

**GOVERNMENT OF INDIA  
MINISTRY OF SCIENCE AND TECHNOLOGY  
DEPARTMENT OF SCIENTIFIC AND INDUSTRIAL RESEARCH**

**LOK SABHA  
UNSTARRED QUESTION NO. †293  
ANSWERED ON 24.07.2024**

**ROLE OF CSIR IN SOCIAL AND ECONOMIC DEVELOPMENT**

**†293. Shri Jugal Kishore:  
Shri Satpal Brahamchari:**

**Will the Minister of SCIENCE AND TECHNOLOGY be pleased to state:**

- (a) the role of Council of Scientific and Industrial Research (CSIR) in providing the necessary foundation of knowledge for the social and economic development in the Country including rural areas and small cities;**
- (b) the details of the achievements made and performance noticed in this regard during the last three years;**
- (c) whether several new measures have been taken by the CSIR to instill scientific thinking in youths; and**
- (d) if so, the details and the positive outcomes thereof?**

**ANSWER**

**MINISTER OF STATE (INDEPENDENT CHARGE)  
MINISTRY OF SCIENCE & TECHNOLOGY  
(DR. JITENDRA SINGH)**

- (a) Council of Scientific and Industrial Research (CSIR) is positioned to undertake research and development focused at the unmet need and deliver knowledgebase/ technology to benefit the masses and Indian industry. CSIR has been pursuing diverse Scientific and Technological activities and thus has been delivering as per national priorities. CSIR is utilizing the knowledgebase and technologies developed/available in its constituent's laboratories/ institutes for addressing the challenges through various projects, which enables deployment of relevant CSIR technologies/innovations/interventions in rural areas and small**

**towns across the country for augmenting the incomes and improving the quality of lives in the villages.**

**(b) The significant achievements/initiatives of CSIR for socio-economic development of the country including rural areas and small cities during the last three years is placed at Annexure-I.**

**(c)&(d) Yes, Sir. The significant measures/ initiatives taken by CSIR to instil scientific thinking in youths is at Annexure-II.**

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**The major recent achievements/initiatives of CSIR for socio-economic development of the country including rural areas and small cities**

**CSIR Aroma Mission:** The mission envisaged to catalyse rural empowerment through cultivation, processing, value addition and marketing of aromatic plants. Under this Mission, more than 36,600-hectare land has been brought under cultivation of aromatic crops generating employment of about 71 lakh rural mandays and 110 startups/new entrepreneurs. CSIR enabled the famed **Purple Revolution** by introducing Lavender cultivation in 10 districts of J&K benefitting more than 1000 farming families through increasing their income from Rs. 20,000/- to Rs. 200,000/- per acre per year. **Atmanirbharata in Lemongrass essential oil:** with the implementation of CSIR Aroma Mission, India has become one of the largest exporters of lemongrass essential oil in the world with about 600 tonnes worth Rs.60 crores of lemongrass essential oil exported during 2021-22. **Golden revolution in Himachal Pradesh:** Himachal Pradesh becomes the highest producer of aromatic marigold essential oil in the country leading to the production of 8 tonnes of marigold oil (worth Rs. 11.2 crore), which has enhanced the farmers' income 2.5 times over traditional crops (Rs. 50,000-60,000/ha/year). The CSIR Aroma Mission has enabled the Indian farmers and aroma industry to become global leaders in the production and export of various essential oils like menthol mint, lemongrass, etc.

**CSIR-Floriculture Mission:** CSIR initiated a 'Floriculture Mission' in 2020-21 with the aim to utilize the knowledgebase available in CSIR institutes and leverage it in an effort to help Indian Floriculture farmers and industry reposition itself to meet the import requirements in the domain. The mission is helping in enhancing the farmers' income and entrepreneurship development through high value floriculture utilizing CSIR technologies. Its implementation has helped to bring about 4121 hectares of land under cultivation in 245 clusters covering 24 States and UTs benefitting about 14,150 floriculture farmers. A significant achievement is the indigenous development of Tulip bulb production in Lahaul & Spiti that helped in reducing the import of planting materials. For the domestication of indigenous wild ornamental plants, propagation techniques including Tissue Culture have been developed for 20 species that are collected from Western Himalaya, Eastern Himalaya, Western Ghats, Eastern Ghats and Indo-Gangetic plains. In collaboration with the Khadi and Village Industries Commission (KVIC), Apiculture has been integrated with CSIR Floriculture Mission for high quality Honey production. So far total 50 clusters have been established with the distribution of about 5800 Bee Boxes provided to the clusters developed by CSIR Labs benefitting around 8000 farmers.

**CSIR Seaweed Mission:** CSIR through its Seaweed mission aimed to "Generate the knowledge and innovations that would help make seaweed cultivation a new form of agriculture which is remunerative, eco-friendly, sustainable and expansive in scope". CSIR takes pride for being the first in the country to pioneer the *Kappaphycus alvarezii* cultivation technology leading to commercial farming of the seaweeds in India. So far, there are more than 800 self-help groups (SHGs) in Tamil Nadu which have adopted *Kappaphycus* cultivation as means of their livelihood. The Seaweed research resulted in to the development of a new seaweed industry generating additional employment opportunities and revenue. The training programmes in seaweed cultivation enhanced the awareness and promoted the seaweed cultivation in the country. About 5000 fishermen were trained so-far under various schemes, especially in Tamil Nadu, Gujarat, Andhra Pradesh. Bio-stimulant (seaweed sap) and Phycocolloids (carrageenan, agar, agarose) are the value-added products being produced

from seaweed. Production of Liquid seaweed plant biostimulants from *Sargassum* spp. (Indian Patent IN 201811029622)

**Cotton Mission:** The aim is to develop next-generation transgenic cotton for broad-spectrum resistance to field pests for yield protection. For the control of the devastating cotton insect pest whitefly, CSIR-NBRI has developed 33 GM cotton lines using its patented gene Tma12. These GM cotton lines show significant tolerance to whiteflies. CSIR-IICT is working to address the problem of pink bollworm (another major cotton insect pest). For the control of whitefly vectored viral diseases in vegetable and horticultural crops, CSIR-National Botanical Research Institute, Lucknow has developed a new GM cotton. This GM cotton attracts whiteflies and kills them. It can guard several crops against viral diseases. The technology will enable farmers to grow crops without application of pesticides.

**Indigenous Cultivation of Heeng to reduce imports:** *Ferula assafoetida* (Heeng) one of the top spices in India is imported from Iran, Afghanistan, and Uzbekistan and spends ~100-130 million USD per year. CSIR-Institute of Himalayan Bioresource Technology (CSIR-IHBT), Palampur along with ICAR-National Bureau of Plant Genetic Resources, has addressed the lack of planting material and agrotechnology, which were major bottlenecks in cultivation. Now the plants have been introduced for cultivation in the country with the first seedlings of heeng planted at Lahaul valley after the Institute successfully conducted experiments with plants and seed germination. Cold desert areas of India such as Lahaul and Spiti, Ladakh, parts of Uttarakhand and Arunachal Pradesh are suitable for cultivation of asafetida and can decrease the imports of Heeng substantially after successful cultivation.

**Gaon Ka Pani Gaon Mein:** CSIR has led a Mission mode project for developing Village Level Water Management (VLWM) Plans for augmenting water resources in selected villages. Mission on High-Resolution Aquifer Mapping & Management in Arid Regions of North-Western India has also been launched and implemented in association with the Ministry of Jal Shakti under Jal Jeevan Mission. Use of advanced Heliborne geophysical survey and other scientific studies have been initiated under the Aquifer Mapping Programme of the Mission. So far, 1 lakh Sq. Km Heliborne geophysical survey data has been collected in the states of Rajasthan, Haryana and Gujarat.

**Electric Tractor named CSIR PRIMA ET11:** Considering the need to reduce greenhouse gas emissions and the eventual scarce availability of fossil fuels shortly, CSIR-CMERI, Durgapur has indigenously designed and developed a compact 100% Pure Electric Tractor named CSIR PRIMA ET11 mainly to cater small and marginal farmers of India. The entire tractor has been designed and manufactured with indigenous components and technologies. Another USP of the developed tractor is that it is Women-friendly as to minimize the effort many mechanical systems are replaced with electronic switches for easy operations. The farmers can charge the tractor using a conventional home charging socket in 7 to 8 hours and operate the tractor for more than 4 hours at field. The technology has been licensed to an Industry for commercialization.

**Electric Tiller for Sustainable Farming:** The tiller is one of the most crucial farm machines for field operations in agricultural industry. This improved version of electric tiller developed with an aim to impact in elevating the economic conditions of small and medium income farmers and further contribute towards country's economic growth by providing an alternative for conventional diesel-powered tillers. The Electric Tiller prioritizes user comfort and environmental sustainability, boasting enhanced torque, reduced vibration, and zero exhaust emissions. Equipped with electronic controls and ergonomic handling, the Electric Tiller marks a significant milestone in agricultural machinery, aiming for a more sustainable and efficient farming future. Technology has been transferred to an industry for commercialization.

**Technology developed for reducing property loss due to Earthquake & natural disasters:** CSIR-CBRI and CSIR-SERC have been designing structures that can withstand

earthquakes, and due emphasis and importance are being given to incorporate this aspect in all designs.

**Waste to Wealth technologies to supplement the efforts of Swachta Abhiyan:** CSIR has developed many waste to wealth technologies and products such as spent wash from distillery, plastic waste to diesel, industrial solid waste etc. and these technologies are at various stages of implementation with MSMEs, industries and other partners.

**Steel Slag Valorisation Technology for Conversion of Steel Slag as Road Making Aggregates:** CSIR developed the steel slag valorization technology to convert waste steel slag as road making aggregates. India's first six lane steel slag based road connecting NH-6 to Hazira port was constructed in May, 2022 at Surat, Hazira, using processed steel slag aggregates as substitute of natural aggregates in all layers of bituminous pavement. The unique design features Steel Slag Road built through CRRI technology has been inducted in INDIA BOOK of Records and ASIA BOOK of records as First Steel Slag Road. Border Roads Organisation (BRO) using the CSIR-CRRI technology has laid a one km road in border area of Arunachal Pradesh.

**Development of Indian National Footwear Sizing System:** CSIR-CLRI conducted a nationwide survey on foot dimensions of the Indian population using 3D Digital Imaging technique to establish the Indian Footwear Sizing System. The Indian National Footwear Sizing System that is being developed will help the populace to get well fitting shoes that adhere to the contours of their feet thus ensuring perfect fit and comfort and also prevent foot debilitations.

**3D-Printed Patient-Specific Medical Implants developed:** CSIR-CSIO developed a technology for manufacturing patient-specific medical implants for several human body parts. The technology has been transferred to industry for commercial production and marketing of the product.

**CSIR Skill India Initiative:** CSIR's Skill India Initiative aims to equip young minds with the necessary technological skills through exposure to CSIR labs. In Phase II (2020-25) of CSIR Integrated Skill Initiative more than 1.10 lakhs individuals have been trained in around 2,460 no. of skilling/reskilling/upskilling training programmes as on date across the sectors and disciplines related to scientific and industrial research. Further, CSIR Integrated Skill Initiative has been on-boarded on Skill India Portal (SIP).

**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.

**Process for the recovery of low sodium salt:** CSIR-CSMCRI has developed a new process for the recovery of low sodium salt (mixture of NaCl and KCl). In the new process, low sodium salt of desired composition is obtained directly by desulphating bittern and manipulating the composition of crude carnalite ( $KCl \cdot MgCl_2 \cdot 6H_2O$ ) obtained from such bittern. The new route is most cost-effective when integrated with production of other marine chemicals or when inexpensive sources of calcium chloride are available. The technology has been demonstrated and licensed to M/s Hindustan Lever Ltd.

**Mercury Remediation at Kodaikanal:** CSIR-NEERI has used advanced technology to remove mercury contamination from a 20-acre thermometer factory site in Kodaikanal, Tamil Nadu. This marks India's first full-scale remediation of a hazardous waste site, with mercury levels found up to 9000 mg/kg in a three-acre area of the factory. The project involved dismantling and safely disposing of the entire plant machinery. The factory, which was shut down in 2001 due to toxic exposure protests, was located in an eco-sensitive zone.

**Nontoxic coating formulations:** CSIR-CFTRI developed two nontoxic, OECD approved coating formulations i.e. sodium alginate and methyl cellulose are developed for farm produce. Along with these environment friendly coatings, electrostatic sprayer has been developed by CSIR CSIO which can be used for coating on farm produce so as to increase the shelf life of fruits and vegetables grown by farmers.

**Bio-fumigant formulation:** A bio-fumigant formulation to prevent spoilage of stored food grains from insect pests and the grain storage structure for the efficient long-term storage of grains without infestations was developed by CSIR-CFTRI. The developed bio-fumigant formulation is an alternative fumigant to conventional phosphine and methyl bromide fumigant insecticides.

**Non-toxic, biodegradable material:** Non-toxic, biodegradable material has been developed as ethylene scavenger to increase the shelf life of ethylene sensitive fresh farm produce.

**Non-toxic, biodegradable film:** Non-toxic, biodegradable film as packaging material has been developed as oxygen scavenger to increase the shelf life of packaged foods like bread and bakery items;

**Immunomodulatory teas:** *Immunomodulatory teas* from Munnar, Kangra and Assam region and a combination of regional teas (CSIR Tea) has been developed. The knowhow for processing for varieties growing in these regions is available with CSIR-IHBT, CSIR-NIIST and CSIR-NEIST.

**Medical Devices:** The technology and the prototypes of the low cost healthcare devices like Dialysis machine for haemodialysis, Dristiscope, IoT enabled smartphone based Hand-held colposcope, Plasmonic sterilization device etc. has been developed by CSIR-CEERI and CSIR-CSIO which can be taken up by small industries/MSME for use in rural/small town settings to cater to the health of population.

**Point of care procedures and devices:** CSIR-CCMB and CSIR-IGIB has developed three robust and economical Point of care procedures and devices (namely Direct blood/dried blood spot-based ARMS-PCR, FELUDA based on CRISPR technology and a very simple paper-based diffusion test) were developed to differentiate between patients, carriers and normal subjects of Sick Cell Anemia. The same are now being setup at various centres (Nagpur and Raipur) in Maharashtra and Chhattisgarh respectively through sharing the expertise from one dedicated Centre which has developed these protocols. A blood-based cheap genetic testing protocol was developed which can obviate the need for sophisticated tests. This is particularly relevant to rural and tribal areas where Sick cell disease is more prevalent.

**IR technology (both NIR and MIR) based instruments for milk analysis:** The affordable yet state-of-the-art IR technology (both NIR and MIR) based instruments for milk analysis, which involved the detection and quantification of all possible adulterants in milk besides the measurement of milk constituents has been developed by CSIR-CEERI. The Mid Infrared based System detects adulterants like urea, sugar, maltodextrin. Another device, Milk Analyser has also been designed and developed for measurement of microbial contamination in milk, early mastitis detection and somatic cell measurement in raw milk. The affordable systems are useful in catering to the rural population which are also involved in cattle rearing and milk production.

**Region specific and pan Indian Dense and Nutritious foods:** Region specific and pan Indian Dense and Nutritious foods has been developed keeping in view of the societal role of CSIR for School children that meet the RDA requirement of nutrients through Food based approach.

**Technology for large scale recycling of parali (paddy/straw) and wheat straw:** CSIR-AMPRI, Bhopal has developed a technology for large scale recycling parali (paddy/straw) and wheat straw for manufacturing hybrid green composite particle/fibre boards in pilot scale. The technology has already been transferred to the Haryana government for commercialization

through the MSME sector in the state. The technology was also transferred to a Chandrapur (Maharashtra)-based private unit for commercialization.

**Sickle Cell Anaemia (SCA) Mission:** Under the mission, CSIR in collaboration with State Medical Colleges and clinical centers are involved in Population screening, genetic testing, carrier testing, prenatal diagnosis and genetic counselling, treatment of identified patients. More than 2 lakh people have been screened for the disease. CSIR along with Cadila has got the DCGI approval of use of Hydroxyurea in SCA patients.

**Zero Waste Potash technology:** CSIR in collaboration with an engineering partner has developed complete technology solution for valorisation of spent wash generated in sugarcane molasses based alcohol distillery. The process allows utilisation of spent wash for production of value-added by products, viz., potash fertiliser, animal feed ingredient etc., while achieving statutory compliance with 'zero liquid discharge' norms. The process know-how has been licensed to M/s Aurangabad Distillery Limited for commercialization which commissioned the first full-fledged commercial plant at Walchandnagar, Maharashtra.

**Dental Implants:** A indigenous dental implant has been designed, developed and successfully validated in human clinical trial. The technology for Dental Implants has been transferred to an industry which has obtained the CE certification in the year 2021 and has commercialized the implants in the name of "ifix" in India. The Hon'ble PM issued a letter of appreciation for this technology.

**Bharatiya Nirdehak Dravya, (BND®):** CSIR has been engaged in the production of Indian Certified Reference Material (CRMs) Trademarked as BHARATIYA NIRDESHAK DRAVYA, (BND®) by signing a MoU with NABL accredited reference material producers for the speedy production of CRMs to meet the national demand. CSIR has initiated CRM production under "Make in India" initiative for "cost-effective" production. The availability of SI traceable BNDs® is poised to boost the "Aatmnirbhar Bharat" initiative and harmonize the quality infrastructure in the country and equip the quality regulatory bodies of almost all the ministries.

**Food and Consumer Safety Solutions Mission:** The Mission has led to the development of several technologies under various paradigm of food safety. Some of the technologies have been commercialized and several others are under different stages of validation for taking up by the industries or regulatory stakeholders. The Mission has led to creation of ecosystem where CSIR and regulatory body, FSSAI, will work together to bring affordable technologies for food safety and testing in the market and raise the awareness among consumers.

**Solar Energy based Cooking System (Solar Chulha):** CSIR-CMERI has developed a Solar Energy based Cooking System (Solar Chulha). The institute has developed three types of solar energy based cooking systems (Solar Chulha), namely, (i) Solar PV energy based electric cooking system; (ii) Hybrid solar PV and Biogas cooking system; and (iii) Solar assisted improved biomass cooking system. Technology of solar PV energy based electric cooking system has been transferred to two industries on non-exclusive basis for production and commercialization.

**Mechanized Sewage Cleaning System:** CSIR-Central Mechanical Engineering Research Institute (CSIR-CMERI), Durgapur has developed a mechanized sewage cleaning system for urban and local bodies. The machine is designed for up to 5,000 people density i.e. best suitable up to 300 mm diameter and up to a 100-metre length of the sewer system. The scavenging system is very economical and it will help the manual scavengers to enhance their efficiency, performance and also safeguard them against intrusive pathogens. Technology know how has been transferred to two industries for production and commercialization

**SARS-CoV2 pandemic and CSIR's contributions towards mitigation:** CSIR stayed at the forefront for the development of several key products and technologies for mitigation of COVID-19, and also made progressive advancements with the developed technologies. Some of the notable technologies developed are as under:

- CRISPR/Cas based paper diagnostic kit (FELUDA);
- Dry-Swab-Direct-RTPCR Diagnostic;
- Clinical Trials of Ayurveda based drugs;
- Process for Remdesivir and Favipiravir;
- Swasth Vayu Non-invasive Ventilator;
- Oxygen Concentrator Plants;
- Make-Shift Hospitals for COVID-19 patients; and
- UV-C Virus Disinfection System, etc.

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### **The significant measures/ initiatives taken by CSIR to instil scientific thinking in Youth is as under:**

#### **CSIR-JIGYASA Program**

To promote scientific temper amongst the school students, CSIR had launched the programme named “JIGYASA” in collaboration with Kendriya Vidyalaya Sangathan (KVS). The programme envisages opening up the national scientific facilities to school children, enabling CSIR scientific knowledgebase and facility to be utilized by school children to instil ‘Scientific Thinking’ in the young minds. Till date, more than 9,50,000 students and about 29500 teachers have benefitted, directly since the inception of JIGYASA Programme. Taking forward CSIR’s Jigyasa program to millions of school students, the Jigyasa-Virtual Lab concept has been formalized in association with IITB, Mumbai. The Virtual Lab platform shall enhance the scientific temper amongst school children where the students will read, have fun and carry out experiments and materials which are presented by the CSIR scientists and other stakeholders.

New initiatives undertaken by CSIR to promote scientific temper under JIGYASA Program include launch of CSIR Sign Language Enabled Astronomy Lab and Science Mobile Lab; 70+ Artificial Intelligence (AI) related Programs which were organized by multiple CSIR Labs across the country during July to August 2023 benefitting more than 9000 students and around 400 teachers; An online talk on the occasion of “Janjatiya Gaurav Divas” in which more than 4115 students and 250 teachers from 84 Schools benefitted; A Science Mobile Lab developed by CSIR- CCMB in partnership with Vishveswarayya museum of Bangalore (under CSIR-Jigyasa and NCSM collaboration) has been launched to visit urban and rural schools, colleges and hospitals in Telangana and Andhra Pradesh states; CSIR JIGYASA Empowering Pupil Innovation and Creativity (EPIC) Hackathon 2024 which invites young and enthusiastic school students across India to join in the journey of developing their Innovative, scientific and entrepreneurial skills.

#### **CSIR-Skill India Initiative**

CSIR has launched the program on ‘Skill India Initiative’ which aims to equip young minds with the necessary technological skills through exposure to CSIR laboratories. In Phase II (2020-25) of CSIR Integrated Skill Initiative more than 1.10 lakhs individuals have been trained in around 2,460 no. of skilling/reskilling/upskilling training programmes as on date across the sectors and disciplines related to scientific and industrial research. Further, CSIR Integrated Skill Initiative has been on-boarded on Skill India Portal (SIP).

#### **Capacity Building & Human Resource Development Programme**

Under its Capacity Building & Human Resource Development, CSIR has the following schemes to promote science and technology research in the country and to foster scientific temperament among youth:

- To nurture the budding scientific talent, the CSIR has been awarding doctoral and postdoctoral fellowships in area to pursue research in basic science, engineering and pharmaceutical and medicinal sciences;
- To promote interaction amongst the Indians research students and faculty with the internationally acclaimed scientists and technologists from abroad, CSIR provides financial assistance to research students to attend the seminars/symposia abroad to present their research work with the objective to gain from the experience and research of the foreign scientific fraternity in their specialized areas. CSIR also promote knowledge sharing by way of funding to national/international seminars/symposia by the Indian academic and R&D institutions;
- CSIR also supports the research proposals from the universities and R&D institutions in frontier areas of science and technology. These extramural research schemes are very fruitful in building the R& D capabilities which in turn benefits the country in its scientific pursuit. Furthermore, CSIR under its Emeritus Scientist Scheme provides funds to experienced retired scientists to pursue the research and
- In addition to this, to promote science and technology research in the country and to nurture the budding scientific talent, CSIR has been conducting CSIR-UGC National Eligibility Test (NET) twice a year for award of Junior Research Fellowship (JRF) and Eligibility for Lectureship. A large number of science & engineering students are also offered Senior Research Fellowships (SRFs), Research Associateship (RAs) and Senior Research Associateship (SRAs) for pursuing doctoral and postdoctoral research. CSIR also provides fellowships to GATE/GPAT qualified candidates to pursue research in engineering and pharmaceutical and medicinal sciences.

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