CSIR Role in National Development – Past, Present and Future

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Director General, CSIR

September 14, 2020
S&T Departments/ Councils

Building and Nurturing India’s S&T Ecosystem...
The First Step ……

Establishment of Board of Scientific & Industrial Research (BSIR) through Deptt. of Commerce resolution no. 148-S&I(1)/40, April 14, 1940 and Industrial Research Utilization Committee on February 01, 1941

Industrial Research Fund (IRF) created on November 14, 1941 through resolution moved by Hon’ble Dewan Bahadur Sir A Ramaswami Mudaliar, Member of the Viceroy’s Executive Council

First session of the UN Economic & Social Council at Church House in London, 23 January 1946.

Mr. Gladwyn Jebb, Executive Secretary of the United Nations, congratulating Sir Mudaliar of India upon his election as first President of ECOSOC.

– was the first step towards birth of CSIR
Resolution to constitute a Council
Department of Commerce Resolution
No. 148.Ind.(157)/41 in 1942

Approval to constitute a Council to be registered as Society under Registration of Societies Act XXI of 1860 called Council of Scientific & Industrial Research
The Role of Philanthropists and General Public

I note from the figures given in your letter that the total contribution received from the general public amounts only to Rs.44,000, the bulk of which is realized from mercantile associations in Calcutta. I am disappointed that the response from the general public has been so poor, particularly from Jamshedpur public, whose total contribution amounts to a surprisingly low figure of Rs.501. I trust efforts to obtain further donations from the public will be continued with unaltered zeal.
Long history of industry partnership with Indian S&T

…… CSIR-CIPLA

- Abdul Khwaja Hamied founder of CIPLA convinced the British Government for public support to R&D, and joined hands with Arcot Ramaswamy Mudaliar to start the Council of Scientific and Industrial Research (CSIR) and was the member of CSIR's Governing Body until his death in 1972.

- Abdul Khwaja Hamied's son, Yusuf Hamied, tied up with AV Rama Rao of CSIR to make AZT to make HIV drugs affordable.

- The trusted partnership developed the process know how on total synthesis of Eribulin, an approved drug for treatment of patients with metastatic breast cancer.

- During the current challenging times with corona virus CIPLA was one of the first to partner with CSIR and successfully launched the generic version of Favipiravir drug in the market known as CIPLENZA in July 2020.

- CIPLA, through CIPLA Foundation has also agreed to partner with CSIR for mass production of the CSIR designed face masks under the project name “SAANS”.
CSIR Vision

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 Contributions Over the Years

...Addressing National Challenges and Carving out Global S&T Niches...

1950-60
- Nation Building
- Supporting Self Reliance
- Baby Food
- Indelible Ink – Mark of democracy!

1960-70
- Meeting Challenges of Technology Denial Era
- Tractor
- Pesticides

1970-80
- Changing R&D from Process Development Focus to Product Development Niches
- Flosolver - Parallel Processor
- SWARAJ

1980-90
- Hansa
- Saheli
- Streptokinase

1990-2000
- Leadership in New Technology
- Bio-jet Engine

2000-2020
- Bio-jet Engine
- Pesticides
- Flosolver - Parallel Processor
- SWARAJ
- Hansa
- Saheli
- Streptokinase
### National Role – CSIR Laboratories

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<th>Responsibility</th>
<th>CSIR Laboratory</th>
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<td>Responsibility of realizing the units of physical measurements based on the International System (SI units) under the subordinate legislations of weights &amp; Measures Act 1956 (reissued in 1988 under the 1976 Act).</td>
<td>CSIR-NPL</td>
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<tr>
<td>In framing of standards for Bureau of Indian Standards (BIS) and Certifying laboratory under CMVR for mass emission testing of vehicles</td>
<td>CSIR-IIP</td>
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<td>Microbial Type Culture Collection and Gene Bank (MTCC)</td>
<td>CSIR-IMTECH</td>
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<tr>
<td>• National Legislations for occupational safety and toxicology</td>
<td>CSIR-IITR</td>
</tr>
<tr>
<td>• Safety and toxicological assessment of chemicals including plastics and polymers as well as other products (NABL accredited)</td>
<td>CSIR-IITR</td>
</tr>
<tr>
<td>Certified OPCW (Organisation for the Prohibition of Chemical Weapons) designated laboratory: Centre for Analysis of Chemical Warfare Agents with International Designation Status</td>
<td>CSIR-IICT</td>
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<tr>
<td>Food testing laboratory</td>
<td>CSIR-CFTRI, CSIR-IITR</td>
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<tr>
<td>National aerospace facilities such as tri-sonic wind tunnels; acoustic test facility; aircraft simulators; aircraft bearings and lubricants qualifications, etc.</td>
<td>CSIR-NAL</td>
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<tr>
<td>Health monitoring and rehabilitation of heritage structures</td>
<td>CSIR-CBRI</td>
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<td>Environmental impact assessment and environmental management plan</td>
<td>CSIR-NEERI</td>
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<tr>
<td>Battery testing (NABL accredited)</td>
<td>CSIR-CECRI</td>
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</table>
CSIR Upto 1960s

Supporting Self Reliance and Nation Building
India’s first Wind Tunnel

Used in many democracies. Even today, CSIR earns royalty

CSIR establishes a vitally important aerospace testing facility

Supporting the White revolution – First time milk powder from buffalo milk

Towards affordable healthcare while Integrating traditional knowledge with modern science
CSIR Upto 1970s

Nation Building and Meeting Challenges of the Technology Denial Era
CSIR’s role in Green Revolution

Indigenous cost-effective technologies – Enhancing crop productivity

Mechanizing agriculture - Over 1 million tractors on Indian soil

Metals, Minerals & Mining

CSIR-trail blazing initiatives in magnesium technologies
CSIR Upto 1980s

Nation Building and Meeting Challenges of the Technology Denial Era
S&T interventions spanning include environment, health, drinking water, food, housing, energy, specialty chemicals & petrochemicals, glass & ceramics, medicinal plants & plants of economic value, leather, mining, metals & minerals, machinery & instrumentation.
CSIR upto 1990’s

S&T Interventions ranging from Process Development to Product Development Niches
Sonalika tractor: Over 1 lakh tractors sold; ₹1400 crore per annum; 2500 exported
CSIR in 2000 - 2020

Leadership in New Technology
## Major PCT Applications from Developing Countries (2002)

<table>
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<tr>
<th>Rank</th>
<th>Applicant</th>
<th>Country</th>
<th>No. (Appl)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Council of Scientific &amp; Industrial Research</td>
<td>India</td>
<td>184</td>
</tr>
<tr>
<td>2</td>
<td>Samsung Electronic Co.</td>
<td>Rep of Korea</td>
<td>184</td>
</tr>
<tr>
<td>3</td>
<td>Biowindow Gene Development Inc</td>
<td>China</td>
<td>136</td>
</tr>
<tr>
<td>4</td>
<td>LG electronics Inc</td>
<td>China</td>
<td>125</td>
</tr>
<tr>
<td>5</td>
<td>Huawaei Technologies Co.</td>
<td>China</td>
<td>84</td>
</tr>
<tr>
<td>6</td>
<td>Ranbaxy Laboratories Ltd.</td>
<td>India</td>
<td>56</td>
</tr>
<tr>
<td>7</td>
<td>LG Chem Ltd.</td>
<td>Rep of Korea</td>
<td>47</td>
</tr>
<tr>
<td>8</td>
<td>SAE Magnetics (H.K.) Ltd.</td>
<td>China</td>
<td>31</td>
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<tr>
<td>9</td>
<td>The National University of Singapore</td>
<td>Singapore</td>
<td>28</td>
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<tr>
<td>10</td>
<td>Philips Electronics Singapore PTE Ltd.</td>
<td>Singapore</td>
<td>24</td>
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</tbody>
</table>
CSIR Technologies for India’s First Light Combat Aircraft TEJAS

An Integral Partner with ADA in Design and Development of TEJAS

- 2 of 5 critical technologies from NAL
- Developed and fabricated 165 composite parts
- Head up Display from CSIR-CSIO
- Fly-by-Wire (FBW) Control Systems:
  - Flight control laws and air-data algorithms
  - Over 1950 flights on twelve different prototypes, over a continuously expanding flight envelope completed
  - State of art training simulator

Total Economic Value of CSIR’s contribution to the LCA Tejas is about Rs 4932 crore
**Head Up Display (HUD) – Air Force Fighter, Air Force Trainer and Naval Variant of the LCA**

<table>
<thead>
<tr>
<th>Description</th>
<th>Cost</th>
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</thead>
<tbody>
<tr>
<td>Cost of development</td>
<td>Rs. 18.72 crores</td>
</tr>
<tr>
<td>Cost of production</td>
<td></td>
</tr>
<tr>
<td>Cost of each production unit</td>
<td>Rs. 0.65 crores</td>
</tr>
<tr>
<td>Cost of imported unit</td>
<td>Rs. 1.30 crores</td>
</tr>
<tr>
<td><strong>Total cost savings over 120 production A/C</strong></td>
<td>Rs. 78.00 crores</td>
</tr>
</tbody>
</table>
Ksheer Scanner: Detection System for Milk Adulteration

• Licensees/Beneficiaries
  • Rajasthan Electronics & Instruments Ltd. (REIL)
  • Alpine Technologies, Surat, Gujarat
• Quantum of Production/Turnover
  • Over 150 Systems deployed at dairies in Goa, Gujarat, Jammu & Kashmir, Kerala, Maharashtra, Punjab, Rajasthan, Uttar Pradesh, and West Bengal
• Market Value Generated
  • ~ 5 lakh systems worth Rs 5,000 Crore
  • Revenue accrued to lab (License fees and Royalty)
  • ~ Rs 92 Lac from License fee & Royalty

Taking India from World’s largest Milk producer to World’s largest quality milk producer
CSIR Aroma Mission- Socio-economic impact

- Comparative Benefit-Cost (B-C) analysis of aroma cash crop verses conventional crop showed higher B-C ratio for aroma cash crop farming.
- Contribution of aroma crop cultivation is 60% to the annual income generation of the farmer household as compared to just 40% contribution to annual income of the farmer from conventional farming.
- Aroma Mission has strengthened the livelihood condition of farmers and created employment opportunities. About 400 tribes benefitted from new variety of Lemongrass cash crop in Anamalai Tiger Reserve, Tamil Nadu.
- Total ~300 Women Self Help Group employees at Janseva Foundation, Loni BK, Tal. Rahata District Ahmednagar, Maharashtra, India.
## Farmer-centric Initiatives

### Medicinal and Aromatic Plants

Societal impact of CSIR efforts on Medicinal and Aromatic Plants

Targeted Area: Wasteland/ Kandi/ Rain-fed

- Total number of States covered: 25
- Total number of MAPs crops Extended for Cultivation: 35
- Total Area brought under Cultivation (ha): 357108
- Total Income generated (Rs. in Lakh): 406802
- Employment/man days generation (in Lakh): 1363
- Human resource trained: 41917

**Menthol mint, Mentha piperita, Spearmint, Artemisia annua, Lemon grass, Basil, Vetiver, Citronella, Patchouli, Palmarosa, Kalmegh, Ashwagandha, Safad Musali, Senna, Aloe vera, Sataver, Isabgol, Davana, Catharanthus roseus, Geranium, Rose, etc.**

### Blight Resistant Diabetic Friendly Improved Sambha Mahsuri

**Samba Mahsuri** (natural BB infection)

**Improved Samba Mahsuri** (BB resistant)

Converted high science to high value for the farmer

Beneficiaries: Farmers in 7 states (TS, AP, TN, KA, MH, CG and BR)

With over 120,000 hectares coverage
In India, half the production of paddy is converted into parboiled rice prior to milling. Earlier, paddy was soaked in cold water for 3 – 4 days before steaming, drying & milling. Microbial load was high as was the smell (detected 2-3 km away).

CSIR – CFTRI developed the “hot – soak – steam” method which goes by the name “CFTRI’s hot soaking method”. Soaking duration brought down to 4 – 6 hours, without the smell (no microbial growth).

The systems consist of drawings of Soaking/ Steaming tanks (with structures), LSU dryer and material handling system like elevators and belt conveyors.

Advantages: Reduced process time & increased productivity. Technology adapted across the globe. Since it was a societal mission, no fees was collected, then.
Empowering the Leather Industry

Fashion Forecasting

- India is a world leader in fashion forecasting – MODEUROP congress selects more than 90% of its colors from India – Contributing to export earnings
- Transforming India into global design leader

Children Shoes: Specialized Intervention

- Standards based on feet dimensions of Indian children along with their growth rate established
- Indian companies exposed to the standards developed
- Manufacturing of children's shoes in India to be aligned to the developed standards

Leather for Employment

- 4.4 million jobs in the Indian leather sector
- 30% of about 4 million people employed in leather sector are women
- USD 24 million exports and 10,000 jobs for Ethiopia
Bio-Jet Fuel

- Patented technology from CSIR-IIP
- Strategic fuel security for IAF
- First Biofuel blended flight from Dehradun-Delhi, 27 August 2018

IAF Flight, 26 January 2019

IAF Flight, 31 January 2020
Distillery Spent Wash as Sustainable Resource for Indigenous Potash Fertilizer

- For Potash country relies on imports
  - 4-5 million MT Muriate of Potash (MOP) per annum
- Technology developed by CSIR-CSMCRI with partner M/s Chem Process Systems
- Value-added byproducts, viz., potash fertiliser, animal feed ingredient etc.

Potential impact: Indigenous Potash (₹2500 crores/year), more Ethanol & Clean Environment

Aurangabad Distillery Ltd. (60 klpd))

- Additional income per ton of cane: ₹50
- 2016-17: Import 37.36 lakh ton
- Foreign Exchange : US$ 913.45 million
- Import Substitution / Savings: 10-12% (K₂O basis) about ₹ 700 cr. per year
CSIR Initiatives for Environment Protection

**Green Crackers**

**Fireworks Industry Connect**

- 200+ NDAs / 275+ MoUs
- 530+ Emission testing certificates issued

**Smart Disposal, Incineration and Carbonization Systems (SMART-DISC) for Menstrual Waste Management**

**Fly Ash-Red Mud based Geopolymeric Paver Blocks**

**Restoration of Nallah with Ecological Units**
Indigenous Dental Implants

Problem: No Indigenous technology available for edentulous situations

Challenge: Designing and machining of the root form implant and bring its acceptability to Indian company for commercialization

Achievement: Technological capability for indigenously designing and machining of dental implants

Competitive Features:
- Material used: Ti-6Al-4V (Titanium alloy)
- Requires Minimal Instrumentation
- Minimal prosthetic inventory – less complicated
- Reasonably Inexpensive
- Clinical trials being conducted at MAIDS

Manufacturing Facility Ready for Inauguration: 1 Lakh Implants/year

Technology transferred to M/s Innvolution Healthcare Pvt Ltd.

Imported Implants: Rs. 10,000/- vs CSIR Implant: Rs. 3,000/-
Integrated micro PCR system with in-situ Identification

The Partnership:
- CSIR-IIIM: DNA/RNA probes for PCR
- IISC: Technical support in optics and material for chips
- bigtec – Concept to product development, manufacture and marketing

The Value Proposition:
- State-of-the-art micro-PCR based diagnostic facility in semi-urban and rural setting where electricity is a problem
- Can be used at Primary Health Centers in rural/urban areas at point of care with minimal sophistication
- PCR that even less educated attendant at PHCs can operate

Hand-held micro PCR for diagnosis
- Hepatitis B Virus (HBV)
- TB
- Malaria
- Dengue
- Chikungunya
- H1N1

Truelab - Real Time Quantitative Micro PCR
- 720 systems deployed (20 Abroad)
- 1.56 lakh tests done
- Ready for deployment at PHCs / CHC across country

Product being marketed worldwide and Truenat received WHO approval recently

<table>
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<tr>
<th>Device</th>
<th>Device Cost</th>
<th>Cost per Test</th>
<th>Test Time</th>
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<tr>
<td>GeneXpert</td>
<td>$ 17,500/-</td>
<td>$ 42</td>
<td>90 min</td>
</tr>
<tr>
<td>MicroPCR</td>
<td>$ 6,000/-</td>
<td>$ 12</td>
<td>60 min</td>
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</table>
Bringing Technology to Disaster Relief Management

Assam Oil fires, with NDMA

Emergency Hospitals, with NDRF

Styrene leak, Vizag, with NDMA & Govt of AP

Amphan Cyclone Relief, with NDMA and NDRF
Traditional Knowledge Digital Library (TKDL)

**Mandate:** Prevent misappropriation of India’s traditional knowledge

Currently contains about 3.85 lakh formulations from Indian Systems of Medicine
- Ayurveda (1.12 lakh)
- Unani (2.3 lakh)
- Siddha (0.38 lakh)
- Sowa Rigpa (0.011 lakh)
- Yoga Techniques (0.034 lakh)

**Enhancing Content**
- Ayurveda Information from Manuscripts – Kerala
- Sowa Rigpa System of Medicine

**Expansion of Scope – Other Areas**
- Indian Systems of Medicine: Traditional diagnostics, devices, tools, practices and surgical methods, and dietary interventions
- Traditional Indian agricultural practices and tools
- Geographical indications
- Tribal medicine and practices
- People’s Biodiversity Registers (PBRs)

**Achievements - Last 5 years**
- Over 235 patent applications amended, rejected or abandoned as on date, based on TKDL evidences

**Enhancing Access**
- Database access granted to 13 patent offices so far
  - 2015: Malaysia 2017: Russia
  - 2017: Peru 2019: Spain

**Expanding access beyond patent offices**
- Draft Cabinet Note for Cabinet Committee on Economic Affairs in process for inter-ministerial consultations
- Inclusion of TKDL database as PCT minimum documentation
- Work in progress, along with Department for Promotion of Industry Internal Trade (DPIIT) and Indian Patent Office
CSIR Student Outreach Program-JIGYASA

Inculcating Scientific Temper in Youth through Vibrant Scientists-Students Interactions

On the directive of Hon’ble PM in CSIR Society Meeting (2016) “JIGYASA” Scientist-Student Connect, was initiated

Models of engagement
- Train the Teachers
- Residential /non-residential programmes at CSIR labs
- Hands on lab experiments
- Visit of Scientists to Schools
- Scientists as Teachers and Teachers as Scientists

About 300,000 students from Kendriya Vidyalaya and other schools visited 38 CSIR Laboratories since 2017

CSIR-KVS MoU on 6th July 2017
Launched in Collaboration with HRD Ministry
COVID and Post-COVID Period...
FELUDA: FnCas9 Editor Linked Uniform Detection Assay

- Paper Based Diagnostic based on CRISPR-Cas
- Broad reach, simpler, less set up cost, visual detection
- Technology Independently Validated; Awaiting DCGI approval
- Technology can be adopted for other diseases
Dry Swab Based Diagnostic

- No new equipments or reagents needed
- Technology Validated by other institutions such as CDFD, Hyderabad and IISER, Behrampur, Orissa
- With the current manpower and funds up to three times more testing can be done with this method immediately
- Dry Swab-based Method: helps in transportation & sample handling as there is no VTM
- RNA Extraction Free and Direct RT-PCR: Saves time and Cost
- Awaiting ICMR Approval
Cost Effective Process Technology of Favipiravir

- Repurposed generic drug
- Cost effective process of API with locally available chemicals developed by CSIR
- Provided API and Key starting materials to Cipla

CSIR has played a pivotal role in launch of Ciplenza by Cipla which has triggered market competition leading to lower pricing of drug
BiPAP Ventilator

- Developed by CSIR-NAL in 36 days
- Non-invasive Ventilator with HEPA ‘T’ filter
- Cost effective, easy to use in Makeshift hospitals, wards, dispensary
- Certified by NABL accredited labs (Safety, Calibration & Performance)
- Transferred to 7 Industries including Bharat Forge and Paras Industries
- Clinical trials at Jubilee Hospital, Hyderabad completed on 30 Covid-19 patients
- Clinical trials at Manipal Hospital, Bengaluru initiated
- Production capacity 350/week
- Awaiting DGHS approval
Kisan Sabha App

- Developed by CSIR-CRRI
- Connects Farmers to Transporters & Mandi’s
- Available in Regional Languages
- Active engagement in Orissa including Aspirational District of Nabrangpur
- >60,000 downloads
Lesson learned from COVID period
.......Toward Atmanirbhar Bharat
China Largest Import Partner & Crude Petroleum Largest Import

Top imports
• Crude Petroleum ($101B)
• Gold ($32.8B),
• Coal Briquettes ($27.2B)
• Diamonds ($24.9B)
• Petroleum Gas ($16.9B)

Most common import partners
• China ($75.5B)
• United States ($31.6B)
• Saudi Arabia ($26.3B)
• United Arab Emirates ($23.8B)
• Iraq ($20.8B)

Source: https://oec.world/en/profile/country/ind
# CSIR Strategy for ‘Aatma Nirbhar Bharat’

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<td>Chapter-12: Apps</td>
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<td>17</td>
<td>Creating the ecosystem for self-reliance</td>
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</tbody>
</table>
CSIR – Sustaining Excellence

Remaining Relevant to the Stakeholders, and thus to the Nation

- Common Man
  - Problem Identification, S&T Interventions, Training, Awareness

- Society

- Industry
  - Gap analysis/Identification of Unmet needs, S&T Interventions, Incubation Facilities, Funds (Loans), Handholding

- MSME

- Entrepreneurs

- Youth
  - Fellowships, Skill Development, Promoting Scientific Temper, Mentoring

- Children
CSIR’s Technology Incubation Centers

- Incorporated as Entrepreneurship Development Center on 10 Jan 2007
- Initiative of CSIR-NCL and DST-NSTEDB
- CREDAL-Accreditated

Venture Center has supported ~380 incubatees till date

- 225+ innovators have received mentoring and advisory support through pre-incubation programs
- 30% of the startups are related to NCL through their alumni, scientist or licensed technology

Commenced in 2017; a 10000 sq.ft of dedicated incubation space

- 18 Incubatees
- Two startups successfully graduated
- Incubatees filed 9 Patents/Trade Marks

Dr. H. Purushotham, CMD, NRDC informed that the National Research Development Corporation (NRDC), an enterprise under DSIR, Ministry of Science and Technology, Govt of India has signed an Agreement with CSIR-NAL to establish an Innovation cum Incubation Centre with external private funding to promote start-ups in the emerging area of Arospace technologies.
Thank you