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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:

- All matters concerning the Council of Scientific and Industrial Research (CSIR).
- All matters relating to National Research Development Corporation (NRDC).
- All matters relating to Central Electronics Limited (CEL).
- Registration and Recognition of R&D Units.
- Technical matters relating to UNCTAD and WIPO.
- National register for foreign collaborations.
- Matters relating to creation of a pool for temporary placement of Indian Scientists and Technologists.

DSIR undertakes programmes to promote R&D by the industries and to support the industrial units develop state-of-the-art globally competitive technologies of high commercial value, catalysing faster commercialization of laboratory-scale R&D, augment technology transfer capabilities, enhance the share of technology intensive exports in overall exports, strengthen industrial consultancy and establish a user-friendly information network to facilitate scientific and industrial research in the country. The DSIR has two public sector enterprises, the National Research Development Corporation

(NRDC) and Central Electronics Ltd (CEL) and two autonomous organizations, Council for Scientific and Industrial Research (CSIR) and Consultancy Development Centre (CDC). The Department also provides host facilities and assistance to a regional institution of the United Nations Economic and Social Commission for Asia and Pacific (UN-ESCAP) viz. Asian and Pacific Centre for Transfer of Technology (APCTT) as the focal point in the country.

2.0 DSIR PROGRAMMES

The Department of Scientific & Industrial Research (DSIR) operates an umbrella scheme on “Industrial Research & Development (IRD), consisting of following four sub-schemes :

- i. Promoting Innovations in Individuals, Start-ups and MSMEs (PRISM) – This scheme primarily focuses on supporting individual innovators, start-up companies, incubatee companies in public funded technology business incubators and MSMEs.
- ii. Patent Acquisition and Collaborative Research & Technology Development (PACE) – This is a scheme focusing on technology acquisition and its development and demonstration for commercialization.
- iii. Building Industrial Research & Development and Common Research Facility (BIRD-crf) – This is a scheme which focuses on creation of Common Research facilities for micro and small enterprises and components of scheme, viz Industrial R&D Promotion Programme. The other components of BIRD-crf sub-scheme that operated during the 12th Plan like “Industrial Research & Development Promotion Program”, “Information Technology and e-Governance”



and "Asian and Pacific Centre for Transfer of Technology (APCTT)" have been de-linked and operate outside this sub-scheme.

- iv. Access to Knowledge for Technology Development and Dissemination (A2K+) – This sub-scheme includes components of Technology Development and Utilization Programme for Women (TDUPW), Support to Studies, Support to Events and Technology Development and Demonstration Programme (TDDP).

2.1 Major Achievements

The major achievements of the various programmes of the Department during the period under report are as under.

2.1.1 Industrial R&D Promotion Programme

DSIR is the nodal Department for granting recognition/registration to the In-house R&D centres established by industry in the country. During the period under report, there were altogether 2052 In-house R&D centres with DSIR recognition. Of these industries, 120 R&D units/companies incurred an annual R&D expenditure of over ₹ 5000.00 lakhs each, 508 companies incurred an annual R&D expenditure in the range of ₹ 500.00 lakhs to ₹ 5000.00 lakhs and 448 companies incurred an annual R&D expenditure in the range of ₹ 200.00 lakhs to ₹ 500.00 lakhs. During the period under report, 234 In-house R&D centres were accorded fresh recognition and DSIR renewal of recognition was accorded to 601 R&D centres.

DSIR actively undertakes the e-Governance initiative through which it invites online applications for Industrial R&D Promotion Programme for greater accessibility and transparency of the Department programmes / schemes. Department uploads the barcode generated certificates for recognition, registration and its renewal of In-house R&D units of industries, Scientific & Industrial Research Organizations and Public Funded Research Institutions. Department is making efforts to make the programme paperless in future.

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. During the period under report 52 SIROs have been accorded fresh recognition. These include cases in the Natural and Applied Sciences, Medical Sciences and Social Sciences.

Secretary, DSIR, Ministry of Science and Technology, is the Prescribed Authority to certify expenditures where higher rate of depreciation is to be allowed 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. During the period under report, one certificate involving ₹ 15.40 crores during 2017-18 on cost of plant and machinery were issued by DSIR.

DSIR is the nodal Department for registration of public funded research institutions (PFRI), Universities, IITs, IISc and NITs, for availing concessional custom duty exemption, vide Notification No. 43/2017-Customs dt. 30.06.2017 and corrigendum dated 22.07.2017-Custom Notification no. 43/2017 dt 30.06.2017 amending the main Notification No. 51/96-Customs dt. 23.07.1996 and amendments thereof. During the period under report, 12 institutions were newly registered with DSIR and 84 institutions were granted renewal of registration.

Secretary, DSIR is designated as the Prescribed Authority under section 35(2AB) of Income-Tax Act, 1961. Fresh approvals were accorded to 112 companies by the prescribed authority. Agreements of co-operation for R&D were also signed with these companies. The detailed R&D expenditure of the approved companies have also been examined by DSIR and 766 reports valued at ₹ 18905.23 crores have been forwarded to Chief Commissioner of Income Tax (Exemption) CCIT (E) in Form 3CL, as required under the IT Act.

2.1.2 Common Research and Technology Development Hubs (CRTDHs)

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 and operate on a cost plus non-commercial basis.

During 2018-19, the Department added to the seven hubs established earlier and approved setting up of five new hubs at CSIR-Central Drug Research Institute (CDRI), Lucknow; Indian Institute of Technology Kharagpur; CSIR-Central Scientific Instruments Organisation (CSIO), Chennai; CSIR-Indian Institute of Toxicology Research (IITR), Lucknow and CSIR-Institute of Minerals and Materials Technology (IMMT), Bhubaneswar; the first two are in the sectors of Affordable Healthcare, and the other three in the sectors of Electronics/Renewable Energy, Environmental Interventions, New Materials/Chemical Process respectively. These hubs are currently engaged in activities like procurement of equipment, and setting up of infrastructure and essential facilities for R&D.

2.1.3 Information Technology and e-Governance (ITeG)

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 during FY 2018-2019 for the implementation of IT Action Plan.

The DSIR Website (Bilingual) has been made compliant to the Guidelines for Indian Government of Websites (GIGW). The website has been regularly updated and has been visited more than 1,20,000 times from 6th August, 2018.

A project entitled 'Design, Development, Implementation of Enterprise Application and Maintenance Support Services for DSIR' has been developed and implemented to automate all the operations of DSIR and link it to providing online services to the Industries and relevant stakeholders. The project has two RFPs, ie. RFP1 includes Enterprise Integration, Program Implementation and eService Delivery and RFP2

includes Office Automation Solution, Workflow Management, Record Management, and Data Warehousing. Incidental benefits include reduction of costs / efforts in seeking and obtaining information and services and minimization of administrative overheads. Training has been imparted to DSIR officers and staff to use ERP System from time to time and continuous engagement with all stakeholders.

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

PRISM (Promoting Innovations in Individuals, Start-ups and MSMEs) scheme aims at to support individual innovators which will enable to achieve the agenda of inclusive development – one of the thrust area of XIIth five year plan (2012-2017). 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 tenure was till 31.03.2017. However, the scheme has now been extended till 31.03.2020 (31st March, 2020) i.e. co-terminus with the fourteenth finance commission period 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 ₹ 2.00 lakh to ₹ 50.00 lakh. The department has also successfully completed 22(twenty-two) on-going PRISM projects supported during the period under report. Some of the successfully completed projects are Multiple Output Converter (MOC) for Utility Power Applications, Design and development of affordable personal Oral Irrigator (3-in-1 Dental Jet) for prevention, control and treatment of dental cavities & gum diseases for rural and urban population, Light weight portable folding stool, Banned Ivory – its "replacement", Non-electric manually operated washing machine (NEMOW),



Design and development of a Tractor Operated Vegetable Transplanter for plug-type seedling, Wave energy converter, Development of a new generation of nematicides, Cocktails to effectively target the plant parasitic pathogen, the root knot nematode *Meloidogyne incognita*, Innovative energy saving furnace with recuperator, Conversion of vegetable/fruit market/kitchen/eating house waste into organic manure and bio-gas, Heat pipe based window mounted solar water heater for domestic apartments, Retrofitted kit for disabled persons, Development of Keratinase treated feather waste based Organic Manure, Low power portable MUGA and ERI spinning machine, Development of seed cum manure dill for row crop cultivation, Prototype development of Analog and Digital RC servo motors for Autonomous Systems, Real time 3D scanner based Psycho-physical rehabilitation, Automatic window washer & dryer machine for high rise building, Artificial human-skin as an alternative to animal model for drug and cosmetic testing and so on.

The financial assistance were extended to around forty-three (43) new innovation-centric project proposals of individual innovators during the period ending 31st March, 2019. The list of projects supported during the period under report are at **Annexure-9**.

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

The 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. The scheme also jointly supports initiatives of other Ministries/Departments aimed at technology development and demonstration, e.g. IMPRINT initiative of Ministry of Human Resource Development and DST, wherein

institutions of higher learning are being supported for development and demonstration of technologies.

Following activities were completed or were in progress during the year under report:

- 3 new technology development projects of industries were recommended during the year. These projects involve a total project cost of ₹ 1742.50 Lakhs and DSIR recommended support is ₹ 590.00 Lakh. This support is in the form of loan to industry.
- 8 technology development projects were monitored during the year.
- Out of these eight projects, five technology development and demonstration projects supported are from industries alone and three along with collaborating partners (public funded Indian R&D organizations/academic institutions/universities). Out of these, four projects have been completed, two projects have been withdrawn by the company and two projects are under progress.

5 technology development projects from institutions (IITs and IISc) in the Manufacturing and Water Resources domains are supported under IMPacting Research Innovation and Technology (IMPRINT) initiative of Ministry of Human Resource Development (MHRD) & DST and are under progress.

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

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.

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During the financial year, proposals were received from a number of agencies to organize workshops, stakeholder meetings, interaction meets, training programmes, exhibitions and other events on topics related to promotion of industrial research and innovation. These proposals were discussed in Technical Advisory Committee (TAC) meeting and 17 proposals recommended by TAC were processed for financial concurrence and approval before sanctioning of the event.

The Technology Development and Demonstration Programme (TDDP) started in 1992. Department has supported 254 R&D projects of Industrial units with a total project cost of ₹ 750.60 crores in which DSIR support is ₹ 280.40 crores. The projects cover a number of industry sectors and the share of these industry sectors in the project supported are: 32% engineering; 27% electronics; 21% Chemical; 7% energy & waste utilization and 13% Health &Pharma. The projects supported have been spread over 22 states of the country and the share of top five states in the number of project supported is: Andhra Pradesh 18%, Karnataka 15%, Maharashtra 13%, Delhi 10% and Tamil Nadu 10%. The scheme was discontinued in XIth Five Year Plan and spill over projects are supported to complete the scheme.

101 technologies developed under the scheme have been commercialized and the Department has received a cumulative royalty of ₹ 72.52 crore during the period 1997-2019.

In the current financial year, progress of last 3 on-going projects was monitored.

3.0 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 has been the national focal point of Asian and Pacific Centre for Transfer of Technology (APCTT) for India since its inception in 1977. Matters pertaining to APCTT and UNESCAP are dealt with in cooperation with the Ministry of Commerce and Industry and the Ministry of External Affairs, Government of India. DSIR also plays an active role in APCTT's functioning, particularly relating to its policies and programmes. India being the host

country has been providing institutional support to APCTT since its inception.

APCTT receives annual institutional support of US\$ 200,000 in Indian Rupees (to meet the local costs) from DSIR in addition to funding for building repairs, renovation work, and municipal taxes. DSIR also extended programme support towards the APCTT project entitled, "Promotion of National Innovation Systems (NIS) in Countries of the Asia-Pacific Region – Phase II" which concluded in 2016. The residual fund of this completed project has been reprogrammed under a new project "Promotion of Regional Cooperation between India and ESCAP member States to Strengthen National Innovation Systems". Activities under this project are under implementation during 2018-2019.

4.0 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 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 Appeals received and their responses are available on DSIR Website.

DSIR has received 237 Applications during 01/12/2017 to 31/03/2019 and all the Applications were registered and disposed off on RTI Request & Appeal Management Information System at <https://rtionline.gov.in/RTIMIS>. During 01/12/2017 to 31/03/2019, 20 applications were registered as first appeal and 02 applications were registered as second appeal.

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 <http://rtiar.nic.in> and <https://dsscic.nic.in/users/pn-login> wherein quarterly returns were uploaded regularly.



The Division provided technical support by way of lectures on 'RTI Act 2005 and its Implementation' covering RTI Act 2005, Proactive Disclosures under Section 4 (1) (b) of the RTI Act 2005, RTI Online Portal, RTI Annual Return Information System and Transparency Audit during

- Training Programme on Effective Implementation of RTI Act and Record Management organized by Council of Scientific and Industrial Research at CSIR-Human Resource Development Centre, Ghaziabad on 5 April 2018.
- Vigilance Awareness Week organized by Council of Scientific and Industrial Research at CSIR-National Physical Laboratory, New Delhi on 1 November 2018.

5.0 AUTONOMOUS INSTITUTIONS

5.1 Council of Scientific and Industrial Research (CSIR)

- The Council of Scientific & Industrial Research, constituted in 1942 is an autonomous body which is known for its cutting edge R&D knowledgebase in diverse S&T areas, is a contemporary R, D & E organization. CSIR has pan India presence through its network of 38 national laboratories which undertake well focused basic and applied research in diverse fields of science and technology. CSIR has also established 39 outreach centres, one Innovation Complex and three units. CSIR's R&D expertise and experience is embodied in about 4000 active scientists supported by about 7000 scientific and technical personnel.
- CSIR has been playing a stellar role in building up the scientific and technological prowess of the country. Through its technological interventions, CSIR has not only provided solutions and innovations for the industry but has also proved to be a catalyst in improving the quality of life of millions of people across the country. CSIR covers a wide spectrum of science and technology – from radio and space physics, 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.

- 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 powerful weapon against unethical commercial exploitation of Indian traditional knowledge. CSIR maintains Microbial Type Culture Collection (MTCC) and Gene Bank.
- 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 5336 papers in SCI Journals during 2017 with average impact factor of 3.353.
- CSIR through its various constituent laboratories is also placing major focus upon creating incubation facilities for spin off and startups. The CSIR would hand hold these companies so as to create a new segment of knowledge enterprises.
- CSIR has been focusing in a significant manner on the development of S&T Human Resource and provided the 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.

5.1.1 Significant Events

Hon'ble Prime Minister and President, CSIR Society visit to CSIR-CDRI

Shri Narendra Modi, the Hon'ble Prime Minister of India and President, CSIR Society visited the CSIR-Central Drug Research Institute (CDRI), Lucknow on 20th June 2017. Shri Ram Naik, the Governor of Uttar Pradesh, Shri Yogi Adityanath, the Chief Minister, Uttar Pradesh and Dr. Girish Sahni, Director General, CSIR, were present for the occasion. The Hon'ble

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Prime Minister was shown around an exhibition showcasing the major contributions of the Institute in drug discovery and development. He was also briefed about the scientific, societal and industrial achievements of the Institute. The development of three new drugs for the treatment of osteoporosis, malaria and blood clot was explained to him. The Hon'ble Prime Minister reviewed the R&D activities and interacted with some senior scientists of the Institute.



Fig. 1 Hon'ble Prime Minister being welcomed by DG,CSIR and Director, CSIR-CDRI

Upgraded SARAS makes a Maiden Flight

The new upgraded version of SARAS PT1N, a 14-seater passenger aircraft developed by the CSIR-NAL completed a successful maiden flight on 24th January 2018. The primary objective is to evaluate the system performance in about 20 flights and the data collected from this would be used to freeze the design of the production version aircraft. The revised version with 14 seats instead of 19, SARAS-PTN1, has improved avionics, radar, linear wing flap actuator, environmental control system, engine flap actuators and flight control system. CSIR-NAL hopes to pitch SARAS as a feeder aircraft, light cargo aircraft and an air ambulance. SARAS PT1N took off at 11 am from the HAL airport and flew for about 40 minutes at the maximum height of 8500 feet at a speed of 145 knots. SARAS is the first Indian multi-purpose civilian aircraft in the light transport aircraft category.

On this occasion, Dr. Harsh Vardhan, Union Minister for Science & Technology, Earth Sciences

and Environment Forest & Climate Change said, "Saras will give a boost to Prime Minister Narendra Modiji's missions of regional air connectivity and air taxi services and Make in India."

Dr. Girish Sahni, Director General, CSIR called it "one of the CSIR's Make in India efforts, which will benefit both civil & military requirements".



Fig. 2 Saras PT1N maiden flight

CSIR Facilitates India's First Ever Biofuel-Powered Flight

India's first historic biofuel-powered flight was flagged off on its maiden voyage on 27th August 2018 from Dehradun airport by Uttarakhand Chief Minister Shri Trivendra Singh Rawat. The bio-aviation fuel was produced indigenously by CSIR-IIP from jatropha oil and was based on the patented technology of the institute. With this development, India has turned out to be one of the few nations in the world to utilise bio fuel for planes. SpiceJet's latest generation Q400 aircraft featured in India's first biofuel-fueled flight from Dehradun to Delhi airport, which lasted for almost 45 minutes.

On the occasion, Dr. Harsh Vardhan, the Hon'ble Minister, S&T, Earth Sciences and Environment, Forest & Climate Change and Vice President, CSIR, said that it is a historic day and that the biofuel technology is going to be a game changer as the Biojet fuel is greenhouse gas neutral, carbon neutral, reduces air pollution and will also bring down the import bill on crude oil. Commercialization of biofuel promises large-scale employment avenues both in the formal and informal sector.

The organizations – SpiceJet for the demonstration flight and Chhattisgarh Biofuel Development Authority that supplied the jatropha oil, sourced from more than 500 farmers contributed for making the maiden flight a success. Besides reducing the greenhouse gas emission by nearly 15%



and Sulphur oxide emissions by over 99%, the use of Bio-aviation fuel is expected to provide indigenous jet fuel supply security, conceivable cost savings as availability at the farm level scales up, superior engine performance and lesser maintenance cost for the airline operators.

CSIR Celebrates 76th Foundation Day 2018

The CSIR celebrated its 76th foundation day on 26th September, 2018 in Vigyan Bhawan, New Delhi, with great fervours and enthusiasm in the presence of a large number of young innovators, school children, young scientists and members of the CSIR family.

Keeping in mind the contributions of CSIR scientists for the benefit of the society, Dr. Harsh Vardhan, the Hon'ble Minister for Science & Technology,



Fig. 3 CSIR Foundation Day Celebration



Fig. 4 Dr. Harsh Vardhan with Indian Air Force team, which carried out the successful test flight of the indigenously developed SARAS aircraft

Earth Sciences, and Environment, Forest & Climate Change and Vice President, CSIR, appealed to former scientists of CSIR to join the national mission to resolve the unresolved problems of the nation through science. Addressing the gathering, Dr. Vardhan

said, the laboratories under CSIR should proactively involve those scientists who were part of its family, as "scientists never retire". "CSIR ranked ninth in the world amongst 1207 public research institution of the world," said Dr. Vardhan. He also said that Indian scientists were among the best in the world.

"CSIR today is a 38-laboratory strong organization, the oldest and most diverse in the country – from agriculture to aerospace, medicine to biofuel and instrumentation to time management," says Dr. Harsh Vardhan.

Dr. Harsh Vardhan further called on the CSIR community to "take a resolve on this Foundation Day, to diagnose the problems that remained unresolved during these 70 years; define specific goals and targets; make a team; develop a management plan and finally a mechanism to monitor the implementation of the action on a year-to-year basis.

He also said that during the past four and a half years, his visits to all the 38 laboratories of CSIR and interactions with the scientists have led him to firmly believe that Indian scientists are among the best in the world and the labs are comparable and in some fields ahead of similar institutions elsewhere in the world.

Prof. Ashutosh Sharma, Secretary, DST & DSIR and DG, CSIR in his welcome address said that an organization like CSIR due to its maturity, stability and wisdom, is not only the driver but also a catalyst in the growth of socio-economic development. CSIR is a repositioned organization which is fully aligned with the national vision, policies, initiatives and relevant and target oriented R&D is the backbone of the re-energised CSIR.

He later announced the Shanti Swarup Bhatnagar (SSB) Awards 2018, the highest multidisciplinary science awards in India. Thirteen scientists were selected for the award, which carries a prize money of ₹ 5 lacs and a citation.

Dr. Vijay Kumar Saraswat, Member, NITI Aayog and Chancellor, Jawaharlal Nehru University, delivered the CSIR Foundation Day Lecture on "Artificial Intelligence (AI) and Humanity". He discussed various aspects of Artificial Intelligence and its effects on society and humanity as a whole.

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Dr. Saraswat also presented the CSIR Annual Awards in various categories including Innovation Awards for School Children, Young Scientists Awards, Technology Awards, Diamond Jubilee Technology Award, Award for S&T Innovation for Rural Development, GN Ramachandran Gold Medal for Excellence in Biological Sciences and Technology & Commendation Award to the Indian Air Force team that carried out the successful test flight of the indigenously developed SARAS aircraft on January 24, 2018.

During the event, a short film on the journey of CSIR achievements was also screened. The film gave a message that CSIR always focuses on developing cutting-edge technologies for the industry and also that CSIR has committed itself to contribute to national development by making technologies affordable and available for the benefit of the masses. Dr. Sanjay Kumar, Head, HRDG and Director, CSIR-IHBT, Palampur, proposed the vote thanks.

Inauguration of Centre for Innovation and Translational Research at CSIR-IITR

Dr. Girish Sahni, Director General, CSIR, visited CSIR-IITR, Lucknow on February 6, 2017 where he inaugurated the Centre for Innovation and

Translational Research (CITAR). The center provides researchers from multidisciplinary backgrounds an opportunity to innovate, develop, probe, and translate the most important technological challenges related to health and the environment with a vision to encourage impactful societal and industrial research, enable start-ups and foster collaborations with researchers to fast track technological solutions. The facility is equipped with state of the art instrumentation, laboratories, and computational resources.

Dr. Sahni also dedicated to the nation a Computational Toxicology Facility (high performance computing for toxicology cheminformatics and Bioinformatics – the only facility for toxicology in India), Translational Research Facility and the Cell and Molecular Biology Facility and Industrial Labs. These facilities will leverage the institute's capabilities by providing researchers, innovators, and entrepreneurs from academia and industry access to state-of-the-art platform technologies and mentorship in a multidisciplinary collaborative environment.

DG, CSIR appreciated the infrastructure being created at CSIR-IITR through CITAR which will help to establish an ecosystem for nurturing innovative technology-based solutions for startups and industries.



Fig. 5 DG-CSIR inaugurating the Translation Research Facility and Computational Toxicology Facility at CSIR-IITR



India's First "Highway Capacity Manual" Released

Shri Nitin Gadkari, the Hon'ble Minister, Ministry of Road Transport & Highways released the country's first ever "Highway Capacity Manual"(HCM). The manual will guide road engineers and policy makers about road expansion.

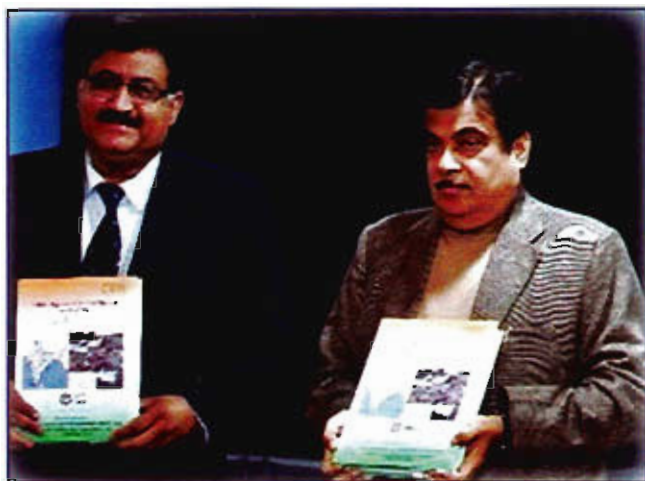


Fig. 6 DG, CSIR and Shri Nitin Gadkari the Hon'ble Minister, Ministry of Road Transport & Highways releasing the country's first ever "Highway Capacity Manual" (HCM)

The manual has been developed by the CSIR-CRRI on the basis of an extensive, country-wide study of the traffic characteristics on different categories of roads like single lane, two-lane, multi-lane urban roads, inter-urban highways and expressways and the associated intersections on these roads. The study was conducted in collaboration with seven academic institutions including IIT-Roorkee, Mumbai and Guwahati; School of Planning and Architecture, New Delhi; Indian Institute of Engineering and Science and Technology, Shibpur; Sardar Vallabhai Patel National Institute of Technology, Surat and Anna University, Chennai.

Countries like the US, China, Malaysia, Indonesia, Taiwan have had their own Highway Capacity Manuals for quite some time. This is the first time that the manual has been developed in India. The manual lays down guidelines for when and how to expand or manage different types of roads and their intersections and the level of services to be put in place. It has been developed based on the

unique nature and diversity of traffic on Indian roads. Shri Nitin Gadkari expressed the hope that the long awaited manual would help in the scientific planning and expansion of road infrastructure in the country. He also said that there was a need to popularise the use of new materials like fly-ash, plastic, oil slag and municipalwaste in road construction. He also called upon researchers and engineers to expedite formulation of a good design for safe and effective speed breakers for Indian roads.

Twinning Agreement signed between CSIR and MIDI, Ethiopia

A Twinning Agreement involving six CSIR laboratories with CSIR-NML as the nodal laboratory was signed with Metals Industries Development Institute (MIDI), Ethiopia, at a total cost of ~6 million US\$ for CSIR.



Fig. 7 Signing of the Twinning Agreement in Addis Ababa, Ethiopia

Indigenous Lithium-Ion Battery Production to Drastically Cut Foreign Imports

CSIR-CECRI and RAASI Solar Power Pvt. Ltd. have signed a Memorandum of Agreement for transfer of technology for India's first Lithium-Ion (Li-ion) Battery project. The Agreement was signed between CSIR-CECRI and RAASI Group in the presence of Dr. Harsh Vardhan, Union Minister for Science & Technology.

Currently, Indian manufacturers source Lithium-Ion Battery from China, Japan and South Korea among some other countries. But now, CSIR-CECRI has developed an indigenous technology of Lithium-Ion cells in partnership with CSIR-NPL, CSIR-CGCRI, and CSIR-IICT. CSIR-CECRI has set up a demo facility in

Chennai to manufacture prototype Lithium-Ion cells. It has secured global IIPRs with the potential to enable cost reduction, coupled with appropriate supply chain and manufacturing technology for mass production.

Li-ion batteries have applications in Energy Storage System – from hearing aid to container sized batteries to power a cluster of villages, Electric Vehicles (2-wheeler, 3-wheeler, 4-wheeler and Bus), portable electronic sector, grid storage, telecom and telecommunication towers, medical devices, household and office power back (ups), powering robots in processing industry. Dr. Harsh Vardhan after the signing ceremony said that “It will give tremendous boost to two flagship programmes of Prime Minister Shri Narendra Modi – increasing the share of Clean Energy in the energy basket by generating 175 Giga Watts by 2022, of which 100 Giga Watts will be Solar and the second, National Electric Mobility Mission, to switch completely to electric vehicles by 2030.”

CSIR-NAL receives 7th National Award for Technology Innovation in Petrochemicals and Downstream Plastic Processing Industry

CSIR-NAL was awarded the 7th National Award for Technology Innovation in Petrochemicals and Downstream Plastic Processing Industry, 2016-17 for research in the field of Polymer Science and Technology by Late Shri Ananth Kumar, Hon'ble Minister of Chemicals & Fertilizers and Parliamentary Affairs, Government of India the Ministry of Chemicals and Fertilizers, Govt. of India. The award was given for the development of co-infused and co-cured fully integral wing inters par box using the VERITY process.



Fig. 8 Team CSIR-NAL receiving 7th National Award for Technology Innovation in Petrochemicals

CSIR-NPL and ISRO sign MoU for Time and Frequency Traceability Services

CSIR-NPL signed a Memorandum of Understanding (MoU) and the ISRO Telemetry Tracking and Command Network (ISTRAC), Indian Space Research Organization (ISRO), Department of Space, in New Delhi. The MoU was signed by Shri V.V. Srinivasan, Director, ISTRAC on behalf of ISRO and Dr. D.K. Aswal, Director, CSIR-NPL, on behalf of CSIR. The Union Minister for Science & Technology, Earth Sciences and Environment, Forest & Climate Change, Dr. Harsh Vardhan and Minister of State for Development of North Eastern Region (I/C), Prime Minister's Office, Personnel, Public Grievances & Pensions, Atomic Energy and Space, Dr. Jitendra Singh, DG, CSIR, Dr. Girish Sahni, and other senior officers from ISRO, CSIR and CSIR-NPL graced this important national event. The scope of this MoU is the rendering by CSIR-NPL of all the necessary actions to support the following:

- Time and Frequency Traceability services from National Time Scale of CSIR-NPL to IRNWT-I and IRNWT-II of ISTRAC/ISRO through Two-way Satellite Time and Frequency Transfer (TWSTFT).
- Time and Frequency Traceability services from National Time Scale of CSIR-NPL to IRNWT-I and IRNWT-II of ISTRAC/ISRO through GNSS CV.
- Annual audit of IRNWT-I and IRNWT-II as per ISO/IEC 17025 for ensuring correctness and accuracy of the time traceability. India's indigenously developed global positioning system called NavIC, has been recently configured to synchronize its clocks to the time provided by the CSIR-NPL. Till recently, the satellites on the NavIC managed by ISRO relied on the US-based GPS system. The linking with CSIR-NPL will aid in high precision satellite-based communication, precise guidance of missiles and navigation.

5.1.2 Significant S&T Achievements

Cultivation of Banana for the First Time in Jammu & Kashmir

Using tissue culture techniques, CSIR-IIIM has for the first time successfully cultivated banana in Jammu and Kashmir. Samplings of high quality tissue culture



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variety Bhim Grand Naine(G-9) banana brought from Cadila Pharmaceutical Limited, Ahmedabad, Gujarat were cultivated over two acres land in the Field Experimental Farm Chatha. The cultivation trial consisted of planting of 2000 samplings of banana plants in August 2016. The fruit setting commenced in July-August 2017. The plant grew to a height of 6.5 to 7.5 feet and gave yield of 20-30 kg per plant and 20-25 tonnes/acre, which translates to almost ₹ 250-300/banana plant. Farmers could get a net return of approximately ₹ 2.5 lakh by cultivation of this crop on one acre of land. This is for the first time commercial cultivation of banana has been successfully accomplished in Jammu and Kashmir making it a profitable agriculture venture for farmers of the State.

New Rice Variety with Low Glycaemic Index Released

CSIR-CCMB in collaboration with the Indian Institute of Rice Research at Hyderabad has released a new variety of rice that resists pests and is also beneficial for those with diabetes. The new Improved Samba Masuri (ISM) rice variety is resistant to Bacterial Blight (BB) and at the same time has the lowest Glycaemic Index (GI) at 50.9 among all major rice varieties, which is an improvement over the 52.9 GI of the earlier Samba Masuri variety.

Consumption of food with low GI results in slow release of glucose into the bloodstream reducing the ill-effects of diabetes. At present, almost 40 per cent of the normal Samba Masuri rice crop is being lost due to Bacterial Blight. The new ISM variety of rice is, therefore, expected to significantly reduce this crop loss, which eventually would lead to reduced prices of rice and increased profit margins for farmers and traders. The traditional Samba Masuri rice is commonly called Sona Masuri and Kurnool Masuri and has very low resistance to BB, a pest disease for which there is no chemical solution yet. It is estimated to be cultivated over four million hectares across the country, annually.

Nutraceutical for Osteoarthritis

In a new breakthrough in the area of osteoarthritis, a common chronic condition of the joints that afflicts mainly the weight-bearing joints such as hips and

knees, and causes physical disabilities, CSIR-CDRI have developed a standardized nano-formulation from *Spinaceaoleracea*, commonly known as Palak, for prevention and management of osteoarthritis by preventing cartilage damage. This nutraceutical has extra health benefits for osteoarthritic joints in addition to the basic nutritional value found in *Spinaceaoleracea* (Palak). It imparts no toxicity and is effective at lower doses with nano formulation. It has been launched with M/s Pharmanza Herbals Pvt. Ltd., Gujarat and its marketing partner namely, Aeran Lab (India) Pvt. Ltd., Thane for marketing, on March 13, 2018 as a Nutraceutical with brand name "Joint fresh".



Fig. 9

Development of RO purifier which preserves minerals

CSIR-IICT has designed hollow membranes which purify drinking water efficiently without causing any decrease in the mineral levels in water. The membranes look like thin plastic wires as they are made of poly-ethersulphone, a synthetic material. The water purifier developed by CSIR-IICT removes the microbes and other contaminants completely, keeping minerals intact in the water. It consists of hollow membranes with pores as small as 0.001 microns. When water passes through this membrane, contaminants like bacteria, virus, suspended solids, and colloidal silica that are larger

than the pore size are filtered, thus giving out pure water. The essential minerals dissolved in water are of very small size and they do not get filtered and stay in the water, thus maintaining good levels of TDS.

Safe Bio-digester for Disposing Bio-degradable Garbage Developed

CSIR-IICT has developed a biodigester' Dubbed Trash Guard', for safe disposal of biodegradable garbage. The bio-digester targets an issue increasingly being faced by every small town in the country – managing waste. Trash Guard is an innovative prefabricated Modular High Rate Digester that is convenient to install in apartments, hotels, resorts and other places of garbage accumulation. It can digest wastes without polluting the environment. It is fully automatic, generates no odour and occupies minimum space. Waste can be directly dropped into the digester where it gets completely digested by bacteria. Trash Guard can produce enough biogas for two kitchens every day.

Trash Guard is based on High Rate Bio-Methanation technology that leads to superior process efficiency in terms of percentage solid reduction. Some of the key features of Trash Guard are multi-stage and two-phase digestion; convenient and self-driven feeding without external pump; intense self-mixing system for digester contents using differential pressure; particle size control without external grinder; capacity to withstand accidental hydraulic shock loads, and high organic loading rate. Confederation of Real Estate Developers Association, India (CREDAI) is promoting this bio-digester technology in residential areas.

Discovery of Shale Gas in Central India

CSIR-CIMFR has discovered shale gas in two areas in the Gondwana basin in Central India and Godavari basin. The total shale gas discovered so far in the country in these two basins is estimated to be about 63 trillion cubic feet (TCF). It is considered as one of the best sources of non-conventional natural gas. Shale gas is methane gas or natural gas trapped within beds of shale rocks that occur 400-3000 metres

below the earth. Shales are fine-grained sedimentary rocks that can be rich sources of petroleum and natural gas. The new discovered reservoirs are being explored using a consortium approach in which institutions like CSIR-NGRI and Coal India Limited will carry out characterization and potential studies of the Gondwana and Damodar basins. Shale gas, which has about 95% of methane and 2% ethane gases, can be used practically everywhere where natural gas is used. Shale gas is being mined on a large scale throughout the developed world and could contribute considerably to kitty of natural energy resources all over the world.

5.1.3 Scientific Excellence

CSIR has published 5336 research papers during 2017 in SCI journals of repute. The new knowledge generated from CSIR laboratories is reflected in terms of high average Impact Factor (3.353). Following Graphs show the trend of research over the last five years:

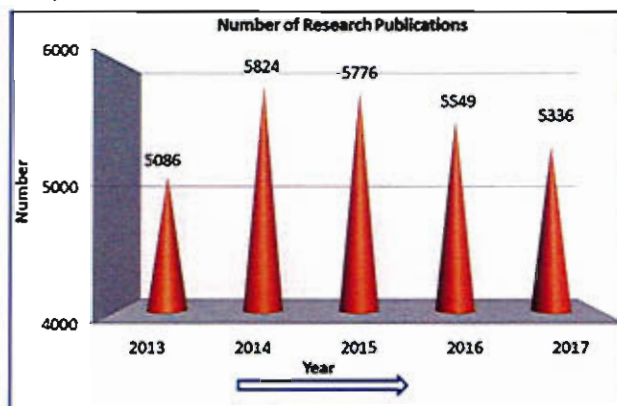


Fig. 10 (a)

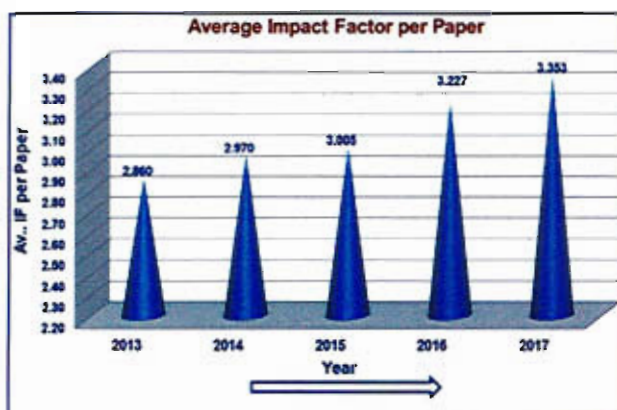
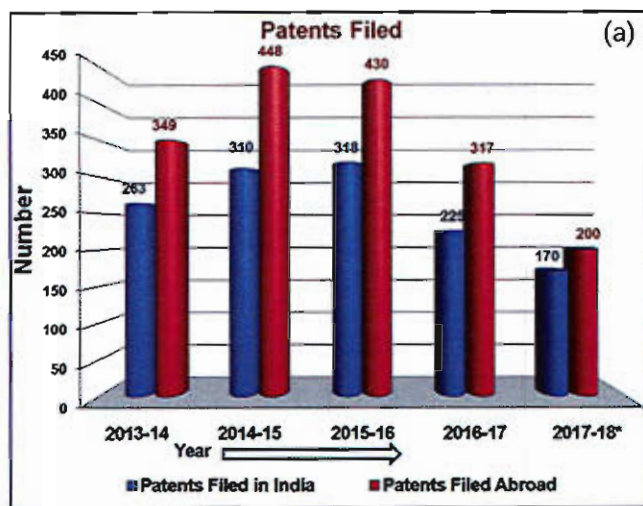


Fig. 10 (b)

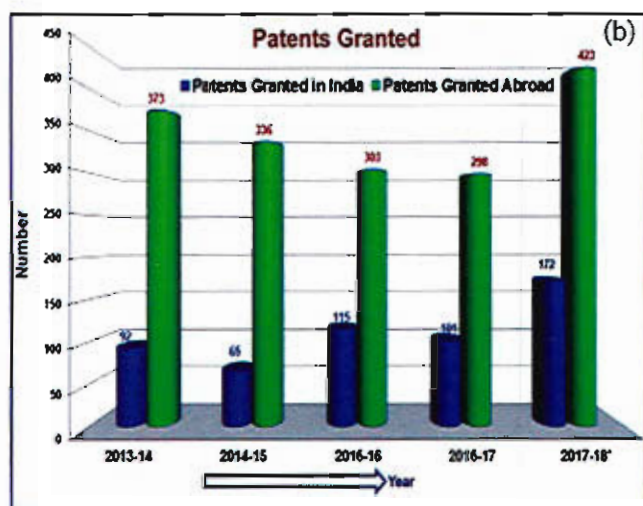


5.1.4 Excellence in Intellectual Property

CSIR has filed 200 patents abroad and 170 patents in India during 2017-18, and it has been granted 172 patents abroad and 423 patents in India. Following graphs provide data on patents filed and patents granted over the last five years:



*Data may increase later, during national phase entry



*Data may increase later, during national phase entry

Fig. 11

5.1.5 Value Generation through External Cash Flow (ECF)

CSIR has generated External Cash Flow of ₹ 963.06 crore during 2017-18 (upto 31-3-2018), through working with various Govt/non-Govt Indian and foreign organizations. Following graphs provide data on ECF generated over the last five years

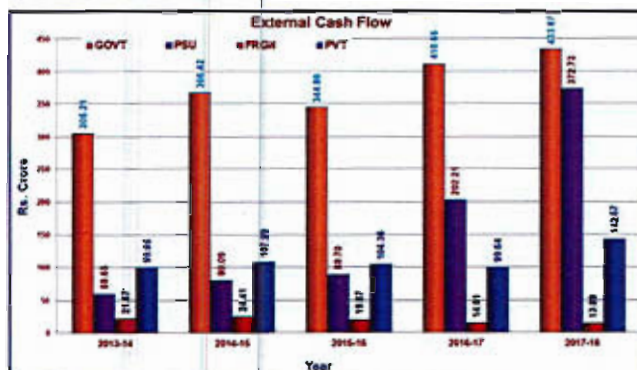


Fig. 12 Graphical Data on ECF generated over the last five years

5.2 Consultancy Development Centre (CDC)

Consultancy Development Centre (CDC) is an Autonomous Institution of the Department of Scientific and Industrial Research (DSIR), Ministry of Science and Technology, Government of India set up for promotion, development and strengthening of consultancy skills and capabilities in the country including enhancement of export of consultancy and professional services.

During the financial year 2017-18, plan support of ₹ 100.00 lacs was received from DSIR for carrying out specific projects & activities. Besides plan support activities, CDC undertook various funded projects from various Ministries/Departments of the Government of India.

6.0 PUBLIC SECTOR ENTERPRISES

6.1 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 and 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 especially suitable for our entrepreneurs and conditions. It acts as an effective Interface for translating R&D

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results into marketable products. Over the last more than six 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 5000 entrepreneurs spread over almost all areas of industry and has provided assistance for filing of 1800 patents. During the financial year 135 new processes/ technologies were assigned to the Corporation for licensing, as compared to 108 processes in the previous year and almost 40 MOUs/MOAs/Agreements with Institutions / Organizations for intellectual property protection, technology commercialization, technology consultation and other value-added services have been signed.

6.2 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 defence 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 Defense Laboratories. In recognition of all these efforts, CEL not only have the distinction of being a DSIR recognized R & D Company, but also has been honoured a number of times with prestigious awards including "National Award for R & D by DSIR". The Company has achieved turnover ₹ 221.27 crores with the Microwave Electronics Division (MED) achieving sales of ₹ 86.16 crore. CEL is involved in the development & production of strategic electronic components such as Phase Control Modules (PCMs) for the Radar systems, Piezo fuse assemblies for High Explosive Anti Tank (HEAT) ammunition. The Company has signed ToT agreement with DRDO/DMRL for Ceramic Radome for Seeker Missiles. The Company is also making all efforts to further expand the product portfolio through various new products which are under development such as Divya Nayan (CSIO Project), Laser Virtual Fencing Systems (LASTEC), Electronic Fuse Assembly (OFB), Bullet Proof Jacket (Indian Army & Paramilitary forces) etc. The Company became the first consumer in UP to install net-metering at 33 KV supply voltage. The net metering system for the 1.2 MWp solar photovoltaic power plants installed in CEL exports its surplus electricity generated through the solar power plants to UPPCL grid.

