GOVERNMENT OF INDIA
MINISTRY OF SCIENCE AND TECHNOLOGY
DEPARTMENT OF SCIENCE AND TECHNOLOGY
RAJYA SABHA
UNSTARRED QUESTION NO. 1890
ANSWERED ON 22.12.2022

DEVELOPMENT OF SOCIALLY USEFUL TECHNOLOGY

1890. SMT. SANGEETA YADAV:

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

(a) whether it is a fact that Government has developed technologies which are of direct relevance for the mankind;

(b) if so, the details thereof during the last three years particularly for women folk; and

(c) the details of socially useful technologies developed by the Ministry and to what extent they have been able to ameliorate the lot of the common man?

ANSWER

MINISTER OF STATE (INDEPENDENT CHARGE) FOR THE
MINISTRY OF SCIENCE AND TECHNOLOGY & EARTH SCIENCES
(DR. JITENDRA SINGH)

(a) & (b): Yes Sir. Government has developed and demonstrated innovative tools & technologies which are of direct relevance for the mankind. The brief details of the technologies developed is at Annexure–I.

Some of the noteworthy technologies developed during last three years particularly for women folk to address their issues related to drudgery reduction, health & nutrition, hygiene & sanitation, education, safety and social security etc. are at Annexure-II.

(c) Ministry is making continuous efforts through deployment of socially relevant technologies for the livelihood generation and improving quality of life especially in rural and other deprived landscape. Brief details of socially useful technologies developed under Ministry with focus on enhancing the farmer's income, entrepreneurship development involving artisans and rural population through technologies is at Annexure-III.

Annexure-I

Technologies developed under Ministry for direct relevance for the health of mankind

- Four COVID-19 vaccines 'DNA Vaccine, ZyCoV- D; Protein subunit vaccine, CORBEVAX™; mRNA vaccine, GEMCOVAC-19™; Intranasal COVID-19 Vaccine, iNCOVACC' supported under "Mission COVID Suraksha-The Indian COVID-19 Vaccine Development Mission" received Emergency Use Authorization (EUA).
- Quadrivalent Human Papilloma Virus (qHPV) vaccine against cervical cancer supported by DBT and BIRAC received market authorization from Drugs Controller General of India (DCGI).
- Anti-viral drug – Virafin (pegylated interferon alpha-2b) developed by Zydus Cadila and supported by DBT-BIRAC for treatment of moderate COVID-19.
- 'Walker with adjustable legs' technology developed in Patna, Bihar transferred to Vissco rehabilitation private limited.
- The first gene therapy clinical trial for Hemophilia 'A' genetic disorder approved by the Central Drugs Standard Control Organisation (CDSCO).
- A novel mechanical nitinol-based clot retriever for the treatment of acute cerebral ischemic stroke.
- Technology for manufacturing of microneedles (MNs) for iron and vitamin B12 deficiency.
- SWADESH - World's first large-scale multimodal neuroimaging database for managing brain disorders.
- Membrane engineered vesicles (mEV) drug of non-pathogenic bacteria for reducing the minimum inhibitory concentration (MIC) in Mycobacterium tuberculosis (Mtb).
- A point of care aptamer based lateral flow detection system for detection of oxytetracycline in cow milk.
- A botanical drug against Dengue developed by ICGEB in collaboration with Sun Pharmaceutical limited.
- Cellulose enzyme technology of about 15,000 L using engineered fungal strain to produce cellulase enzymes at a commercial scale for use in a 2G-ethanol plant.
- A 0.5- 1 ton per day (TPD) CO2 capture (IOT based, fully computer- controlled) pilot plant.
- Cauloside C – a plant-based saponin for Bacterial production of a biosurfactant of plant origin.
- A rapid diagnostic kit for the detection of common fermented foodborne pathogens by LAMP (loop-mediated isothermal amplification) reaction.
- Water testing kit (ERU Kit) for municipal & household water samples.
- Antibodies against the four essential Chikungunya virus (CHIKV) non-structural proteins namely, nsP1, nsP2, nsP3 and nsP4 developed by DBT-ILS and commercialized by Abgenex India Pvt. Ltd., Bhubaneswar, India.
- SwasthVayu- a BiPAP non-invasive ventilator for COVID-19 patients in just 36 days.
- Indigenous RT-PCR diagnostic kit INDICoV™ with Make-in-India components for detection of COVID-19 infection
- CSIR Ushered Repurposed Drugs (CuRED) website to provide information about the drugs, diagnostics and devices.
- Paper based COVID19 detection kit - FnCas9 Editor Linked Uniform Detection Assay (FELUDA)
- UV-C technology for mitigation of airborne transmission of SARS-COV-2

- Second-generation protein-based subunit vaccine for COVID-19.
- Nano-Biosensors and Microfluidics for Healthcare
- Technologies for Robust Structural Health Monitoring of Critical Infrastructure and Conservation & Restoration of Heritage Structures
- Clustered Regularly Interspaced Short Palindromic Repeats (CRISPR) based technique for detection of SCA mutation
- Novel Therapy for Management of Sepsis- body's extreme response to an infection.
- GOMED-Tech: Development, Translation and Commercialization of Genetic tests for prevalent genetic diseases in India
- Image-Guided Vascular Vein Visualizer: VeinViz
- Process technology for large area (10 cm X 10 cm) manufacturing of micro-nano patterned (300 nm - 300 micron) hydrophobic surfaces.
- Efficient and large-scale production of carbon quantum dots (CQDTs) from cheap coal feed-stock
- Divya Nayan: A Personal Reading Machine for Visually Impaired
- Scale-up of AutoCEPH: A software for 2-D Computerized Cephalometric Analysis as a web service
- Truenat for Point of care Tuberculosis detection
- Seaweed Formulations for Productivity and Health of Dairy and Poultry Animals
- Truenat for Point of care Covid-19 detection
- CSIR- Technos-Raman (CTR Series) Raman spectrometers
- Spike Protein based Subunit Vaccine for COVID-19
- mRNA Platform for Vaccines and Therapeutics
- INDICoV™ - Indigenous RT-PCR diagnostic kit
- Continuous, cost-effective and eco-friendly production process for Paracetamol
- Hydrogen based Fuel Cell Bus retrofitted with 40 kW LT-PEMFC Fuel Cell Stack
- Marketing authorization for indigenous diabetic drug

Other societal relevant technologies:

- Community-owned & community-operated affordable safe water solution;
- Enamel coated forced-draft improved biomass cookstove developed;
- Foundry waste-based paver blocks technology;
- Water Quality Monitoring System Architecture and Device;
- Portable, wireless light system for rural India;
- Low cost, portable laboratory workbench for providing science education to school children in rural areas;
- Low-cost carding machine for Namda Weavers of Tonk, Rajasthan;
- Food Processing Technology using Solar Dehydration Technology to produce value added fruit bars/rolls, and formulation of nutritional supplements(drinks/powder) from locally grown fruits & vegetables, millets and/or pulses to address prevalent nutritional issues of Geriatric Population; Pregnant & Lactating mothers & to the School going children;
- Rice De-husking machine & Domestic Egg Incubator;
- Livelihood related technologies suitable for Arid/Desert Regions among others;
- Electrostatic Nozzle for agricultural applications;

- Inter-row rotary cultivator for wide-row crops;
- Precision planter for vegetables;
- Food and Consumer Safety Solutions;
- Offset rotavator for orchards;
- Irrigation scheduler for pressurized irrigation systems;
- Cotton picking head;
- NAROTTAM-App available on the Google play store;
- Internal fuel-based red brick production;
- Happy Seeder for addressing crop burning issue;
- Biorefinery for Roadside fruit juice vendors;
- Low-cost water quality monitoring kit;
- AI machine for sex identification of pupa and cocoon cutting to foster women empowerment in sericulture;
- Pulp extracting machine;
- CHIC CAD software;
- Fuel Briquetting or pelletization technology;
- Drone based Electromagnetic and Magnetic Systems;
- 5kW HT-PEMFC based combined cooling and power system;
- Indigenous Nano-Materials for Construction;
- Hybrid Agro Waste Composite Materials;
- Recycling of E-Waste;
- Electronics Augmentation on Bullet Resistant Bunker (BRB) Vehicle;
- Vertical Slurry Transport System for Lifting of Minerals/Ores in Heterogeneous Regime;
- Thermal barrier coatings for strategic applications;
- Precision instrumentation towards whole-slide digital microscopy for high-throughput analytics;
- Aircraft Testing with Bio-Aviation Fuels blended in Jet A1;
- Development of Cost-Effective Industry Grade Non-Contact Type Online Moisture Sensor Using Microwave and NIR;
- 10kW Fuel Cell Stack and Hydrogen based Fuel Cell Car Prototype;
- Solar DC Cooking System;
- Mechanized Sewage Cleaning System;
- Highly efficient and scalable process for manufacturing of Azelaic acid from oleic acid;
- Coal gasification plant;

Annexure-II

Technologies developed particularly for women folk

- Laxmi Asu Making Machine significantly reduced drudgery of weavers involved in making Pochampally sarees. More than 12000 weaver families benefited from this widely disseminated innovation.
- Garbh-Ini is an Inter discisplinary Group for Advanced Research on BirtH outcomes. Under this initiative, a unique pregnancy Cohort comprising 8000 women has been established using an interdisciplinary approach comprising methodologies of clinical, epidemiological, statistical, genetic, proteomic and imaging sciences to study Pre-Term Birth (PTB). The Garbh-Ini platform has also established biorepository of well characterized clinical phenotypes with around 1 million bio-specimens and ~600,000 ultrasound images.
- Under Unique Methods of Management and treatment of Inherited Disorders (UMMID) programme 1,25,000 no. of pregnant mothers and new-borns have been screened for genetic disorders.
- CHIC CAD software to create newer and innovative embroidery designs for rural artisans It improves the productivity, strengthens earlier design concepts and generates large variety of employment and trade. More than 1085 khakhas (designs) have been prepared through CHIC CAD and 560 women have been trained on the tool.
- Fuel Briquetting or palletisation technology improved efficacy for biomass-based fuel production with high calorific value. It uses biomass vizagri, horti, forest, food processing waste, Lantana, Amla processing waste, Sugarcane baggasse, forest leaves, paddy straw as individual or in combination. The technology is replicated in entire Kandi area and around 200 women were trained under this technology.
- Infection preventing medicated sanitary napkins – NAARI: a low cost medicated sanitary napkin with natural aroma, Aloe vera, natural absorbent and essential oils. It protects from bacterial infection, helps to maintain personal hygiene and gives relief from unpleasant menstrual odour.
- Pulp extracting machine for sorting & washing of the apples and heat treatment of the pulp improved quality control and provided opportunity of developing value-added pulp from B/C grade fruits as well as from surplus crops which helps in income generation of women farmer.
- Electric Sanitary Pad Incinerator (GreenDispo) with improved operational efficiency and reduced power consumption meeting the incinerator emission standards.
- Technology for utilization of offered flowers collected from places of worship for making incense sticks, fragrant cones and rose water. It is popularized with more than 5000 women and shrine boards in all over India especially in major place of worships. Technology helped the Women working at Shri Sai Temple, Shirdi (Ahmednagar) in enhancing their livelihood.
- Value added products (viz. oral contraceptive, minerals & vitamin enriched products, multigrain high protein mix, natural perfumes, herbal lipstick/lip balm etc.) benefitted women in creation of livelihood.
- A low-cost sanitary napkin machine revolutionized the personal hygiene sector and more than 1300 sanitary napkin making units have been installed.
- Walnut cracker for women in Kashmir valley for walnut peeling and cracking activities manually has been developed and boosted for the productivity in food processing industry locally.

- Value addition of Agri-products like Soya Milk, paneer (Toffu), spices and food items like papad, pickle, wadi, garlic paste, squash etc. to conserve traditional knowledge of Indian Women;
- Treerich Biobooster (TRB)- A bio-Product alternative to traditional potting mixture (sand: soil: FYM) is developed from coconut fibre waste, as an alternate source of livelihood support to Irular tribes in forest fringe villages of Coimbatore, Tamilnadu. 255 tribal women, inhabiting the forest fringe village in Coimbatore District, were trained on development of TRB and the product was demonstrated to more than 2500 people at various forums.
- Technology for Minimal Processing of Ready-to-Cook (RTC) Fresh-cut Vegetables and Making designer chocolates through 3-D printing reduced drudgery of women in food processing sector;

Annexure-III

Initiatives undertaken, and technologies developed under Ministry to benefit common man and farmers:

- Three desalination plants of each capacity 1 Lakh litre of potable water per day based on a Low Temperature Thermal Desalination (LTTD) technology developed by National Institute of Ocean Technology (NIOT) have been demonstrated at Kavaratti, Agati and Minicoy Islands of Union Territory of Lakshadweep (where the required temperature difference of about 15ºC is observed between sea surface water and deep sea water) converts sea water to potable water for catering the requirements of the local inhabitants. Based on the success of these plants, Ministry of Home Affairs (MHA) through Union Territory (UT) Lakshadweep has entrusted the work of establishing 6 more LTTD plants at Amini, Androth, Chetlet, Kadmat, Kalpeni and Kiltan with a capacity of 1.5 lakhs litres/day.
- Advance farm equipment like a) Electrostatic Nozzle for agricultural applications, b) Inter-row rotary cultivator for wide-row crops, c) Precision planter for vegetables, d) Offset rotavator for orchards, e) Irrigation scheduler for pressurized irrigation systems and f) Cotton picking head have potential to enable the Indian farming community to adopt modern technology tools to reduce the overall cost of cultivation along with higher production and productivity leading to more environmentally sustainable agriculture.
- A viable technology of an internal fuel-based red brick production process was demonstrated in Bhagalpur, Bihar to address environmental and energy concerns for red brick production in a natural draught zigzag kiln. The technology utilized 2% coal waste with soil before the fabrication of the green brick to reduce the consumption of external fuel, thus resulting in energy savings and reduced emissions. The technology improved energy efficiency by 9%, reduced external fuel consumption by ~30%, reduced air pollution load by 10% (CO, CO_2, NO_x & SO_x), improved compressive strength of fired brick by around 12% and reduced the production cost by 8%.
- To address the serious issue of crop burning contributing towards global warming and environmental pollution Happy Seeder technology was demonstrated to 255 farmers with 141 acres of field in three Agro-climatic zones of Punjab in districts of *Ludhiana, Mansa and Hoshiarpur*. Soil sample analysis revealed an overall increase in the organic carbon content, available phosphorus, dehydrogenase activity and alkaline phosphatase activity. The cost-benefit analysis reflected a saving of INR1585/- per acre besides a reduction in diesel and farm labour use.
- To create an additional source of revenue for the farmers, roadside fruit juice vendors an academic-industrial partnership was created with VNIT Nagpur and Merino Industries Limited (Hapur, UP) to jointly develop and demonstrate biorefinery from citrus waste. A biorefinery is analogous to a petroleum refinery, unlike crude oil, biomass, in the present case waste oranges, are converted into bio-products pectin, fibres, essential oil, cellulose etc.
- Indigenous affordable and robust technological solutions developed under Water Technology Initiative programme in DST promotes application led research to address various water challenges related to water quality, including sustainable technologies for Desalination & Arsenic, Flourides, Iron, Nitrates other emerging contaminants mitigation and monitoring promote solution centric approach to address challenges related to water quantity, accessibility, availability, recycle and reuse.

- ICAR developed 1084 no. of agricultural related technologies for increasing efficiency of agricultural production and quality. These technologies are licensed to different stakeholders in the value chain.
- Improved crop varieties of paddy, wheat, pigeon pea, mustard, carrot, mango, brinjal, cauliflower, onion, pepper, cardamom etc. and value added herbal formulations for the pest management in various crops benefitted a network of over 10,000 farmers from 30 States/Union Territories.
- Ten varieties of high demand indoor decorative plants 'Anthurium' (a flower with high market value) developed by cross-pollination. Anthurium (Anthurium spp.). During the last year, over 8500 plants, as well as the flowers, have been sold to the market of mainly Pune and Thiruvananthapuram. The innovator has been propagating it through cuttings & seeds and supplying some plants and flowers throughout the country, but she was unable to meet the demand due to the time-consuming technique of propagation method.
- Micro Solar Dome (MSD) technology is a low-cost solar lighting device, which harvest sunlight to charge a battery to provide light during day and night (up to 7hrs of light during the night through solar route). The MSD can be fixed into rural roofing structures and can charge mobile phones though USB integrated with the device.
- More than 500 tribal families in West Bengal and Tripura have benefited out of this.
- Cotton stripping machine was widely disseminated in the state of Gujarat amongst people who had to pluck cotton from cotton bolls, which was a drudgery prone task traditionally undertaken manually by women and children. It resulted in eliminating child labour and the drudgery of the women from the sector.
- Mitticool, a large portfolio of earthenware products, including refrigerator has created a mass appeal with all sections of society and boosted focus on eco-friendly products apart from generating employment.
- Traditional Watermills with wooden turbine are replaced with Cast Iron Turbine and Flumes with jet in Uttarakhand and are being used for additional purposes like de-husking, grinding of grains, expelling of oil etc. Besides lifting water, they are also being used as small-scale power generator for meeting local energy needs.
- 3190 water millers are re-employed with the use of improved water mill with average monthly income of approximately Rs.10000/- to Rs.15000/- per month.
- IndiGau chip India's first Single Nucleotide Polymorphism (SNP) based chip for the conservation of pure varieties of indigenous cattle breeds like, Gir, Kankrej, Sahiwal, Ongole, etc. was developed. IndiGau is the largest cattle chip of the world with 11,496 markers (SNPs) more than that placed on 777K Illumina chip of US & UK breeds.
- An energy efficient, innovative and cheap device has been developed which can address the problem of postharvest losses in India. A Start-up Fruvetech Pvt Ltd has been registered (CIN: U72900DL2021PTC376517) for commercialization of this technology.
- Rice crop varieties ADT 46-Sub-1 (Submergence tolerant), MTU-1293 (Salinity tolerant version), HUR 105-Sub-1 (Submergence/flooding tolerance), KR16024 IET-28791 (Submergence tolerance), IR 64-Sub1- DTY2.2 (CR Dhan
- 804) (Submergence tolerance), Shalimar Rice -6 (blast disease resistance), Shalimar Rice -6 (blast disease resistance); Pea crop variety HIM Palam Matar-2 (Powdery mildew resistance); Mungbean crop variety HUM 27 (Early maturing, medium dwarf, green seed, resistant to MYMV) developed by DBT.

- Mission mode programs of CSIR (Aroma Mission, Floriculture Mission, Cotton Mission, Seaweed Mission) across the country aimed at enhancing the farmer's income including women, entrepreneurship development involving rural population through technologies that promote cultivation and processing of economically important plants and development of value-added products.
- Agro-technologies for cultivation and value addition under Purple Revolution in J&K increased the farmer's income from Rs. 20,000/- to Rs. 200,000/- per acre per year.
- Efficient field distillation units for on the farm processing of Lemongrass essential oil has become one of the largest exporters in the world with annual export of 300-400 tonnes Lemongrass essential oil worth Rs. 35-40 crore. Farmers are earning the income of Rs. 30,000/- to 70,000/- per hectare per year depending upon the water availability and environmental conditions
- Improved varieties 'HIMGOLD' and 'HIM SWARNIMA' of wild Marigold (*Tagetes minuta* L.) under Golden revolution in Himachal yielding high grade aromatic oil. Total essential oil production in the country is 6.5 tonnes, which has enhanced the farmers' income 2.5 times over traditional crop.
- Indigenous development of Tulip bulb production initiated in Lahaul & Spiti has helped reduce the import of planting material.
- Domestication of indigenous wild ornamentals: Propagation techniques including Tissue Culture have been developed for 20 species (collected from Western Himalaya, Eastern Himalaya, Western Ghats, Eastern Ghats and Indo-Gangetic plains)
- Natural bioactives formulation named Freshness keeper has been developed to prolong (up to 20 days from existing 14 days) vase life of flowers.
- A novel process to isolate molecular biology grade agarose from Seaweed. Bio-stimulant (seaweed sap) and Phycocolloids (carrageenan, agar, agarose) are the value added products being produced from seaweed. About 7000 farmers have been trained in seaweed cultivation and ten entrepreneurs (MSME) are into the processing of Seaweed for value added products.

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