period 1st January 2023 to 31st March 2024.

S.No.	Name of the Organization	Recognition granted upto
	Natural and Applied Sciences	
1.	ISF College of Pharmacy of ISF Educational Society, GT Road, Ghal Kalan, Moga – 142001, Punjab	31.03.2025
2.	TIH Foundation for IOT and IOE, Indian Institute of Technology-Bombay, A.S. Marg, Powai, Mumbai – 400076, Maharashtra	31.03.2025
3.	Conservation Initiatives, 1, Mukunda Path, Suruj Nagar, Six Mile, Kamrup Metro, Guwahati – 781022, Assam	31.03.2025
4.	Narula Institute of Technology of Narula Educational Trust, 81, Nilganj Road, Agarpara, Kolkata – 700109, West Bengal	31.03.2025
5.	Prayoga, Mythri, 10-32, I Main Road, BM Srikantiah Road, Hanumanthanagar, Bengaluru Urban – 560019, Karnataka	31.03.2025
6.	Indian Institute for Human Settlements, 197-36, 2nd Main Road, Sadashivnagar, Bengaluru Urban, Bengaluru – 560080, Karnataka	31.03.2025
7.	Foundation for Science Innovation Development, Innovation Centre, Indian Institute of Science Campus, Bengaluru Urban – 560012, Karnataka	31.03.2025
8.	City Educational and Social Welfare Society, 47 L 4 M1,Jawahar Quarters, Begum Bridge Road, Meerut – 250 005, Uttar Pradesh	31.03.2025
9.	Triveni Educational & Social Welfare Society, Ramakrishna Senior Secondary School,M Block Vikaspuri, New Delhi – 110018	31.03.2025
10.	Indian Institute of Public Health Shillong Society, Pasteur Hills, Lawmali, District East Khasi Hills, Shillong – 793001, Meghalaya	31.03.2025
11.	Sri SaiKrishna Educational Society, H.No. 80-112-G-1-1, Abbas Nagar, Kurnool – 518002, Andhra Pradesh	31.03.2026
12.	Jain Trust, No. 91-2 Dr. A.N. Krishna Rao Road,V.V. Puram, Bengaluru Urban, Bengaluru – 560004, Karnataka	31.03.2026
13.	T-Works Foundation, 3rd Floor, D-Block, Room No. 423A,Telangana Secretariat, NTR Marg, Hyderabad – 500022, Telangana	31.03.2026
14.	Garden City University, GCC House,No. 340, 5th Main, Indiranagar, Bengaluru Urban, Bangalore – 500038, Karnataka	31.03.2026
15.	Lendi Institute of Engineering and Technology (A), Sai Dhamam Educational Trust, HIG-24, Sector-1, M.V.P. Colony,Vizianagaram – 535005, Andhra Pradesh	31.03.2026
16.	Foundation for Underwater Domain Awareness, 102 Cordia Nyati Estate, Mohammadwadi, Pune – 411060, Maharashtra	31.03.2026
17.	Bhagawan Sri BalaSai Educational and Charitable Society, Kalinga University Campus, Kotni, Near Mantralaya, Naya Raipur, Raipur – 492101, Chhattisgarh	31.03.2026
18.	Nalanda Institute of Technology, Plot No - 1018, Near Rajdhani Gas, Nayapalli, District Khordha, Bhubaneswar – 751012, Odisha	31.03.2026
19.	Velammal Institute of Technology, Chennai – Kolkata National Highway, Panchetti, Ponneri Taluk, Thiruvallur – 601204, Tamil Nadu	31.03.2026
20.	Integrated Research and Action for Development, C80, Shivalik, Malviya Nagar, District South Delhi, New Delhi – 110017	31.03.2026

S.No.	Name of the Organization	Recognition granted upto
21.	Aarthi Educational and Charitable Trust, K S R Kalvi Nagar, Tiruchengode, Namakkal – 637215, Tamil Nadu	31.03.2026
22.	Sister Nivedita University, DG 1-2, Action Area-I, Newtown, North 24 Paraganas, Kolkata – 700156, West Bengal	31.03.2026
23.	Infotech Education Society, IES Campus Kalkheda, Ratibad Main Road, Bhopal – 462044, Madhya Pradesh	31.03.2025
24.	Advanced Center for Water Resources Development and Management (ACWADAM), Plot 4, Lenyadri Society, Sus Road, Pashan, Pune – 411021, Maharashtra	31.03.2026
25.	Raja Charity Trust, 1, Gandhi Kalaimandram Road, PACR Salai, Rajapalayam – 626117, District Virudhunagar, Tamil Nadu	31.03.2025
26.	Kuruom School of Advanced Sciences Foundation, Gata No. 960, Village Utrawan, Tehsil Mohanlalganj, Lucknow – 236302, Uttar Pradesh	31.03.2025
27.	Sai University, One Hub Road, Paiyanur, OMR, Chengalpattu – 603104, Tamil Nadu	31.03.2026
28.	Indian Institute of Management, Balicha, Udaipur – 313001, Rajasthan	31.03.2026
29.	SahityaSadawartSamiti, D Block, Malviya Nagar, Jaipur – 302017, Rajasthan	31.03.2026
30.	PSGR Krishnammal College for Women of GRG Trust, Peelamedu, Coimbatore – 641004, Tamil Nadu	31.03.2026
31.	Asian Development Research Institute, ADRI Lane, BSIDC Colony, Off Boring Patliputra Road, Patna – 800013, Bihar	31.03.2026
32.	National Entrepreneurship Network, 6th Floor, Bhive Workspace, 48, Church St, Haridevpur, Shanthala Nagar, Ashok Nagar, Bengaluru – 560001, Karnataka	31.03.2026
	Agricultural Sciences	
33.	Heartfulness Institute, D.No.13-110,Kanha Shanti Vanam,Kanha Village, Nandigama Mandal, Ranga Reddy – 509325, Telangana State	31.03.2026
	Social Sciences	
34.	Administrative Staff College of India, Bella Vista, Raj Bhavan Road, Khairatabad, Hyderabad – 500082, Telangana	31.03.2025
35.	Nehru Memorial Museum and Library, Teen Murti House, New Delhi–110011	31.03.2025
36.	Indian Social Institute, Plot No. 10-11-12, Institutional Area, Lodhi Road, South Delhi, New Delhi – 110003	31.03.2026
37.	Project Concern International, F-87, Ohkla Industrial Estate, Phase 3, District: South East Delhi, Delhi – 110020	31.03.2026
38.	Population Council Institute, B 21 Lower Ground Floor, Jangpura Extension, District New Delhi, Delhi – 110014	31.03.2026
	Medical Sciences	
39.	PMS College of Dental Science and Research of NRI Service and Educational Trust, Thiruvananthapuram – 695028, Kerala	31.03.2025
40.	Sapthagiri Educational Trust, Sai Bhavan, 31B Madley Road, T.Nagar, Chennai – 600017, Tamil Nadu	31.03.2025
41.	Shri Ram MurtiSmarak Trust, N-3 Rampur Garden, Bareilly – 243001, UP	31.03.2025
42.	Bangalore Speech & Hearing Trust, Dr. S.R. Chandrasekhar Institute of Speech and Hearing, Hennur Road Kariyanapalya Lingarajapuram, Bengaluru Rural, Bengaluru – 560084, Karnataka	31.03.2025
43.	Angammal Educational Trust, Vivekanandha Educational Institutions for Women, Elayampalayam, Tiruchengodu, Namakkal – 637205, Tamil Nadu	31.03.2025
44.	Shree BankeyBihari Educational Society, 0.5 Km ahead of Masuri Canal, Masuri, Ghaziabad – 201302, Uttar Pradesh	31.03.2025
45.	Community Empowerment Lab, F-09, 9th Floor, F-Block, Tower-B Shalimar Grand, 10, Jopling Road, Lucknow – 226001, Uttar Pradesh	31.03.2025

S.No.	Name of the Organization	Recognition granted upto
46.	Foundation for Diffusion of Innovations, Umesh Sadan, 16 Panchvati Society, Maninagar, Ahmedabad – 380 008, Gujarat	31.03.2025
47.	Swami Vivekananda Youth Movement, No. CA2, KIADB Industrial Housing Area, Ring Road, Hebbal, Mysuru – 570016, Karnataka	31.03.2025
48.	G H Raisoni University, Anjangaon Bari Road Amravati, Amravati – 444701, Maharashtra	31.03.2025
49.	Foundation for Advancement of Essential Diagnostics (FAED), House Number 11, Latakata Road, Maidamgaon, Bakrapara, Bsistha, Kamrup Metro – 781029, Assam	31.03.2025
50.	Bai Jerbai Wadia Hospital for Children and Institute of Child Health Research Society, BaiJerbai Wadia Hospital for Children, Acharya Donde Marg, Parel, Mumbai – 400012, Maharashtra	31.03.2026
51.	Bhaktivedanta Hospital and Research Institute of Shri Chaitanya Health and Care Trust, Bhaktivedanta Swami Marg, Srishti Complex, Mira Road, Thane – 401107, Maharashtra	31.03.2026
52.	NIMS University Rajasthan, Jaipur-Delhi Highway, Jaipur – 303121, Rajasthan	31.03.2026
53.	Dr. Panjabrao Deshmukh Memorial Medical College, Shivaji Nagar, Amravati – 444603, Maharashtra	31.03.2026
54.	Sri VenkataSai Educational Society, H.No. 16-20-740-51, Kalayan Nagar Colony, Gaddiannaram Dilsukh Nagar, Hyderabad – 500060, Telangana	31.03.2026
55.	Fernandez Foundation, Dr. L.J.F. Block, 4-l-122911, Bogulkunta, Hyderabad – 500 001, Telangana	31.03.2026
56.	Apollo Hospitals Educational & Research Foundation (AHERF), 8-2-293 82 III 900A, Jubilee Hills, Hyderabad – 500034, Telangana	31.03.2026
57.	ESIC Medical College and Hospital, NH-3, NIT, Faridabad – 121001, Haryana	31.03.2026
58.	Ahalia School of Optometry & Research Center, Ahalia Campus, Kozhippara Post, Palakkad – 678557, Kerala	31.03.2026
59.	Nitte Meenakshi Institute of Technology, Post Box No. 6429, Govindapura, Gollahalli, Yelahanka, Bangalore – 560064, Karnataka	31.03.2026
60.	North Eastern Indira Gandhi Regional Institute of Health & Medical Sciences, Registrar of Societies, Meghalaya, NEIGRIHMS, Mawdiangdiang, Shillong, District: East Khasi Hills, Meghalaya – 793018	31.03.2026
61.	Kalpana Chawla Government Medical College, Model Town, Karnal – 132001, Haryana	31.03.2026
62.	KLE Academy of Higher Education and Research, JNMC Campus, Nehru Nagar, Belagavi – 590010, Karnataka	31.03.2026
63.	Cankids…Kidscan, D7-7, Vasant Vihar, New Delhi – 110057	31.03.2026
64.	Sibar Educational Academy, Sibar Institute of Dental Sciences, Takkellapadu Village, Pedakakani Mandal, Guntur – 522009, Andhra Pradesh	31.03.2026
65.	Mahatma Gandhi Mission Dental College & Hospital, Plot No. 1- 2, Sector-01, Kamothe, Navi Mumbai – 410209, District Raigad, Maharashtra	31.03.2026
66.	Dharmsinh Desai University, College Road, Nadiad – 387001, District Kheda, Gujarat	31.03.2026
67.	Bareilly International University, Rohilkhand Medical College Campus, Pilibhit Bypass Road, Bareilly – 243006, Uttar Pradesh	31.03.2026
68.	Sangat Sahib Bhai Pheru Sikh Educational Society, Opposite Kotwali, Faridkot – 151203, Punjab	31.03.2025
69.	Institute of Reproductive Medicine, HB-36-A-3, Salt Lake, Sector-III, Kolkata – 700106, West Bengal	31.03.2025
70.	Sri Shridevi Charitable Trust, Shivadeepthi, III Cross, SS Puram,Tumakuru – 572102, Karnataka	31.03.2025
71.	Government Dental College & Hospital, Government Medical College, Campus, Hanuman Nagar, Medical Square, Nagpur – 440003, Maharashtra	31.03.2026
72.	Shri Guru Ram Rai University, Patel Nagar, Dehradun – 248001, Uttarakhand	31.03.2026
73.	BLDE Deemed to be University, Smt Bangaramma Sajjan Campus, B M Patil Road Solapur Road, Vijayapura – 586103, Karnataka	31.03.2026

ANNEXURE- 7

DETAILS OF PROJECTS SUPPORTED UNDER PROMOTING INNOVATIONS IN INDIVIDUALS, START-UPs AND MSMEs (PRISM)

(During the Period from 01.01.2023 - 31.03.2024)

New Projects

1. Development of Automatic Portable Ventilator
2. Development of Smart Water Logging Detection Device.
3. Nutrient Pellet Formulation.
4. An Integrated and Portable Health Check-Up Device.
5. UAV Assisted Intelligent Precision Agriculture Ecosystem.
6. Design and development of low-cost electro polishing unit for preparation of SEM and TEM Samples for microstructural characterization.
7. Cost-effective device to predict and measure the earthquakes.
8. Development of IoT Based Structural Health Monitoring Unit.
9. Dynamic Response Control of Building using Tuned Mass Damper.
10. Any Time Medicine Dispensing Machine.
11. Ambu Bag Pressing Machine.
12. Onsite delamination machine for solar panels xone: a brain computer interface based on neurobionics and assistive technologies.
13. Solar Companion Proposal
14. Pre -brewed Instant Tea decoction.
15. Development of graphene- PVA membrane for water treatment process.
16. Development of Point of Care Biosensor for Chronic Kidney Disease Diagnosis
17. A Novel wound healing Gel from Human amnion chorion powder and psyllium seed polysaccharide with Gentamycin for skin burns
18. Automated Personalized Public Transport Technology
19. To Demonstrate & establish Physical Stability of Orthopedic Implant Coating
20. LoRa Vision and Node assisted IoT Network for Real-Time Monitoring and Controlling of Fishpond
21. Development of an efficient solar distillation apparatus

22. Development of PRISM (Photonic Reflector Integrated Solar Maximiser- ANANT VIRIYA
23. Multi-Tasking Precision Paddy Platform
24. On-site Delamination of Solar Panels
25. Rotatable condenser unit for split Air conditioners for improved efficiency
26. Development of BTMS of battery thermal management system to enhance lithium ion battery safety
27. Point-of-care test for blood placental growth factor to improve early detection of Preeclampsia in low resource settings
28. Solar Companion

Ongoing projects

1. Automatic Power Generating arrangement employing synchronous dynamo electric machine using freely hanging load and having improved feedback and Torque transmission mechanism.
2. Copper Coated Multifunctional Cotton Fabrics
3. Non destructive coconut maturity classifier using ai for coconut processing industries and coconut tree climbing robots
4. Redesigning, testing and implementation of blowpipe (baklas) to protect the goldsmiths from exposure to smoke/fume during melting of gold beads/jewellery
5. Development of SRM for EV Applications
6. Automatic mechatronic device for blood component extractor.
7. Energy efficient air conditioner using a customized ejector
8. Development of Indigenous ceramic dics for sputter sources and electronics applications.
9. Development of Plastic Dust Extractor machine
10. Comprehensive and Application-based Solution for Addressing Malnutrition (CASAM) by community health workers
11. A pain-free affordable and self-use glucometer for accurate measurement of glucose from saliva used for testing blood glucose levels
12. Development of polymeric microneedle device for the targeted delivery of therapeutics to the posterior segment of eye
13. Development of a High Data rate Visible Light Communication System for Green Wireless Technology and Healthcare”
14. Farm waste to Green Charcoal for power generation”

15. Design and development of novel and innovative Hybrid Ball Burnishing Assisted 3-axis Wire Arc Additive Machine for Industrial application

16. Development of Multifunctional Metal Bending, Twisting, Scroll Making, Auger Forming Machine and their variants

17. Development of Fire Fighter Drone

18. A Novel Acupuncture treatment planning and navigation support device for accurate positioning and needling for acupuncture practitioners

19. Iron Flow Battery An electrical energy storage system for renewable energy sources

20. Development of Multiuse Smart Eye-care Diagnostic Solution

21. Development of Combo Comb Hair Dy Dispenser

22. Development of Smart Bin

23. Design and Development of low-cost solar dryer for bat manufacturers in Kashmir

24. Smartvest- Worlds first wearable assistive device with real time speech guided navigation for the Blind & Visually Impaired people

25. Development of a high data rate visible light communication system of green wireless technology and healthcare

26. Development of Advanced Voting Machine (AVM)

27. Design and fabrication of an indigenous multicolor tunable photo reactor with inbuilt stirrer

28. A User friendly & Affordable Head movement based Mouse for Computer

29. Real time Adaptive sterilization of indoor spaces for protection against SARS

30. A novel diffusion coating process to enhance wear resistance of tooling and machine parts

ANNEXURE- 8

DETAILS OF COMPLETED PROJECTS SUPPORTED UNDER PROMOTING INNOVATIONS IN INDIVIDUALS, START-UPs AND MSMEs (PRISM)

(During the Period from 01.01.2023 - 31.03.2024)

Completed Projects

1. AMBU (Aqua Management Binary Unit)
2. Infusion Flow Monitoring Device
3. Casil-O-Scope- The affordable & portable eye examining device
4. Building Zinc Gel Battery for e-Rickshaw (electric three wheelers)
5. Power Appliance for Toilet cleaning
6. Use of waste biomass for the development of edible coating
7. Braille Slate for Maths Learning
8. Compact societal composter
9. Development of Ergonomically designed working model of Fruit Plucking Device
10. Fatigue analysis and injury Prevention in sports training using wearable device
11. Battery Enclosure development for power enhancement in electric vehicle
12. Design and Development of Reducing Atmosphere (Redox) Fabric Indigo Dyeing Machine
13. Development of harvesting machine for henna
14. Development of materials with antimicrobial efficacy for biomedical applications
15. Iron and Vitamin C Chocolate
16. A Fuzzy Based Solar Egg-Incubator: A Low Cost New Technology
17. Development of Half- face piece Air Purifier & Air Mask
18. Designing of Self retaining Vascular Forceps.
19. An Automated Panipuri Vending Machine
20. A low cost Cervical spine off loader & postural corrector column-an innovative prothesis for leg spondylitis.
21. Development of osteoporosis estimation device application
22. Development of Vertical Quadripilator Lathe
23. Affordable Prosthetic Hand for Trans radial Amputees with Adaptive Grasp and Pinch Capabilities
24. Development of Enhanced Potato yield using Tuberonic Acid based novel approach
25. Design of a Compact Multiband Patch Antenna for Wireless Application

ANNEXURE-9

Details of the new projects initiated under (TDUPW) programme during the year 2023-2024

S.No	Title of Project	Name of Organization
1	Socio-Economic empowerment of women Micro Entrepreneurs with a special focus on Mushroom Cultivation; A sustainable Livelihood option	Rajagiri College of Social Sciences (Autonomous), Rajagiri P.O, Kalamassery, Cochin
2	Livelihood improvement of women through skill development in ornamental fish farming with special emphasis on production of attractive and high quality ornamental fishes	Dr. Jayalalithaa Fisheries University, Nagapattinam, Tamil Nadu
3	Entrepreneurship development for farm and rural women through sericulture value addition technologies	Forest College and Research Institute, Tamil Nadu Agricultural University, Mettupalayam
4	Skill Satellite Centre under Technology Development and utilization programme for women TDUPW/ A2K+.	PSGR Krishnammal College for Women, Peelamedu, Coimbatore
5.	Technology intervention for product diversification in handloom weaving to promote capacity building for livelihood security of women artisans.	Dept. of Textiles and Apparel Designing College, Faculty of Community Science, Assam Agricultural University (AAU), Jorhat, Assam, Pin- 785013

ANNEXURE 10

LIST OF APCTT's PARTNER INSTITUTIONS

1. Agency for Innovative Development, Ministry of Higher Education, Science and Innovations, Republic of Uzbekistan
2. Asia-Pacific Regional Innovation Knowledge Network for 4th Industrial Revolution Technologies, Guangzhou University, People's Republic of China
3. Asian Infrastructure Investment Bank, Beijing, China
4. Asian Institute of Technology, Thailand
5. Asian and Pacific Training Centre for Information and Communication Technology for Development, ESCAP
6. Atmospheric, Geophysical and Astronomical Services Administration, Department of Science and Technology, Philippines
7. Bangkok Metropolitan Administration
8. Centre for Atmospheric Sciences, Indian Institute of Technology Delhi, India
9. China Agricultural University
10. China-South Asia Technology Transfer Center, People's Republic of China
11. Climate Technology Centre & Network
12. Council of Regional Organizations of the Pacific
13. Department of Environment, Ministry of Environment Forest and Climate Change, Bangladesh
14. Department of International Cooperation, Ministry of Science and Technology, People's Republic of China
15. Department of Scientific and Industrial Research, Ministry of Science and Technology, Government of India
16. Dhaka North City Corporation, Bangladesh
17. Dhaka South City Corporation, Bangladesh
18. East China Normal University, China
19. Economic Research Institute for ASEAN and East Asia, Jakarta, Indonesia
20. ESCAP Subregional Office for East and North-East Asia
21. ESCAP Subregional Office for the Pacific
22. Faculty of Engineering, Naresuan University, Thailand
23. Gansu Natural Energy Research Institute, China

24. GeoInformatics and Space Technology Development Agency, Thailand
25. German Agency for International Cooperation
26. Government of the Cook Islands
27. Gurugram Metropolitan Development Authority, India
28. Hangzhou Fast and Network Technology Co., Ltd., China
29. India-China Technology Transfer Center, India
30. Indian Institute of Technology Mumbai, India
31. Industrial Technology Institute, Sri Lanka
32. Institute of Atmospheric Physics, Chinese Academy of Sciences, China
33. Institute of Karst Geology, Ministry of Natural Resources, China
34. Institute of Tibetan Plateau Research, Chinese Academy of Sciences
35. Local Government Division of Ministry of Local Government, Rural Development and Cooperatives, Government of Bangladesh
36. Ministry of Education, Science and Technology, Nepal
37. Ministry of Finance, Government of Tuvalu
38. Ministry for Foreign Affairs and Trade, Samoa
39. Ministry of Higher Education, Science, Research and Innovation, Thailand
40. Ministry of Natural Resources, China
41. Ministry of Natural Resources and Environment, Viet Nam
42. Ministry of Science and Technology, Government of Bangladesh
43. Ministry of Science and Technology, Government of Pakistan
44. Ministry of Science and Technology, Government of Viet Nam
45. Ministry of Technology, Sri Lanka
46. National Institute of Disaster Management, Ministry of Home Affairs, Government of India
47. National Institutes of Natural Sciences, Japan
48. National Metal and Materials Technology Center, National Science and Technology Development Agency, Thailand
49. National Science and Technology Development Agency, Thailand
50. Nepal Academy of Science and Technology, Nepal
51. Northwest Clean Air Agency, the United States
52. Pacific Islands Forum

53. Pacific Oceanological Institute, Far Eastern Branch Russian Academy of Sciences, Russian Federation
54. Pakistan Council of Scientific and Industrial Research, Pakistan
55. Philippine Council for Industry, Energy and Emerging Technology Research and Development, Department of Science and Technology, Philippines
56. Pollution Control Department, Thailand
57. Research Center for Carbon Neutrality in Agriculture and Rural Areas, College of Technology of the College of Engineering, China Agricultural University, China
58. Research Center for Environmental and Clean Technology, National Research and Innovation Agency, Indonesia
59. Secretariat of the Pacific Regional Environment Programme
60. Singapore National University
61. Sustainable Urban Development Section, ESCAP
62. Tencent Technology (Shenzhen) Co., Ltd, China
63. Thailand Institute of Scientific and Technological Research
64. Trade Investment and Innovation Division, ESCAP
65. United Nations' Ten-Member Group supporting Technology Facilitation Mechanism for SDGs
66. United Nations Satellite Centre
67. University of Science and Technology, Republic of Korea
68. Vietnam Clean Air Partnership
69. WAYTOUS, China
70. World Agroforestry Centre, Kenya
71. Yunnan Province Science and Technology Department, China

ANNEXURE 11

List of Publications of the APCTT

Publication title	Focus area	Periodicity	Target audience
Asia-Pacific Tech Monitor	Affordable and sustainable clean energy technologies (Oct-Dec 2022)	Quarterly	Science technology and innovation policymakers, small and medium enterprises, research and development institutions, academia, technology transfer intermediaries
	Technologies for decarbonizing transport systems(Jan-Mar 2023) in support to the theme of the 79th ESCAP Commission Session held in May 2023	Quarterly	
	Innovative technologies for disaster risk reduction – successful cases and good practices from Asia and the Pacific (Apr- Jun 2023)	Quarterly	
	Partnerships and regional collaborations: integrating climate finance with the technology mechanism for climate change (Jul-Sep 2023)	Quarterly	
	Innovative technologies for air pollution control (Oct-Dec 2023)	Quarterly	
	Digital Innovation for Sustainable Development in Asia and the Pacific (January- March 2024) – In press	Quarterly	To be published shortly
Compendium of good cases of innovative technologies for air pollutions control in cities	Air pollution control	One-time report	Policymakers, pollution control authorities / departments, city municipal authorities and the private sector
City-level assessment reports for Dhaka, Bangladesh	Air pollution control	One-time publication	Policymakers, pollution control authorities/ departments, city municipal authorities and the private sector
City-level assessment reports for Gurugram, India	Air pollution control	One-time reports	Policymakers, pollution control authorities/ departments, city municipal authorities and the private sector
City-level assessment reports for Bangkok, Thailand	Air pollution control		Policymakers, pollution control authorities/departments, city municipal authorities and the private sector
Comparative study report between the selected cities	Air pollution control		Policymakers, pollution control authorities/departments, city municipal authorities and the private sector

ANNEXURE 12

EXTRACTS OF AUDIT OBSERVATIONS BY CAG

Audit paras pertaining to DSIR that appeared in the CAG report

Audit Observations on DSIR : Nil

Audit Observations on Autonomous Bodies under DSIR – Council of Scientific and Industrial Research (CSIR) are as under:

S.No.	Report No.	Para No.	Subject	Action/Audit Comments
1.	2 of 2021	11.1	Functionality of IT Application System 'One CSIR'	The Draft ATN uploaded by the Ministry has been checked and found that Compliance Document 1.0,Compliance Document 2.0,Compliance Document no.2,ERP performance Analysis, ERP performance test Report, ERP Implementation OM,CSIR OM no. ERP/1/2020 dated 28.05.20 and Validation sample report and status as on October 28, 2020 have not attached by Ministry as mentioned in ATN. Hence, it returned and requested to attach above mentioned documents to issue vetting comment.
2.	21 of 2022	4.1	Irregular grant of incentives and allowances	The 1st vetting comment has been issued vide letter no. DGA(SD)/ Rep 1(18)/DSIR/BNG/2018-19/276-277 dated 17.11.23
3.	26 of 2022	2.1(i)	Deficiencies in Internal Controls in Central Autonomous Bodies	The Revised vetting comment has been issued vide letter no. DGA(ESD)/Rep21(62)/APMS/2019-20/Vol-II/386 dated 05.03.24
4.	26 of 2022	2.1(ii)	Deficiencies in Internal Controls in Central Autonomous Bodies	The 1st vetting comment has been issued vide letter no. DGA(ESD)/Rep21(62)/APMS/2019-20/Vol-II/253 dated 16.10.23
5.	26 of 2022	2.1(iii)	Deficiencies in Internal Controls in Central Autonomous Bodies	The 1st vetting comment has been issued vide letter no. DGA(ESD)/Rep21(62)/APMS/2019-20/Vol-II/254 dated 16.10.23.
6.	26 of 2022	2.3.2 (sl. no.24)	(i) Current Liabilities: ₹ 70.35 crore (ii) Liabilities against Government grants (Schedule 5): ₹ 99.84 crore	The 1st vetting comment has been issued vide letter no. DGA(ESD)/ Rep 21(62)/APMS/2019-20/Vol-II/224-225 dated 13.09.23
7.	24 of 2023	4.1	Deficient contract management leading to avoidable expenditure of ₹ 94.09 lakh	The para received recently and CSIR has been requested to furnish comments.

Pendency position of ATNs in respect of Audit Observations

S.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
1.	2021	0	1*	0	0
2.	2022	0	0	5	0
3.	2023	0	1*	0	0

* Under Examination at CSIR Hqrs level.

CSIR Establishments

BIOLOGICAL SCIENCES

CSIR-CCMB	Centre for Cellular and Molecular Biology, Hyderabad
CSIR-CDRI	Central Drug Research Institute, Lucknow
CSIR-CFTRI	Central Food Technological Research Institute, Mysore
CSIR-CIMAP	Central Institute of Medicinal & Aromatic Plants, Lucknow
CSIR-IGIB	Institute of Genomics & Integrative Biology, Delhi
CSIR-IHBT	Institute of Himalayan Bio resource Technology, Palampur
CSIR-IICB	Indian Institute of Chemical Biology, Kolkata
CSIR-IIIM	Indian Institute of Integrative Medicine, Jammu
CSIR-IMTECH	Institute of Microbial Technology, Chandigarh
CSIR-IITR	Indian Institute of Toxicology Research, Lucknow
CSIR-NBRI	National Botanical Research Institute, Lucknow

CHEMICAL SCIENCES

CSIR-CLRI	Central Leather Research Institute, Chennai
CSIR-CECRI	Central Electrochemical Research Institute, Karaikudi
CSIR-CSMCRI	Central Salt & Marine Chemicals Research Institute, Bhavnagar
CSIR-CIMFR	Central Institute of Mining & Fuel Research, Dhanbad
CSIR-IICT	Indian Institute of Chemical Technology, Hyderabad
CSIR-IIP	Indian Institute of Petroleum, Dehradun
CSIR-NCL	National Chemical Laboratory, Pune
CSIR-NEIST	North-East Institute of Science and Technology, Jorhat
CSIR-NIIST	National Institute for Interdisciplinary Science and Technology, Thiruvananthapuram

ENGINEERING SCIENCES

CSIR-AMPRI	Advanced Materials and Processes Research Institute, Bhopal
CSIR-CBRI	Central Building Research Institute, Roorkee
CSIR-CGCRI	Central Glass and Ceramic Research Institute, Kolkata
CSIR-CMERI	Central Mechanical Engineering Research Institute, Durgapur
CSIR-CRRI	Central Road Research Institute, New Delhi
CSIR-IMMT	Institute of Minerals and Materials Technology, Bhubaneswar
CSIR-NAL	National Aerospace Laboratories, Bengaluru

CSIR-NEERI	National Environmental Engineering Research Institute, Nagpur
CSIR-NML	National Metallurgical Laboratory, Jamshedpur
CSIR-SERC	Structural Engineering Research Centre, Chennai

INFORMATION SCIENCES

CSIR-NIScPR	National Institute of Science Communication and Policy Research, New Delhi (Merger of CSIR-NISCAIR & CSIR-NISTADS)
CSIR-4-PI	Fourth Paradigm Institute, Bengaluru

PHYSICAL SCIENCES

CSIR-CEERI	Central Electronics Engineering Research Institute, Pilani
CSIR-CSIO	Central Scientific Instruments Organisation, Chandigarh
CSIR-NGRI	National Geophysical Research Institute, Hyderabad
CSIR-NIO	National Institute of Oceanography, Goa
CSIR-NPL	National Physical Laboratory, New Delhi

UNITS

CSIR-HRDC	Human Resource Development Centre, Ghaziabad
CSIR-TKDL	Traditional Knowledge Digital Library, Ghaziabad
CSIR-URDIP	Unit for Research and Development of Information Products, Pune
CSIR-OSDD	Open Source Drug Delivery, New Delhi
CSIR-TRISUTRA	Translational Research and Innovative Science through Ayurgenomics, New Delhi

ABBREVIATIONS / ACRONYMS

AMPRI	Advanced Material and Processes Research Institute
APCTT	Asian and Pacific Centre for Transfer of Technology
CBDT	Central Board of Direct Taxes
CBRI	Central Building Research Institute
CCMB	Centre for Cellular and Molecular Biology
CDRI	Central Drug Research Institute
CDS/ISIS	Computerized Data Services/Integrated Set of Information Systems
CECRI	Central Electrochemical Research Institute
CEERI	Central Electronics Engineering Research Institute
CFTRI	Central Food Technological Research Institute
CGCRI	Central Glass and Ceramic Research Institute
CII	Confederation of Indian Industry
CIMAP	Central Institute of Medicinal & Aromatic Plants
CIMFR	Central Institute of Mining and Fuel Research
CITT	Centre for International Trade in Technology
CLRI	Central Leather Research Institute
CMERI	Central Mechanical Engineering Research Institute
CRRI	Central Road Research Institute
CSIO	Central Scientific Instruments Organisation
CSIR	Council of Scientific & Industrial Research
CSMCRI	Central Salt & Marine Chemicals Research Institute
DBT	Department of Bio-Technology
DCPC	Department of Chemicals & Petrochemicals
DCSSI	Development Commissioner, Small Scale Industries
DRDO	Defence Research and Development Organization
DSIR	Department of Scientific & Industrial Research
ESCAP	Economic and Social Commission for Asia and the Pacific
EXIM	Export-Import
FC	Foreign Collaborations
FICCI	Federation of Indian Chambers of Commerce and Industry
ICAR	Indian Council of Agricultural Research
ICAS	Indian Council of Ayurveda & Siddha
ICMR	Indian Council of Medical Research

ICSSR	Indian Council of Social Sciences Research
ICSTI	International Centre for Science & Technology Information
IDAMS	Internationally Developed Data Management System
IGIB	Institute of Genomics & Integrative Biology
IHBT	Institute of Himalayan Bioresource Technology
IICB	Indian Institute of Chemical Biology
IICT	Indian Institute of Chemical Technology
IIFT	Indian Institute of Foreign Trade
IIIM	Indian Institute of Integrative Medicine
IIP	Indian Institute of Petroleum
IISc	Indian Institute of Science
IIT	Indian Institute of Technology
IITR	Indian Institute of Toxicology Research
IMMT	Institute of Minerals and Materials Technology
IMT	Institute of Microbial Technology
INFLIBNET	Information Library Network
INSA	Indian National Science Academy
IPR	Intellectual Property Rights
ISRO	Indian Space Research Organization
ITPO	India Trade Promotion Organization
LAN	Local Area Network
LCA	Light Combat Aircraft
MDR	Multi Drug Resistance
MIT	Ministry of Information Technology
MoU	Memorandum of Understanding
NACIDS	National Access Centres to International Database Services
NAFEN	National Foundation of Indian Engineers
NAL	National Aerospace Laboratories
NBRI	National Botanical Research Institute
NCAER	National Council of Applied Economic Research
NCL	National Chemical Laboratory
NCSI	National Centre for Science Information
NEERI	National Environmental Engineering Research Institute
NEIST	North-East Institute of Science & Technology
NGRI	National Geophysical Research Institute

NICMAR	National Institute of Construction Management and Research
NID	National Institute of Design
NIDC	National Industrial Development Corporation
NIFT	National Institute of Fashion Technology
NIIST	National Institute for Inter-disciplinary Science and Technology
NIO	National Institute of Oceanography
NISCAIR	National Institute of Science Communication and Information Resources
NISTADS	National Institute of Science Technology and Development Studies
NML	National Metallurgical Laboratory
NPL	National Physical Laboratory
NRDC	National Research Development Corporation
NRFC	National Register of Foreign Collaborations
NSTMIS	National Science and Technology Management Information System
PSE	Public Sector Enterprise
SERC	Structural Engineering Research Centre
SIRO	Scientific and Industrial Research Organization
SME	Small and Medium Enterprise.
TCO	Technical Consultancy Organization
TDB	Technology Development Board
TEDO	Technology Export Development Organization
TM	Technology Management
TQM	Total Quality Management
UGC	University Grants Commission
UNCTAD	United Nations Conference on Trade and Development
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNIDO	United Nations Industrial Development Organization
WIPO	World Intellectual Property Organization

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