Year End Review -2017: Department of Science & Technology

Council of Scientific & Industrial Research (CSIR)

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The Council of Scientific & Industrial Research (CSIR), known for its cutting edge R&D knowledge base in diverse Science &Technology areas, is a contemporary Research & Development (R&D) organization. Having pan-India presence, CSIR has a dynamic network of 38 national laboratories, 39 Outreach Centres, 3 Innovation Complexes and 5 units. CSIR's R&D expertise and experience is embodied in about 4600 active scientists supported by about 8000 scientific and technical personnel.

CSIR covers a wide spectrum of science and technology – from radio and space physics, oceanography, 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, farm and non-farm sectors. Further, CSIR's role in S&T human resource development is noteworthy.

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 is granted 90% of US patents granted to any Indian publicly funded R&D organization. On an average CSIR files about 200 Indian patents and 250 foreign patents per year. About 13.86% of CSIR patents are licensed - a number which is above the global average. Amongst its peers in publicly funded research organizations in the world, CSIR is a leader in terms of filing and securing patents worldwide.

CSIR has pursued cutting edge science and advanced knowledge frontiers. The scientific staff of CSIR only constitute about 3-4% of India's scientific manpower but they contribute to 10% of India's scientific outputs. In 2012, CSIR published 5007 papers in SCI Journals with an average impact factor per paper as 2.673. In 2013, CSIR published 5086 papers in SCI journals with an average impact factor per paper as 2.868.

CSIR has operationalized desired mechanisms to boost entrepreneurship, which could lead to enhanced creation and commercialization of radical and disruptive innovations, underpinning the development of new economic sectors.

CSIR has put in place CSIR@80: Vision & Strategy 2022 – New CSIR for New India. CSIR's mission is "to build a new CSIR for a new India" and CSIR's vision is to "Pursue science which strives for global impact, technology that enables innovation-driven industry and nurture trans-disciplinary leadership thereby catalysing inclusive economic development for the people of India".

CSIR is ranked at 84th among 4851 institutions worldwide and is the only Indian organization among the top 100 global institutions, according to the *Scimago* Institutions Ranking World Report 2014. CSIR holds the 17th rank in Asia and leads the country at the first position.

This has been a year of great significance for CSIR.Some of the major achievements during 2017 are as follows:

- **CSIR at the Ninth Position Worldwide - SCImago Institutions Ranking World Report 2017**

  CSIR has been ranked 9th in the world amongst the 1207 government institutions, with an overall global ranking of 75 in the world, covering 5250 institutions. In the Asiatic region, it ranks at 14 overall out of 1431 entities, and at No 3 among 284 Government-funded research bodies, with only Chinese Academy of Sciences and Japan Science and Technology Agency ahead of the Council. CSIR is the only Indian Organization among the Top 100 global institutions. A total of 252 Indian organizations are covered in the evaluation.

  According to the Nature Innovation Index 2017, CSIR is ranked at 162 and IITs at 185 in the Top 200 institutions world-wide. Among Top 50 global institutions by normalized WIPO patent families, CSIR is at 16, and is the only Indian organization in this top 50 list.

- **CSIR Aroma Mission**

  CSIR has contributed significantly in the development, nurturing and positioning of essential oil-based aroma industry in the country. This has led to creation of an ecosystem benefitting the industry, farmers and next generation entrepreneurs. The effort has had been aimed at socio-economic development on one hand and

creation of desired capability and capacity on the other. In doing so, several CSIR laboratories have developed and deployed desired technologies in the domain. The segment is maturing and there is global connect in a significant manner, providing newer opportunities which are associated however with several challenges. Industry thus needs to reposition itself in this important segment. CSIR has committed itself to contribute for the purpose in a mission mode. CSIR Aroma Mission has been conceptualized for the purpose and is being made operational.

The objectives of the Mission have been divided into eight verticals. These include:

- Development of superior varieties and their agro-technologies and assessment of their suitability for specific agro-climatic regions;
- Promotion of cultivation and processing of aromatic crops, enhancing area under selected aromatic crops along with enabling interventions including setting up of distillation units and catalysing setting up of cooperatives for marketing of the produce;
- Value-addition of aromatic crops (High-end aroma chemicals and products) ;
- Skill development activities;
- Intellectual property generation, valuation and management;
- Entrepreneurship development/Spin-offs;
- Business development; and
- Making public aware of Mission activities and achievements using appropriate interface.

- **CSIR Phytopharmaceuticals Mission**

  Medicinal plants have played a key role in human health since time immemorial. Plants and their parts have been in use since ancient times as medicines for the treatment of a range of diseases. In spite of the great advances observed in modern medicine in recent decades, plants still make an important contribution to global healthcare. As per World Health Organization (WHO), because of poverty and lack of access to modern medicine, about 65-80% of the world's population living in developing countries depends essentially on plants for primary healthcare.

  The CSIR Mission on phytopharmaceuticals aims to improve the availability (through cultivation) of such medicinal plants which are in high demand by global and domestic industry involved in the preparation of medicines of Indian traditional systems. Under this mission it is proposed to prevent exhaustion of medicinal plants from their native locations by identifying the elite germplasm and conserving it by cultivation and in gene banks. Improved varieties along with their agrotechnologies will be developed to increase productivity and profitability per unit land area, and to make use of such areas which are affected by abiotic stresses such as drought, salinity, flood, shade etc. Chemical processes will be developed for the preparation of standardized extracts and enriched fractions of selected medicinal plants to transfer the value-addition technologies to the entrepreneurs to promote use and export of value-added material instead of the raw plant material. Efforts would be made to translate the potential clinical leads in different CSIR laboratories to develop them into phyto-pharmaceutical drugs which would be affordable and acceptable at global standards.

  The verticals are:

  - Captive cultivation of medicinal plants;
  - Conservation and revival of engendered and threatened medicinal plant species;
  - Technology Packages for production of GMP grade medicinal plant extracts;
  - Phytopharmaceutical development from important medicinal plants;
  - Intellectual Property generation, valuation and management;
  - Design & Development of Digital Library of Indian Medicinal Plants & Natural Products; and
  - Showcasing CSIR technologies / products / services with appropriate interface.

- **CSIR Mission on Sickle Cell Anemia**

  Sickle Cell Anemia (SCA) is the most common blood related disorder in India with a high prevalence among ethnic groups that have a socio-economic disadvantage, such as tribal populations. Every year approximately 5,00,000 children are born with SCA worldwide with India accounting for nearly 50% of the cases.

  SCA is a genetic disease caused by a point mutation in the sixth codon of the β-globin expressing gene resulting in the replacement of glutamic acid by valine, which under deoxygenation state oligomerizes with α-globin and gives rise to a type of haemoglobin named as HbS (Haemoglobin sickle). The mutated valine favours the hydrophobic interactions between the β subunits of the hemoglobin tetramers leading to the HbS polymerization and formation of long hemoglobin fibers. These fibers deform the disc shaped RBCs to sickle shaped cells. The sickle shaped cells lose flexibility with reduced oxygen carrying capacity and induce dehydration in the cells. Due to irregular shape of these cells, they are prone to physical stress leading to hemolysis and capillary occlusion. Individuals suffering from sickle cell disease show symptoms such as body

pain, clotting, dyspnea, anaemia, jaundice, pneumonia, repeated infection etc. Their lifespan is usually reduced to 5-25 years with 50% of children with SCA dying before the age of 5. Hence early and affordable detection, treatment as well as preventive measures are important in managing this disease.

CSIR has developed a Mission Mode Project on Sickle Cell Anaemia through brainstorming and domain expert group discussions. The CSIR Mission on Sickle Cell Anaemia aims at:

- Managing Genetic Burden of Sickle Cell Anaemia and Understanding Genetic Basis of Differential Response to Hydroxyurea Therapy;
- Drug discovery and development for management of SCA;
- Genome editing and stem cell research approach for the treatment of SCA; and
- Development and on-ground implementation of an affordable, accurate and accelerated diagnostic kit.

The project will be implemented by CSIR-IIIM, Jammu; CSIR-CCMB, Hyderabad; CSIR-IICB, Kolkata; CSIR-IMT, Chandigarh; CSIR-IGIB, Delhi; CSIR-NCL, Pune and CSIR-URDIP, Pune.

- **CSIR hosts Atal Incubation Centre - Support for Start-Up India**

CSIR constituent laboratory, CSIR-Centre for Cellular and Molecular Biology (CCMB), Hyderabad has been identified as one of the ten organisations in the country to host a Atal Incubation Centre to be supported by NITI Aayog. The initiative is part of the Atal Innovation Mission set up by Union government to promote innovation and entrepreneurship in the country. CSIR-CCMB would offer its scientific expertise, infrastructure and business management to the start-ups.

- **CSIR’s Integrated Skill Development Initiative**

CSIR has launched an Integrated Skill Development Initiative for gainful utilization of its state-of-the-art infrastructure and human resources through specific industry oriented skilling programmes. The plan is for expanding the present 30 programmes to 75 in diverse areas with varying duration (8 weeks to 52 weeks) by end of the year. The skill development programmes include the following areas: Leather process Technology; Leather Footwear & Garments; Paints & coatings for corrosion protection; Electroplating & Metal Finishing; Lead Acid Battery maintenance; Glass Beaded Jewellery / Blue Pottery; Industrial Maintenance Engineering; Internet of Things (IoT); and Regulatory – Preclinical Toxicology.

Recently CSIR and Andhra Pradesh Scheduled Caste Co-operative Finance Corporation Ltd. (APSCCFC) have signed an Agreement for Skill training and Entrepreneurship in Leather Sector. The initiative is set to benefit 10,000 Scheduled Caste Candidates from Andhra Pradesh, creating income generation assets to the households and thus enabling social and economic development. An investment of Rs. 30 Crore is being made by APSCCFC in next 2-3 years.

- **JIGYASA: Inculcating Scientific Temper in Youth through Vibrant Scientists-Students Interactions**

CSIR has launched a program named JIGYASA in collaboration with the Ministry of Human Resource Development. The focus is on connecting school students and scientists so as to extend the classroom learning of students with experiential education based on a very well planned research laboratory environment. “JIGYASA” aims to inculcate the culture of inquisitiveness on one hand and scientific temper on the other amongst the school students and their teachers. The Programme is expected to connect 1151 Kendriya Vidyalayas with 38 National Laboratories of CSIR targeting 100,000 students and nearly 1000 teachers annually.

- **CSIR’s Jammu Kashmir Arogya Gram Yojana: Value Addition to Farmer Income and Better Land Utilization through Medicinal and Aromatic Plants**

CSIR has achieved multiple breakthroughs in developing medicinal and aromatic plants (MAPs) that grow in different kinds of soils e.g. water logged soils, saline lands, desert prone and semi-arid soils, drought hit regions, snow bound areas or waste lands. CSIR developed varieties not only harness all available cultivable land but enhance incomes to farmers. Returns are much higher than conventional agriculture. The estimated area under cultivation over the years from such interventions by CSIR is more than 3.5 lakh hectares with an estimated value of Rs 4000 crores and generated employment of more than 7.00 crore man-days.

CSIR’s ‘Jammu Kashmir Arogya Gram Yojana’ was launched in July 2015 as an effort for handholding of farmers to enable value added agriculture of aromatic and medicinal plants. 10 Districts (Kathua, Udhampur, Reasi, Doda, Ramban, Kishtwar, Samba, Poonch, Jammu and Rajouri) comprising kandi land/rainfed/ wasteland/unutilized land/snow bound areas are covered under this initiative. Through this initiative 107.82 ha

of land has been brought under cultivation, which has resulted in employment generation of 26,959 mandays, and benefitted 399 farmers. The efforts that targeted at rural skill set enhancement through farm based activities and technology support, provided training to 1760 personnel on specific agro-technologies.

CSIR has also developed agri-implements such as Krishi-Shakti (tractor for small land holdings), Air-Assisted Electrostatic Sprayer for Crops, Inter-row rotary cultivator for wide-row crops, Digital Grain Moisture Analyser, etc. for enhancing productivity and reducing drudgery of farmers.

Recently, CSIR has launched two Mission programmes – Aroma and Phytopharmaceuticals - with significant stakeholder focus, targeting niche yet cost effective agri- and value-add technologies for high national impact.

- **CSIR Developed Improved Samba Mahsuri: A Diabetic Friendly Rice**

  Samba Mahsuri (SM) is one of India's most popular and highly prized rice varieties because of its high yield and excellent cooking quality. It is cultivated in more than 2 million hectares of land in the country. However, SM is highly susceptible to many pests and diseases including the serious bacterial blight (BB) disease. BB is one of the serious production constraints of rice in India, limiting rice yields by upto 30 % in many of the states in which SM is cultivated. This disease is a particular problem because effective chemicals for managing the disease are not available.

Recognizing the seriousness of the problem of BB, CSIR-CCMB and ICAR-IIRR jointly developed BB resistant derivatives of SM and one of the breeding lines was released as a new variety under the name, Improved Samba Mahsuri (ISM) in the year 2008. The BB resistant lines of SM, when evaluated across the country through multi-location trials, exhibited high yield and grain quality similar to the original parent, SM and also showed excellent resistance to BB in disease in locations prone to BB infection.

After its release of ISM, its cultivation area has been steadily increasing and upto 2016 it is estimated to have been cultivated in an area of 130,000 hectares across the country. ISM matures 7-10 days earlier than Samba Mahsuri and farmers in East Godavari attested that it is more tolerant to lodging than other popular varieties. ISM has another unique feature of low glycemic index (i.e. a value of 50.99), which is amongst the lowest value for several rice varieties tested. Foods with glycemic index (GI) value below 55, like ISM, are considered highly suitable for consumption by patients suffering from diabetes as consumption of foods with low GI results in slow release of glucose into the bloodstream, thus reducing the ill effects of the diabetes. Therefore, ISM, in addition to possessing desirable attributes like high yield, fine-grain type, bacterial blight resistance, premium market price etc., also has a unique advantage of low GI, thus enhancing its market potential and profit earned by the farmers.

Popularization of ISM amongst rice farmers was supported by CSIR through its CSIR-800 program. The ongoing research in this collaborative program of CSIR-CCMB and ICAR-IIRR is aimed at developing derivatives of Samba Mahsuri that have higher yield, mature early and possess tolerance to other biotic stresses.

- **CSIR Developed Handheld GPS-Enabled 'Ksheer Tester' – System for Detection of Adulteration in Milk to Reduce Public Health Risk**

  n order to address the grave problem of adulteration in milk, CSIR has developed an electronic system, named 'Ksheer-Scanner', a low cost portable system with user friendly features, which detects contaminants in just 40-45 seconds. The system is useful for on-the-spot milk testing by food inspectors. Over 55 Ksheer-Scanner systems have been deployed at dairies in Goa, Gujarat, Jammu & Kashmir, Kerala, Maharashtra, Punjab, Rajasthan, Uttar Pradesh and West Bengal.

  Recently, a new handheld GPS-enabled 'Ksheer Tester', a variant of the benchtop system, Ksheer-Scanner, has been developed by CSIR for checking adulteration in milk. The device would enable any person to track the location of the tested sample of milk and receive the test results through SMS on the device. The handheld milk adulteration tester, with system capabilities comparable to those of Ksheer Scanner which was meant for dairy-level inspection, is aimed for domestic usage. User friendly salient features include single button operation, fast measurement time (less than 60 Seconds) and the ability to detect contaminants like urea, salt, detergent, soap, boric acid and hydrogen peroxide down to low levels ranging from fractions of a percent to parts per million depending on the adulterant. A cost of below Rs. 10,000 per piece enables small communities and dairy-processing businesses to adopt this cost-effectively.

· CSIR developed Mercury-free UV lamps for Water Purifiers – Green Solutions for Societal Problems

The CSIR-Central Electronics Engineering Research Institute (CSIR-CEERI), Pilani has developed mercury-free plasma (MFP) UV-lamp for water disinfection systems which would provide water free of environmentally and health hazardous mercury. The developed MFP-UV-lamp is a better alternative for mercury-based UV lamps and has been well-tested in the household water purifier systems. This is a first of its kind worldwide. The technology can also be used for sterilization of food, medical equipment, surfaces, ill-skin conditions, air-conditioners and air fresheners for hospitals, etc. The technology has been transferred to two companies for its mass production.

CSIR Developed Oneer : An Electronic device for drinking water disinfection

The device is based on the principle of anodic oxidation. The device is particularly useful for the treatment of drinking water supplies that have microbial contamination to disinfect pathogenic microorganisms and to provide safe drinking water to communities as per National and International standards [World Health Organization (WHO) and Environmental Protection Agency (EPA) USA] prescribed for potable water. This has high disinfection efficiency of >8 Log reduction of bacteria (E coli) and is maintenance-free. It is a low-cost water disinfection device that can even treat brackish or turbid water unlike UV technology. Cost of treated water is less than 1 paisa per litre. Domestic device can supply 10 litres of water for homes and small establishments while the online version can supply 450 litres of safe water for communities.

- **CSIR Developed Easy to assemble Cost-Effective Toilets – Towards Swachh Bharat**

  CSIR has developed a cost-effective toilet that weighs less than 500kg and has a life of 25-30 years suitable for areas where toilet coverage is still incomplete. It can be made in-situ and even assembled in less than five hours. A Memorandum of Understanding was signed with M/s. Smart Built Prefab Pvt. Ltd., Hyderabad, for technology transfer for manufacturing textile reinforced concrete (TRC) panels for the construction of such toilets. The TRC panels are manufactured using textile reinforced concrete prototyping technology (TRCPT), an innovative all-in-one technology developed by the CSIR laboratory.

- **CSIR Developed Waterless Chrome Tanning Technology – Enabling the Indian Leather Industry for Global Competitiveness at Reduced Environmental Impact**

  Chromium, a toxic element with significant adverse environmental and public health impact, is widely used as part of tanning agents with about 2.0 billion sq. ft. of leather being made in India. About 20 thousand tons of chrome tanning agent is discharged in the consequent wastewater. CSIR has developed a “Waterless tanning technology” that a) completely eliminates two processes before and after tanning, b) eliminates the use of water in tanning, c) reduces the total dissolved solids in wastewater from this process by 20% and d) brings down the usage of chromium by 15-20%, resulting in material saving. The technology has been widely accepted in the country, with over 100 tanners in all clusters enrolling for its adoption. Several countries including Ethiopia, South Africa, the Netherlands, New Zealand, Vietnam and Brazil have evinced interest in this CSIR technology.

- **CSIR Developed Cost-effective technology to treat Tannery Effluents – Towards Swachh Bharat**

  A technology that separates sodium chloride and sodium sulphate found in waste in common effluent treatment plants (CETP) has been developed by CSIR-Central Salt and Marine Chemicals Research Institute (CSIR-CSMCRI), Bhavnagar. Once separated, the salts can be reused in preserving hides and in tanning process. The technology will drastically cut down the cost of treating effluents from tanneries. The CSIR constituent laboratories, CSIR-Central Leather Research Institute (CSIR-CLRI), Chennai and CSIR-CSMCRI have signed an MoU with All India Skins and Hides Merchants Association to initiate the trials of the technology in Gujarat.

CSIR Developed Divya Nayan – Portable Reading Machine for Visually Impaired and Low-literacy Populations

Portable Reading Machine (PRM) is an assistive device for visually impaired that helps them reading printed documents, e-books, or recorded speech. It is based on the principle of contact scanning of a printed document and converting it into speech. The device is stand-alone, portable, wireless and uses open source hardware and software. The device can analyze a multi-column document and provide seamless reading. It is capable of page, sentence and word level navigation while reading. It helps visually impaired to read print media as well as electronic files such as eBooks. It has support for speaking Hindi, English and is further compatible for other Indian languages such as Bengali, Kannada, Malayalam, Marathi, Punjabi, Tamil, Telugu, etc. The device may also be readily configured for major foreign languages, and find application extensions in low-literacy populations for improved understanding of written documents.

CSIR Developed Integrated Drishti-Aviation Weather Monitoring System (D-AWMS)

The first Indigenous Aviation automatic Weather Monitoring System has become functional at the Mangalore International Airport w.e.f. 25th June 2017. This integrated Weather Monitoring system has been developed and deployed jointly by CSIR-National Aerospace Laboratories (CSIR-NAL) and India Meteorological Department.

The main feature of this system is that it measures Wind Speed, Wind Direction, Pressure, Temperature and Relative Humidity along with Visibility which are critical for aviation safety. A mandatory system required for Airport operations has been developed, as per the International Civil Aviation Organization (ICAO) requirements. In view of indigenous efforts, saving of foreign exchange to the country also accomplished.

- **Timescale of ISRO's GPS 'NavIC' gets synchronized to the Indian Standard Time (IST) generated by the "Primary Atomic Clocks" of CSIR-NPL**

A symposium on Indian Strategy on Quality Infrastructure was held on 29th November, 2017 to highlight the role of accurate and precise measurements for building the quality infrastructure of the country. The symposium highlighted the importance of measurements and the ways through which it facilitates international trade, and enhances the quality of life and the environment. The symposium was attended by more than 400 foreign delegates from 31 countries.

The symposium witnessed a landmark occasion, as the Timescale of Indian GPS (NavIC - NAVigation with Indian Constellation) developed by Indian Space Research Organization (ISRO) was synchronized to the Indian Standard Time (IST) generated by the "Primary Atomic Clocks" of CSIR-NPL. The link was dedicated to the Nation.

MoU between CSIR and ISRO for Time and Frequency Traceability

CSIR-NPL is the custodian of Indian Standard Time (IST) and has the national responsibility for realization, establishment, maintenance and its dissemination. As a 'National Metrology Institute', CSIR-NPL has the mandate to maintain 'Indian Standard Time' (IST) using the most up-to-date technologies. The National Time Scale is contributing to the Universal Coordinated Time (UTC) maintained by International Bureau of Weights and Measures (BIPM) and has uncertainty of 20 nano-second.

A MoU was signed between CSIR and ISRO on August 04, 2017 under which CSIR will provide time and frequency traceability to ISRO. Under the MoU, CSIR-NPL will provide the UTC traceability to the Time Scale of the Indian Regional Navigational Satellite System (IRNSS), an independent navigation satellite system, being developed by ISRO. The all in view GPS P3 technique will be used by CSIR-NPL for providing traceability to ISRO's time scale. Due to the criticality of precise time signals for satellite navigation, Two Way Satellite Time and Frequency Transfer (TWSTFT) system between CSIR-NPL's Laboratory in New Delhi and ISRO's Laboratories in Bangalore and Lucknow has been setup to provide few nanoseconds uncertainty to the ISRO's time scale.

In satellite based navigation systems, the spatial resolution is decided by precise synchronization of the clocks embedded in the end user's device with clocks in the satellites. The accuracy of satellite navigation systems depends on the proper synchronization of on-board clocks. For navigation purpose atleast four satellites are needed to know someone's position accurately. The time have to be incredibly accurate as light travels 30 centimetres in one nanosecond (or 300 million metres in one second) so that any tiny error in the time signal could put a defined activity by a very long way.

- **Lithium Ion Battery: India's First Fabrication Facility by CSIR**

CSIR has developed the following technologies in this area: High performance kish graphite anode materials for Li-ion batteries; High performance lithium transition metal oxides cathode materials for Li-ion batteries; Advanced polymer separators for Li-ion batteries; Magnesium-Organic Battery Technology (6V / 200 Ah); Ni-MH battery for EV applications (12V/50Ah); and Ni-Fe battery for EV applications (12V/60 Ah). India's first lithium ion battery fabrication facility based on indigenous novel materials for making 4.0 V/14 h standard cells has been established. The so developed technology on the Li-ion batteries is to be commercialized soon.

· CSIR's Certification for Coal used in Power Plants

CSIR entered into an MoU with Coal Supplying Companies and Power Utilities for quality analysis of coal being supplied to power utilities by coal supplying companies. This collaboration will enhance efficiency of use of coal by power sector. As a part of the MoU, CSIR-CIMFR would make use of its knowledgebase support in maintaining the quality of coal at national level for the entire power sector. It is estimated that about 300 million metric tons of coal samples would be analyzed for quality per year. The contract value of the project is around Rs. 250 crore per annum.

The CSIR effort will result in improvement in performance of power plants, besides leveraging benefits to the consumer in particular and society as a whole as a result of more efficient power generation and less pollutants at generation stage.

- **CSIR's Twinning Programme with the Metal Industries Development Institute (MIDI), Ethiopia**

  CSIR has entered into an agreement with the Metal Industries Development Institute (MIDI), Ethiopia on June 7, 2017 to implement a twinning programme. CSIR won the seven million US dollar assignment through a process where many international organisations, including from European countries, were initially considered by Ethiopia for the programme. CSIR will enhance the capacity and capability of MIDI under the twinning arrangement and thereby enable it to contribute more efficiently towards the development of Metals and Engineering sectors in Ethiopia and thus enhance their competitiveness. The MIDI will be positioned to emerge as a globally competitive center of excellence in the field of Metals and Engineering, through the twinning programme.

- **CSIR Agreement with Agricultural Skill Council of India: For Skill Upgradation in Aquaculture and Fisheries**

  CSIR-National Institute of Oceanography (CSIR-NIO), Goa has signed a memorandum of understanding (MoU) with the Agricultural Skill Council of India (ASCI), to collaborate for capacity-building programmes focused on upgrading local workers' skills in aquaculture and fishery. ASCI aims to create an ecosystem for quality vocational education in agriculture and allied sectors. CSIR-NIO will support it in developing national occupational standards, curriculum and course content for various segments connected to fishery.

- **CSIR-IMTech and Johnson & Johnson Enter into Partnership for Collaborative Research on New Drugs for Tuberculosis**

  A MoU was signed between CSIR-IMTech and global multinational healthcare company, Johnson & Johnson Private Limited on 16 August 2017 for Collaborative Research on New Drugs for Tuberculosis. The MoU between CSIR-IMTECH and Johnson and Johnson will enable collaborative research and facilitate scientists from both organizations working together on a R&D program to explore potentially more effective, safer, all-oral treatment regimens to tackle multidrug-resistant TB (MDR-TB), as well as new molecular entities to treat TB patients.

  The collaboration with companies like Johnson & Johnson will bring a paradigm shift in drug discovery approaches for TB in India, where CSIR-IMTech will provide microbiology and medicinal chemistry expertise and Johnson & Johnson will provide its preclinical resources and drug development support. The research collaboration will help support the ambitious national plan of eliminating TB by 2025.

  The collaboration resonates with the Government of India's mission of 'Swasth Bharat' (Healthy India) and 'Make in India' especially for new drug discovery and development. Over the years, CSIR has contributed significantly in the domain of affordable health care. The capacity of generic drug industry in the country which produces the cheapest drugs in the world today has been built based on CSIR's end to end contributions.

- **CSIR Agreements with Technology Transfer Company (i.e. NRDC) and Industry Association (i.e. CII) – Towards Ease of Doing Technology Business**

  CSIR has entered into Agreement of cooperation with the Confederation of Indian Industry (CII) and National Research Development Cooperation (NRDC). These efforts are to enhance the technology commercialization and deployment of CSIR interventions and also focus on aligning the Council's R&D efforts to India's key aspirations under Make in India, Digital India, Start-up India, Skill India, Clean India etc. Enabling synergy with the needs of the line ministries will also be pursued through the cooperation. The cooperation is envisaged to lead to development and deployment of critical platform technologies/product technologies for value addition to the manufacturing sector of the country.

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