

**GOVERNMENT OF INDIA
MINISTRY OF SCIENCE AND TECHNOLOGY
DEPARTMENT OF SCIENCE AND TECHNOLOGY
LOK SABHA**

**UNSTARRED QUESTION No. 2485
TO BE ANSWERED ON 21.12.2022**

TECHNOLOGIES HAVING RELEVANCE TO MANKIND

† 2485. SHRI PARBHUBHAI NAGARBHAI VASAVA:

Will the Minister of **SCIENCE AND TECHNOLOGY** विज्ञान और प्रौद्योगिकी मंत्री 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 tribals; and**
- (c) the details of socially useful technologies developed by the Ministry and to which extent they have been able to ameliorate the lot of the Adivasis and Vanvasis?**

ANSWER

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

विज्ञान और प्रौद्योगिकी तथा पृथ्वी विज्ञान मंत्रालय के राज्य मंत्री (स्वतंत्र प्रभार)
(डॉ. जितेंद्र सिंह)

(a) & (b) Yes Sir. The Government has developed several technologies which are of direct relevance for the Mankind. The technologies developed are not community specific and are relevant to tribals also. The details of such technologies developed in the last three years are given in Annexure – I.

(c) The details of socially useful technologies developed by the Ministry and to the extent they have been able to ameliorate the lot of Adivasi and Vanvasis are given in Annexure – II.

Annexure - I

| Sl. No. | Technology |
|----------------|--|
| 1 | Production of turmeric from fresh turmeric rhizome |
| 2 | Compounded asafoetida |
| 3 | Amla candy |
| 4 | Composite ragi bread |
| 5 | Fruit spreads |
| 6 | Ginger dehydration & bleaching |
| 7 | Green chilli sauce |
| 8 | Protein enriched buns |
| 9 | Ready to use idly batter and dosa batter |
| 10 | Turmeric curing & polishing |
| 11 | Cereal flakes rice |
| 12 | Flomop (surface disinfectant) |
| 13 | Mosrep (mosquito repellent agarbatti) |
| 14 | Naari (infection preventing aromatic sanitary pad) |
| 15 | Herb based mospray (mosquito repellent spray) |
| 16 | Herb based mosaway (mosquito repellent cream) |
| 17 | Herb based cracknil- anti crack cream |
| 18 | Making of incense sticks from offered flower |
| 19 | Menthaarvensis (kosi, saryu, kranti and unnati) |
| 20 | Palmarosa (cv. Prec-1, triptaandcim-harsh) |
| 21 | Khus (vetiver) cv. Cim- vridhi and ks-1 |
| 22 | Lemongrass (cv. Krishna and shikhar) |
| 23 | Geranium (bourboun type-cim-pavan) |
| 24 | Gulab (rose) cv. Noorjahan and rani sahiba |
| 25 | Citronella cv. Bi-13 and jalpallvi |
| 26 | Tulsi (basil) cv. Cim- saumya |
| 27 | Sarpagandha cv. Cim- sheel |

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| 28 | Ashwagandha cv. Poshita and nimtli-118 |
| 29 | Kalmegh cim-megha |
| 30 | Satavar cim-shakti and cim sunahri |
| 31 | Rural movable bio- methane reactor |
| 32 | Improved soft coke making technology |
| 33 | Contactless auto uv disinfect unit or chamber for touch screens, thumb or finger scanners and keypads of biometric identification devices and other devices or systems |
| 34 | Development of leather and products from chicken feet Skins, “exploring the unexplored raw materials for leather processing” |
| 35 | Sole from fleshing waste |
| 36 | Preparation of compost from animal hair waste (process based technology) |
| 37 | Co-digestion of tannery solid wastes for biogas generation |
| 38 | Demineralized bone matrix: an osteoinductive material which induces new bone formation |
| 39 | Retanning agent from paper industry wastes |
| 40 | Chrome – melamine syntan |
| 41 | Waterless chrome tanning technology (wctt) |
| 42 | Preservation-cum- unhairing (pcu) process |
| 43 | Odor abatement system for tanneries |
| 44 | Dry tanning (dispersing agent) |
| 45 | A process of using thermocol (expanded polystyrene) waste in hot bituminous mixes for road construction |
| 46 | Development of electro-mechanical field density gauge |
| 47 | Vehicle mounted automatic controlled mobile bridge inspection device |
| 48 | Design of noise barrier based on different frequencies (a) low frequency noise barrier configuration (b) middle frequency noise barrier configuration and (c) high frequency noise barrier configuration |
| 49 | New process for preparation of harder grade bitumen (vg40 and vg50) for formation of asphalt surfacing for roads and airfields |
| 50 | New design for box insertion through highly unstable cohesionless soil by stabilization of vertical cut slopes |
| 51 | Utilisation of pvc pipe waste in modifying bitumen for paving applications |
| 52 | High performance highly modified bitumen and process thereof |
| 53 | Digital grain moisture analyser |
| 54 | Air-assisted electrostatic sprayer for crops |

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| 55 | Postural stability system |
| 56 | Induction motor efficiency monitoring system (imems) |
| 57 | Energy management system |
| 58 | Recycling of waste zinc and lithium batteries to recover useful products |
| 59 | Foot controlled water tap |
| 60 | Virtual intelligent technique for rehabilitation of persons with motor disability |
| 61 | Exoskeleton devices |
| 62 | Control module for touch based finger gesture controlled intelligent patient vehicle |
| 63 | Electronic knee |
| 64 | Recycling of waste CFLs and tubelights |
| 65 | Impedance based grain moisture analyser |
| 66 | Sensor system for fluoride, nitrate & arsenic |
| 67 | Pump efficiency monitoring system |
| 68 | Electrostatic disinfection machine |
| 69 | Electrostatic dust mitigation and smog control device |
| 70 | Divya nayan - a personal reader for the visually impaired |
| 71 | Aerosol canopy for dental procedures |
| 72 | Respiration assistive intervention device - respi aid |
| 73 | Safety goggles – the protective eyewear |
| 74 | Microorganism decontamination box(suraksha) |
| 75 | Knowhow on cultivation of gracilaria debilis and preparation of agar there from |
| 76 | Knowhow for cultivation of gracilaria edulis and preparation of agar there from |
| 77 | Scaled up farming of agarophyte gelidium laacerosa |
| 78 | Cultivation of salicornia brachiata and preparation of nutrient rich salt of plant origin |
| 79 | Decentralized solar thermal dryer for hygienic drying of food products |
| 80 | Herbal incense cones from flowers |
| 81 | Distillation unit (under csir-aroma mission) |
| 82 | Benzene recovery technology |
| 83 | Improved jaggery making plant “gur bhatti” |

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| 84 | Oneer |
| 85 | Argemone oil detection kit (ao kit) |
| 86 | Mustard oil check (mo check) |
| 87 | Foot operated hand washing system (hasta-suraksha) |
| 88 | Disinfectant spray (jeevnasi) |
| 89 | Uv disinfectant |
| 90 | Herbal disinfectant |
| 91 | Touch less hand sanitizer |
| 92 | Incubation hood |
| 93 | Insulated coffin |
| 94 | Hand sanitizer, liquid soap & soap bar |
| 95 | Hands free hand sanitization system |
| 96 | Teracotta "terafil" water filter |
| 97 | Improved smokeless chullah |
| 98 | Wind solar hybrid (wish) system |
| 99 | Jaldost - airboat |
| 100 | Swasthvayu - non- invasive bipap ventilator |
| 101 | Herbal sindoor stick |
| 102 | Anti-cough herbal formulation |
| 103 | Herbal lipstick |
| 104 | Hand sanitizer(non- alcohol) |
| 105 | Herbal antioxidant formulation |
| 106 | Natural colours |
| 107 | Herbal lip care formulation |
| 108 | Nutri jam |
| 109 | Herbal floor disinfectant and cleaner (floormop) |
| 110 | Plant growth promotion formulation for biological control of fungal diseases in crops (bio-inoculants) |
| 111 | Alcohol based herbal hand sanitizer gel |
| 112 | Alcohol based liquid herbal hand sanitizer |

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| 113 | Arsenic free rice - 'muktashree' |
| 114 | Kesari : a promising variety of turmeric for north india |
| 115 | Herbal gulal from floral temple waste |
| 116 | Dehydration of flowers and foliage and floral craft |
| 117 | Ultrafiltration membrane preparation |
| 118 | Preparation of membrane for oxygen enrichment of air |
| 119 | Pop for ganesh idol immersion |
| 120 | Phytorid - scientific wetland with active biodegradation for wastewater treatment (swab) |
| 121 | Electrolytic de- fluoridation technique for fluoride removal in water (edf) |
| 122 | Passive air rejuvenating system for indoor air pollution control (pars) |
| 123 | Wind augmentation and purifying unit (wayu-ii) |
| 124 | Neerdhur: domestic multi-fuel improved cook-stove |
| 125 | Restoration of nallahs with ecological units (reneu) |
| 126 | High rate transpiration system (hrts) |
| 127 | Neeri-zar: portable instant water filter for natural disaster |
| 128 | Microbial culture– for improved efficiency of existing wastewater treatment system (bioculture) |
| 129 | Neerflush: a low-cost affordable technology for improving the sanitation & hygiene |
| 130 | Neerwash: paddle operated hand wash system hands free hand sanitization point -neerjantuk hands free hand washing point -neerwash |
| 131 | Liquid based disinfectant and solid wastes disinfected (sanchar/wichar) |
| 132 | Greendispo - an eco- friendly incinerator for disposal of sanitary pads |
| 133 | Green fire crackers |
| 134 | Hand pump attachable iron removal plant |
| 135 | Citronella (jor lab c-5) |
| 136 | Lemongrass (jor lab l- 8) |
| 137 | Lemongrass (jor lab l- 9) |
| 138 | Lemongrass (jor lab l- 10) |
| 139 | Patchouli (jor lab p-1) |
| 140 | Process for extraction of fibres from banana pseudo stem |
| 141 | Knowhow for fabrication of essential oil distillation unit (300l/day) |

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| 142 | Op-12 biofertilizer |
| 143 | Organic fertilizer- sufal |
| 144 | Vermicompost production |
| 145 | Mushroom cultivation |
| 146 | Domestic stove cum charcoal making unit |
| 147 | Liquid deodorant cleaner |
| 148 | Solid deodorant freshener |
| 149 | Wood care formulation |
| 150 | Anti-mold leather polish |
| 151 | Herbal room/air freshener |
| 152 | Anti-fungal ointment for animal |
| 153 | Herbal anti-bacterial hand wash |
| 154 | Herbal mosquito repellent ointment |
| 155 | Herbal mosquito larvicide |
| 156 | Herbal mosquito repellent spray |
| 157 | Herbal mosquito repellent vaporizer |
| 158 | Herbal mosquito repellent wax candle |
| 159 | Herbal mosquito repellent incense sticks |
| 160 | Herbal anti-arthritis formulation |
| 161 | Composite board from agro-waste |
| 162 | Process for making handmade paper |
| 163 | Process for making low dust chalk pencil |
| 164 | Process for making coloured wax crayons |
| 165 | Biodegradable cutleries, cups, glass and plates from wheat barn, sugar cane bagasse, rice husk, fruit peels and pineapple leaves |
| 166 | Refrigerated adsorption dehumidified drier (radd) |
| 167 | Rapid chiller for coconut water processing & value added products from coconut water |
| 168 | Natural sweeteners from sap of palm, coconut and sugar cane juice |
| 169 | Ready to eat /ready cook products from underutilized resources (raw banana, tubers and pulses) |
| 170 | Development of trikatu syrup |

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| 171 | Technology development for value addition of traditional millets and ancient grains |
| 172 | Technology for functional vegetable oils based on red palm olein (rpo) for culinary use with enriched carotenoids and optimum fatty acid profile for addressing malnutrition and for better health management through dietary approach |
| 173 | Process for spice based herbal tea bag dips with antidiabetic, cardiovascular protection and immune modulatory properties |
| 174 | Technology for red palmolein (rpo) based soft gel as vitamin a supplement for combating vitamin a deficiency |
| 175 | Technology for value addition of indigenous vegetables and fruits |
| 176 | Technology for extraction of bioactives and dietary fibre from spent materials |
| 177 | Clean bioprocess for white pepper production |
| 178 | Swing technology for spice oil, oleo resin and encapsulated flavours from fresh / dry spices |
| 179 | Process know-how for the fabrication of polycoir composite materials as wood substitute for building and furniture applications |
| 180 | Process for development of weather resistant coir geotextile |
| 181 | Bio degradable coir mulching mats |
| 182 | Natural fibres extraction |
| 183 | Compact food waste bioenergy unit |
| 184 | Onsite wastewater treatment cum resource recovery unit |
| 185 | Buoyant filter bioreactor (bfbr) - biological treatment of waste water containing biodegradable solids |
| 186 | Gas biofilter for odour control |
| 187 | Manufacturing endophytic bacterial formulation viz. Plant tonic |
| 188 | Knowhow for automatic hand sanitizer dispenser |
| 189 | Knowhow for automatic air sanitizer |
| 190 | Technology for construction of toilet unit with precast thin segmental elements |
| 191 | Technology for manufacturing textile reinforced concrete (trc) toilet units |
| 192 | Technology for construction of water tank using flow-able cement mortar |
| 193 | CSIR-NAL developed swasthvayu, a bipap non-invasive ventilator for COVID-19 patients |
| 194 | Mrna vaccines tchnology. In addition, the developed technology can be used to develop vaccine for other infectious diseases like dengue, tuberculosis or malaria. |
| 195 | An indigenous RT-PCR diagnostic kit indicov™ |
| 196 | CSIR Ushered Repurposed Drugs (cured) |
| 197 | CSIR-IGIB developed paper based COVID19 detection kit - fncas9 Editor Linked Uniform Detection Assay (FELUDA) |

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| 198 | Ormeloxifine- once a week oral contraceptive pill |
| 199 | Repurposing of umifenovir against covid-19 |
| 200 | Tri-layered reusable face mask with antimicrobial coating |
| 201 | Electrochemical preparation of sodium hypo chlorite (1.0 % naocl) disinfectant |
| 202 | Automated alcohol-based hand sanitiser dispenser |
| 203 | Process for the preparation of coconut oil based soap solution |
| 204 | Design and development of printable face shield to protect from covid-19 |
| 205 | Cyanide free brass electroplating |
| 206 | Flooded lead acid battery |
| 207 | Alternative chemical formulations for reduced emission fireworks. (flowerpots, jiljil and atom bomb) |
| 208 | Alternative chemical composition for the replacement of barium nitrate. |
| 209 | Electrochemical de- fluoridator |
| 210 | Electrochemical de- arsenator |
| 211 | Modified atmosphere packaging of vegetables |
| 212 | Osmo air dried fruits |
| 213 | Dehydrated drumstick powder |
| 214 | Tutti - fruti |

(I) Department of Science and Technology

| <i>Sl. No.</i> | <i>Details of Technology having direct relevance for Tribals</i> |
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| 1. | Improved Sustainable Technology of Muga culture for elevation of cocoon production is developed by Central Muga Eri Research & Training Institute, Jorhat, Assam – have been spread in selected villages of Assam for increasing the production, disease and pests management, new mounting and spinning device and product diversification of Tribal Framers. 200 tribal farmers in Lakhimpur, Dhemaji, Golapara and kamrup district of Assam have benefited out of these technologies. |
| 2. | Organic garbage recycling for the generation of livelihood and zero solid waste” is a technology has been developed for converting the organic waste from homes into value added products like animal feed and compost using simple techniques of segregation and recycling of resources. More than 6,000 tribal households were benefitted in Meghalaya |
| 3. | Carp Seed production and integrated fish farming technology. Improved Carp Seed production techniques with integrated fish farming developed by Central Institute of Freshwater Aquaculture, Bhubaneswar contributed to 2.53-3.18 times higher fish production from ponds in selected villages of Ganjam district in Odisha. Plankton productivity of ponds also increased from 0.8-1.8 to 1.8-2.4 ml/50 litre of water with adoption of better management practices. 250 tribal farmers of Ganjam district, Odisha were benefitted through production of 20.5 lakhs of carp spawn through induced breeding programmes in the established hatcheries. More than 200 tribal families have benefited in Ganjam district in Odisha |
| 4. | Improvised Lac Cultivation and Integrated Bodi Farming resulted in diversified livelihoods, leading to resilience building, income increase and improved nutrition, while conserving the natural resources. 500 tribal families in Gadchiroli, Maharashtra benefitted through this. |
| 5. | Vaccine for mycoplasmosis . Developed by Faculty of Veterinary Sciences and Animal Husbandry, Sher e Kashmir University of Agricultural Science and Technology, Srinagar from local isolates of the mycoplasma. Highly effective in prevention and control of mycoplasma diseases among small ruminants (sheep & goats) reared by tribals in Ganderbal of Kashmir valley and Kargil district of Ladakh |

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| | <p>region in J & K.</p> <p>More than 200 tribal farmers from tribal areas of Ganderbal (Kashmir) and Kargil benefitted and more than 500 No. of animals (sheep and goats) were screened for mycoplasmosis/diseases by Slide agglutination test (SAT) and cELISA.</p> |
| 6. | <p>Improved Wool Shearing machine- Livelihoods of Gujjars and Bakarwals (involved in livestock rearing) in Rajouri, Dhangri and Nowshera blocks, in Rajouri & Poonch district of Jammu & Kashmir is strengthened through adaptation of improved mechanized skills resulting in yield enhancement. An improved access to livestock health management and rearing practices has helped in reduction of mortality rate.</p> <p>The improved wool shearing machine is being used by 120 tribal families for wool processing in Rajouri, Dhangri and Nowshera blocks, in Rajouri & Poonch district of Jammu & Kashmir.</p> |
| 7. | <p>Technology for organic cultivation and production of essential oils from Tulsi. organic cultivation and production of essential oils from Tulsi by hydro distillation method is being done as an alternative income generation avenue by tribals in Odisha. Identification of quality oil yielding Tulsi germplasm, its distribution for sowing and establishment of small scale production unit in the vicinity of rural community is helping in entrepreneurship development amongst the youth.</p> <p>More than 10,000 Tribals were benefitted in Angarapara, Chatabar and Mendhasala gram panchayat, in khurda district of Odisha. Through value added products of Tulsi plant like essential oil by hydro distillation method etc.</p> |
| 8. | <p>Bee-Keeping Mud Hive. The technology developed for wet temperate zones has led to promotion and conservation of indigenous honeybee <i>Apis cerana</i>. The technology has increased local bee colonies and improved pollination which increased the apple productivity by 20 % in apple orchard.</p> <p>500 kg of honey was harvested with scientific processing in one year from 100 colonies leading to 30% increases in income of the farmers in the tribal areas as additional income.</p> |
| 9. | <p>Traditional Watermills. The traditional Watermills with wooden turbine are replaced with <i>Cast Iron Turbine and Flumes with jet</i> 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.</p> <p>3190 water millers are re-employed with the use of improved water mill with average</p> |

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| | monthly income of approximately Rs.10000/- to Rs.15000/- per month. |
| 10. | <p>Micro Solar Dome (Surya Jyoti). 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 through USB integrated with the device.</p> <p>More than 500 tribal families in West Bengal and Tripura have benefited out of this.</p> |
| 11. | <p>Improved Extraction and food processing, technologies were employed for wild edible plant TASHE in Arunachal Pradesh. The energy value, phyto-chemical and other parameters like antioxidant properties were evaluated. Smart technologies were employed for conservation, popularization, sustainable utilization, cultivation and economic value addition for 'Tashe'. More than 200 tribal families benefited from the new and improved technologies.</p> |
| 12. | <p>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. A prototype disc making machine has been installed at Institute of Forest Genetics and Tree Breeding (IFGTB), Coimbatore for demonstration and production of Treerich Biobooster (TRB) to the WSHGs that slowly reduced their dependence on forests. The germination of vegetable crops in TRB enriched with flower compost and vegetable compost is found to be 89% and 84% respectively when compared to 44% in normal potting medium.</p> <p>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. TRB demonstration was given to, 500 farmers from various districts of Tamil Nadu and 75 farmers from VVK and KVK, Thrissur, Kerala. TRB product demonstration was given to 311 Irular tribes of 35 settlements of Coimbatore district at their premises. There has been an increase in income from Rs.150/- per day to Rs.300/- per day due to adoption of technology and the socio-economic studies of 82 households studied during their project periods revealed that the HDI before and after training was 0.680 and 0.841, respectively</p> |
| 13. | <p>Trainings are being given in advanced technologies like Artificial Intelligence, Sensors, Data Science, Computer Networks, Cyber Security and Block Chain Technologies to 34,50,000 ST students in 115 aspiration districts of India.</p> |
| 14. | <p>Advanced technical services that include continuous R&D activities, Product development, Re-engineering, testing facilities, Quality assurance and Market Research, Workshops and Capacity Building programmes for ST Communities are</p> |

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| | <p>being conducted to solve the problems related to predominant livelihood through technological interventions. The technologies like Dual mode groundnut pod stripper, smart fencing system to protect agriculture, invasive plant cutter, smart crop & water management and smart agro sprayer for pesticides and fertilizers have been developed, resulting in drudgery reduction, solving human-wildlife conflict and better management of resources. There is increase in agricultural productivity in the range of 20-25% with increase in household income to the range of 15-20%</p> <p>The technologies are being used by 650 tribals directly and 3408 indirectly in Telangana state.</p> |
| 15. | <p>The Research Centre on Heritage Foods and Beverages established at Institute of Advanced Study in Science and Technology, Guwahati is documenting and validating the traditional and ethnic foods and practices of scheduled tribe (ST) communities of North East. Advanced technologies are being used to standardize and develop fermentation technology for improved quality, safety, functionality, value addition, elucidation of the health promoting properties and the impact of the foods on human health via modulation of gut-brain axis for translating these ITKs into products and technologies for improving the societal health and economy of these communities.</p> <p>The technologies developed will benefit tribal population living in entire Nort East region.</p> |
| 16. | <p>The livelihoods of Lambada Community of Telangana State has been improved by mechanized manufacturing of traditional ornaments and house hold products without losing their ethnicity. Specific need-based technologies like modified CNC based carving machine, mechanized bangle making machine, image based embroidery, coin Stamping and spot welding machine have been developed and introduced to benefit 800 people enabling higher productivity (mechanization), drudgery and waste reduction. A mechanized common facility center for product diversification and training has been established.</p> |

(II) Department of Biotechnology

The technologies developed under the **Biotechnology based programme for societal development** of DBT are being implemented in agriculture and allied sector including animal husbandry, dairy, fisheries; integrated farming system; health & nutrition; environment & biodiversity conservation for benefitting SC/ST population including Adivasi and Vanvasis. In last 5 years, the technologies under this programme have benefited nearly 39,000 rural population including Adivasi and Vanvasis. These projects have resulted in improvement of health and well-being and increase in income of beneficiaries.

DBT-Institute of Life Sciences (ILS), Bhubaneswar, has initiated a number of activities aimed at improving the lives and livelihoods of the tribal farming community. Technological interventions in the Aspirational district Nabarangapur, Odisha, enhanced farm incomes through promotion of integrated farming system as well as fisheries, poultry, goatry, etc., and value addition to primary produce. Several training programs were conducted for ensuring natural resource management and integrated pest and nutrient management, off farm livelihood options as well as promoting nutritional literacy in the region. More than 500 nutrition gardens have been established resulting in enhancing the livelihoods of more than 500 farm families. Technological interventions in promotion of medicinal and aromatic plants have benefitted more than 100 farmers at Tigiria region in Cuttack district. A distillation unit for processing of the medicinal plants has also been established.

(III) Council of Scientific & Industrial Research (CSIR)

CSIR is making efforts through deployment of socially relevant technologies and knowledge base available with various institutes of CSIR especially in rural and other disadvantaged areas for the livelihood generation. Followings are some of the benefits accrued to the common man especially the tribals/farmers:

1. R&D on herbs and medicinal plants in tribal areas

CSIR, through its constituent laboratories is also engaged in R&D on herbs and medicinal plants in tribal areas.

Latest technologies have been used for documenting the medicinal plants used by the tribal communities such as the Bhangalis, Gaddis, Gujjars, Lahulas and Pangwals, of Himachal Pradesh through primary field surveys.

CSIR-CIMAP had conducted survey of the small pockets of forest and hilly areas of the country for assessment of indigenous medicinal herbs to some extent and a total of 80 plant specimens were identified and documented for preservation in the Herbarium and raw drug repository.

CSIR-NEIST had conducted a study of the ethno-medicinal plants of the north eastern region and their traditional uses in curing diseases, covering a large number of ethnic communities like Apatani, Bodo, Chakma, Chautali, Chutia, Dimasa, Garo, Hmar, Jaintia, Karbi, Khasi, Koch, Manipuri, Miri, Mishing, Mishimee, Mizo, Monpa, Moran, Motak, Naga, Nepali, Nocte, Shyam,

Sonowal, Syngpho, Tai, Taangsa, Tiwa, Etc.

Latest technologies have been used, mainly for the purposes of documenting traditional knowledge, validation of medicinal uses and conservation, etc. Agro-based industry potentialities of a number of endemic plant species like *Aquilaria malaccensis*, *Litsea cubeba*, *Curcuma caesia*, *Cinnamomum asomicum*, *Cinnamomum impressinervium*, *Cinnamomum pauciflorus*, *Panax* sp., *Taxus baccata* sub. sp. *wallichiana*, *Betula alnoides*, *Clausena heptaphylla* etc. , many of which are associated with the medicinal, aromatic and spice use in the region.

2. Traditional Knowledge Digital Library (TKDL)

CSIR, in association with the Ministry of AYUSH, has been preserving traditional/tribal knowledge of Indian herbal medicinal drugs in the form of the Traditional Knowledge Digital Library (TKDL), in different foreign languages such as Spanish, Japanese, Chinese and others to prevent the patenting of India's traditional knowledge. The TKDL includes India's rich traditional knowledge related to the Indian systems of medicine, including use of plants and herbs, from classical/traditional books related to Ayurveda, Unani, Siddha and Sowa Rigpa as well as practices of Yoga.

3. Aroma Mission Phase-II: Catalyzing rural empowerment through cultivation, processing, value addition and marketing of aromatic plants

Technologies - Improved, area specific varieties & agrotechnologies; Efficient field distillation units for on the farm processing and Value added products/formulations

- Area Covered under cultivation of aroma crops: ~27,000 hectares
- States covered: 29
- Tribal Clusters developed:20
- On farm processing/distillation units:300
- training/awareness/skill development programmers organized:1124
- Farmers benefitted: ~65,000
- Rural employment generated:12 lakh man days
- Farmers income enhancement: Rs 30,000 – 70,000/- per hectare per year

4. Floriculture Mission: Enhancing farmer's income and entrepreneurship development through high value Floriculture utilizing CSIR Technologies

Technologies - Improved varieties & agrotechnologies (indoor & open field) and value added products/formulations

- Area brought under cultivation of Floriculture crops: 750 hectares
- State covered: 21
- Indigenous development of Tulip bulb production initiated in Lahaul & Spiti has helped reduce the import of planting material.
- Apiculture integration with Floriculture in collaboration with KVIC: 49 clusters established
- 2500 Bee Boxes provided by KVIC distributed to the clusters developed by CSIR Labs benefiting around 2000 farmers
- 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)

5. Cotton Mission: Development of next-generation transgenic cotton for broad-spectrum resistance to field pests for yield protection

Technologies - Transgenic Cotton line resistant to pink bollworm, armyworm and whiteflies; and Methanol Cotton: repels the insect pests

- These technologies offer immense potential to protect the cotton crop from insect pest mediated yield loss in the field.
- These scientific interventions can contribute in increasing the farmers' income through reduction in the cost of pesticide application

6. Seaweed Mission: Technological convergence for sustainable production and utilization of Seaweeds

Technologies -Cultivation of *Kappaphycus alvarezii* for bio-stimulant (fertilizer) production; indigenous red seaweed "*Gracilaria dura*" cultivation in the west coast of India; and a novel process to isolate molecular biology grade agarose from Seaweed

- So far about 7000 farmers have been trained in seaweed cultivation
- Ten entrepreneurs (MSME) are into the processing of Seaweed for value added products using CSIR technologies
- Bio-stimulant (seaweed sap) and Phycocolloids (carrageenan, agar, agarose) are the value added products being produced from seaweed

(IV) Indian Agricultural Research Institute

The details of technologies that have relevance to tribal dominated ecologies are:

- High yielding wheat varieties: HD 3226, HD 3249, HD 3406, HD 3407, HD 3411 for timely sown condition, HD 3271 and HD 3298 for late sown condition
- Nutritionally improved wheat varieties: HD 3226, HD 3298, HI 1633, HI 8823
- Water use efficient wheat varieties: HD 3293
- Short duration High yielding rice varieties: Pusa Basmati 1692, Pusa Basmati 1845, Pusa Basmati 1885
- Herbicide tolerant rice varieties suitable for direct seeding: Pusa Basmati- 1979, Pusa Basmati 1985
- High yielding maize hybrid for MP : PusaJawahar Hybrid Maize 1
- Provitamin A, lysine and tryptophane rich maize hybrids: PusaVivek QPM9 Improved, Pusa HQPM 5 Improved, Pusa HQPM 7 Improved, PusaBiofortified maize hybrid 1)
- Biofortified Bajra hybrid : Pusa 1201
- Gram varieties suitable for central zone including Gujrat, MP etc: BG 3062, PusaChanna 10216, PusaChanna 20211
- Short duration pigeon pea variety: PusaArhar 16
- Lentil varieties: L 4729 for central India, PDL 1 and PSL 9 for drought and salt affected soil, respectively.

During last three years the technologies like wheel hand hoe, pedal operated paddy thresher, pre-germinator paddy seeder, safety device for chaff cutter have been disseminated in seven States of NEH region through 27 KVKs of the region under NEH programme of the institute.

| S.No | Tools/equipment/machinery | Number of units supplied during last 3 years | | | Regions/states covered |
|------|---------------------------------|--|-------------|-------------|---|
| | | 2018-19 | 2019-20 | 2020-21 | |
| | | | | | NEH region |
| 1. | Wheel hand hoe | 1300 | 900 | 900 | (Assam, |
| 2. | Pedal operated paddy thresher | 400 | 150 | 150 | Meghalaya |
| 3. | Peregrinated paddy seeder | 300 | - | - | Mizoram, |
| 4. | Safety gadgets for chaff cutter | 150 | - | - | Arunachal Pradesh, Nagaland Sikkim, Manipur, Tripura) |
| | Total | 2150 | 1050 | 1050 | |
