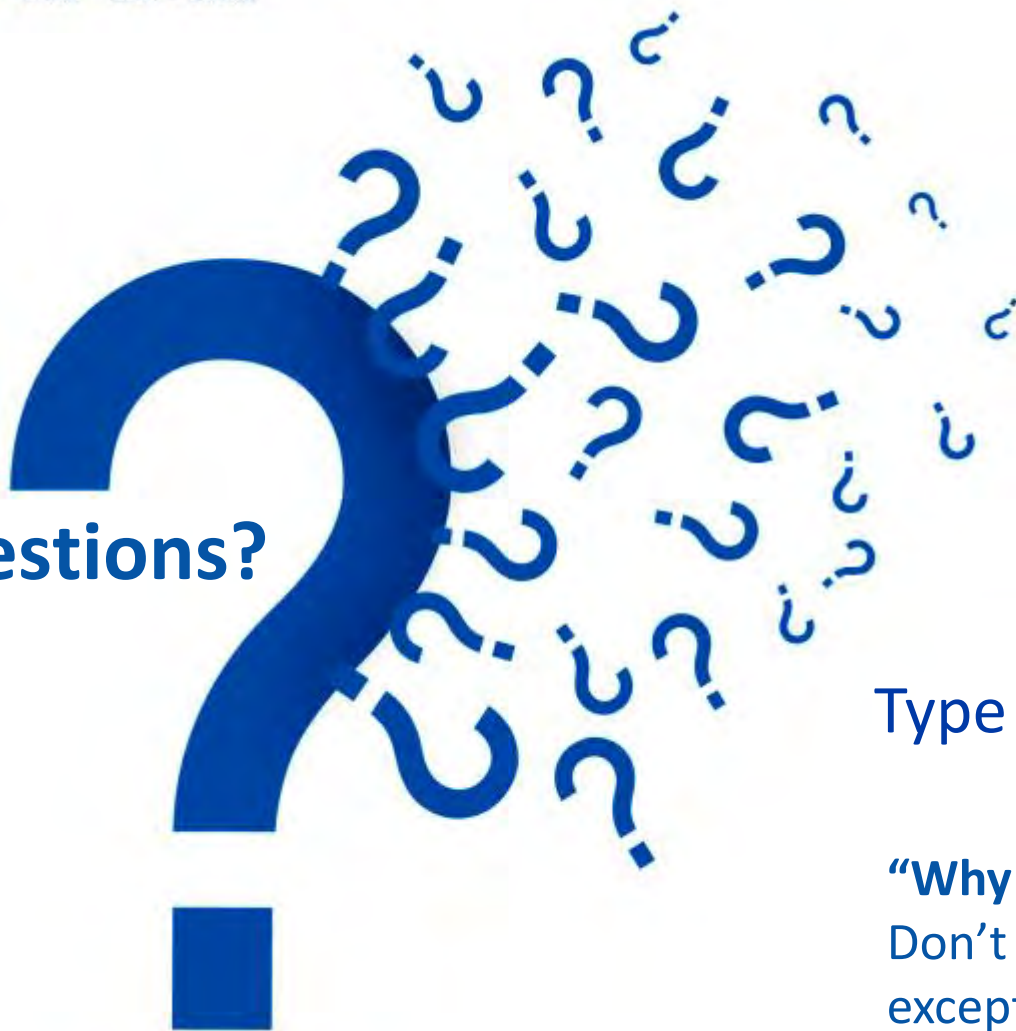


Have Questions?



Type them into questions box!

“Why am I muted?”

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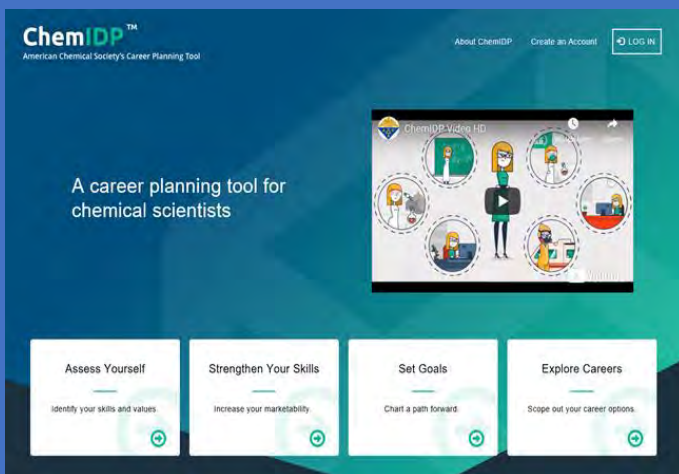
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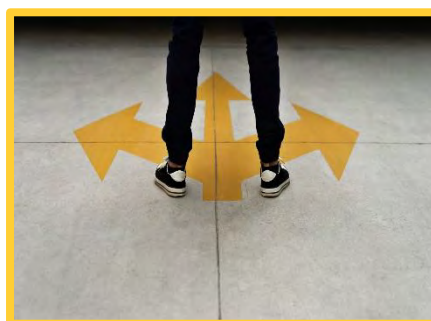
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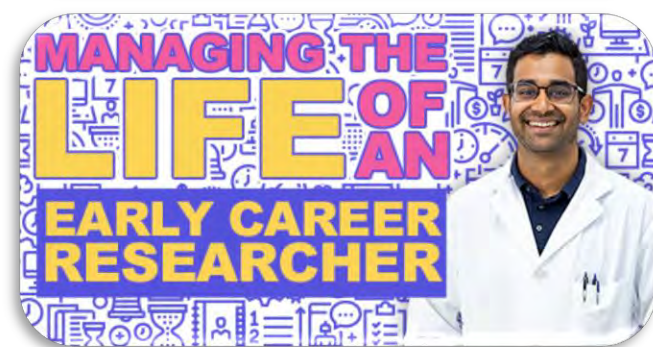
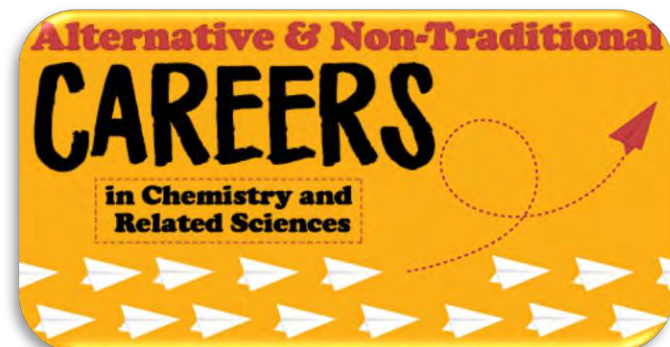
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Science, Technology and Innovation

Key Drivers for Aatmanirbhar Bharat



Featuring Dr. Shekhar Mande

Secretary, DSIR and Director General, Council of Scientific
& Industrial Research, Ministry of Science and Technology, India



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T H I S A C S W E B I N A R W I L L B E G I N S H O R T L Y . . .

Science, Technology and Innovation: Key Drivers for *Aatmanirbhar Bharat*



Dr. SHEKHAR MANDE
Secretary, DSIR and Director General,
Council of Scientific & Industrial Research, Ministry
of Science and Technology, India



DR. DEEKSHA GUPTA
Associate Director-India, Editorial, Society Programs
& Services, American Chemical Society

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Science, Technology & Innovation, Key Drivers for Aatmanirbhar Bharat

ACS Webinars

Shekhar C. Mande

Council of Scientific and Industrial Research &
Department of Scientific and Industrial Research
Ministry of Science and Technology, GoI

23-Dec-2021



Technologies from the Stone Age

Levallois technology to
make stone tools



From the Aravallis, 19.12.2021



Archaeological remains of a sea port



Lothal excavations and advanced society



Bead factory



S&I Drivers for Human Creativity



The dancing girl of Mohenjodaro was made of Bronze (Cu - Tin alloy). It was made by metal casting using the "Lost-wax" process in which the molten metal is poured into a mould which is partly or wholly made of wax. The hot metal melts the wax and takes up its place and then solidifies on cooling. The lost wax process is also used for Dhokra artifacts which are prevalent in India even today and may have originated during the Indus Valley civilization.

[https://en.wikipedia.org/wiki/Dancing_Girl_\(sculpture\)](https://en.wikipedia.org/wiki/Dancing_Girl_(sculpture))



How does it connect with the concept of Swadeshi?

Swadesh Mantra of Swami Vivekananda

हे भारत !

केवल दूसरों की हाँ में हाँ में हाँ मिलाकर, दूसरों की इस क्षूद्र नक़ल के द्वारा, दूसरों का ही मुँह ताकते रहकर..... क्या तू इसी पाथेय के सहारे, सभ्यता और महानता के चरम शिखर पर चढ़ सकेगा?

क्या तू अपनी इस लज्जास्पद कायरता के द्वारा उस स्वाधीनता को प्राप्त कर सकेगा जिसे पाने के अधिकारी केवल साहसी और वीर हैं?

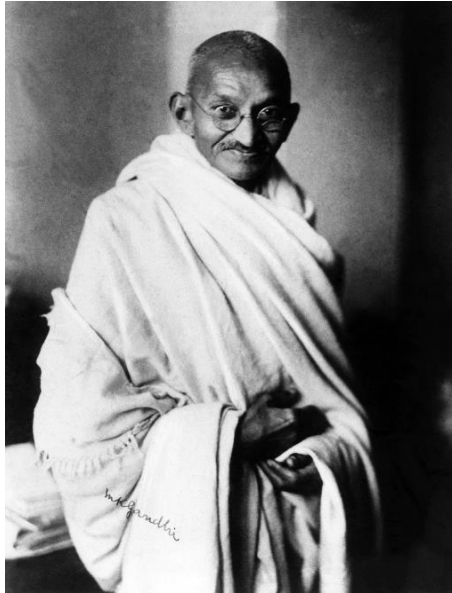
.....

मेरे भाई, कह : "भारत की मिट्टी मेरा स्वर्ग है, भारत के कल्याण में ही मेरा कल्याण है।" अहोरात्र जपा कर, "हे गौरीनाथ ! हे जगदम्बे ! मुझे मनुष्यत्व दो। हे शक्तिमयी माँ ! मेरी दुर्बलता को हर लो; मेरी कापुरुषता को दूर भगा दो और मुझे मनुष्य बना दो, माँ !"

~ स्वामी विवेकानन्द



The Principle of Swadeshi



Gandhi Ashram, Sabarmati

Man is not omnipotent. He therefore serves the world best by serving his neighbour. This is swadeshi, a principle which is broken with one professes to serve those who are more remote in preference to those who are near.

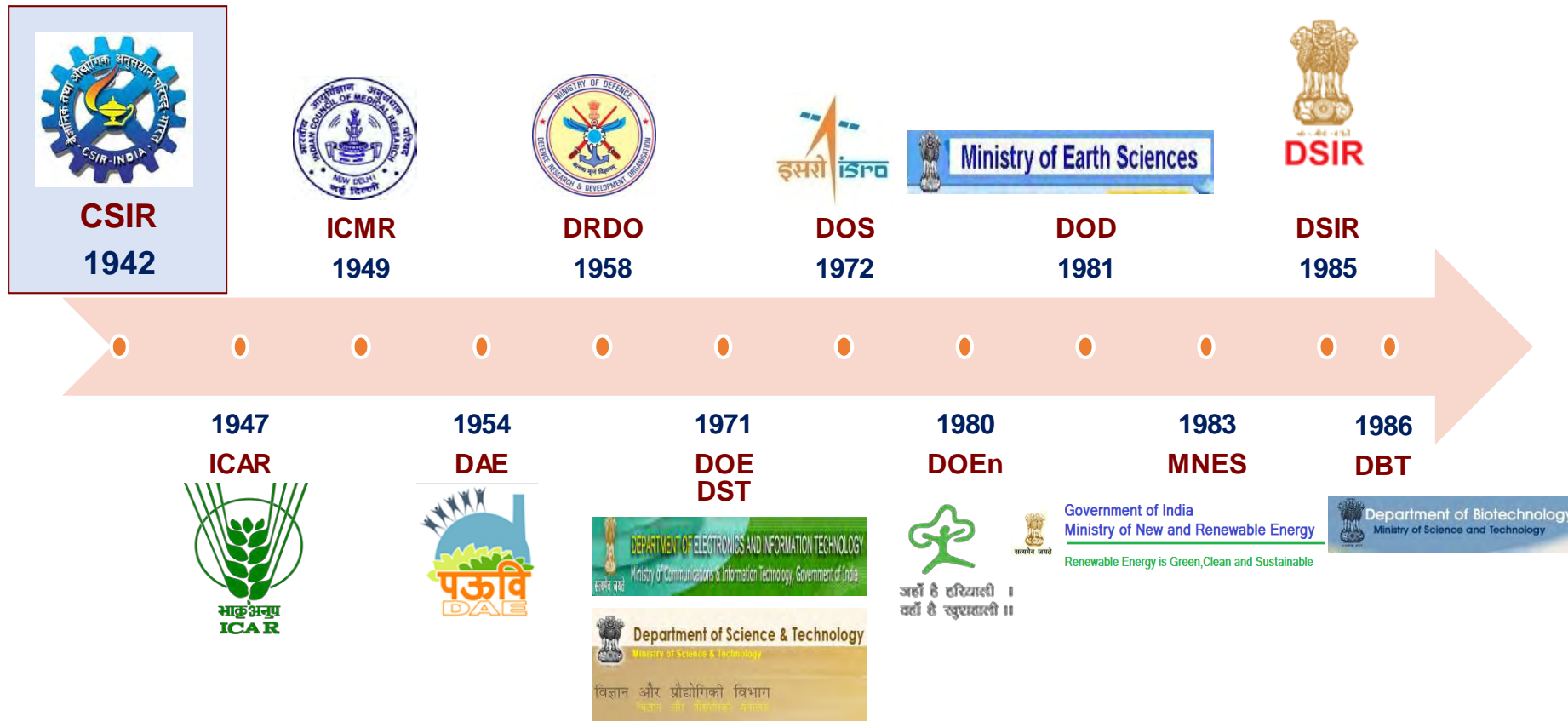
Observance of swadeshi makes for order in the world; the breach of it leads to chaos. Following this principle, one must as far as possible purchase one's requirements locally and not buy things imported from foreign lands, which can easily be manufactured in the country. There is no place for self interest in Swadeshi, which enjoins the sacrifice of oneself for the family, of the family for the village, and of the country for humanity.



Evolution of Modern S&T Eco-System in India

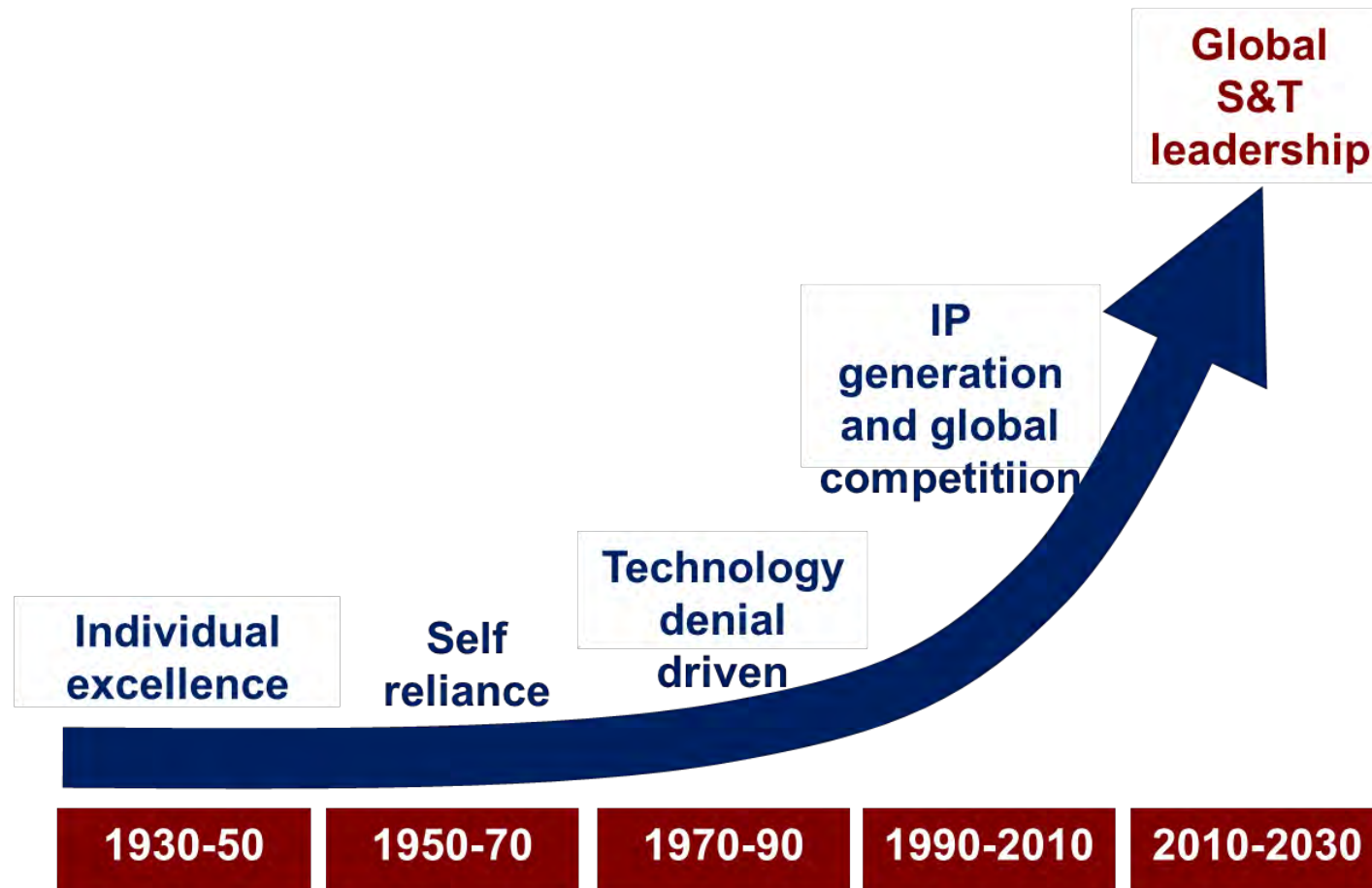


S&T Departments / Councils Building and Nurturing India's S&T Ecosystem...





S&T Drivers in India through the Times





The Role of Philanthropists and General Public

THE TATA IRON AND STEEL CO., LTD.
BOMBAY HOUSE, 34, BRACE STREET,
FORT, BOMBAY.

15th June 1951.

My dear Joe,

Thanks for your letter AOC/497 of the 4th May regarding the Sir Arisibir Dolel Memorial.

I am glad that the associated companies have undertaken to fulfill the target of Rs.1.8 lakhs fixed for them for their employees.

Regarding the contributions from the Tata organisations, the Steel Company and the Trusts have agreed to a total donation of Rs.2.70 lakhs made up as follows:

Tisco	Rs. 1,00,000
Sir Dorabji Tata Trust	Rs. 1,00,000
Sir Ratan Tata Charities	50,000
The J.R. Tata Trust	20,000
Total	Rs. 2,70,000

The above donations, together with an anticipated contribution of Rs.1,000 from the employees of the Steel Company, will make a total contribution of Rs.2.70 lakhs on behalf of the Tata organisations.

I have also approached the N. M. Wells Christian for a donation and enclose herewith a copy of my letter to Sir Shapurji.

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.301. I trust efforts to obtain further donations from the public will be continued with unabated zeal.

The Steel Company and the Tata trusts will be making the payment of their contributions to you shortly and the Building Sub-Committee may now go ahead with the plans.

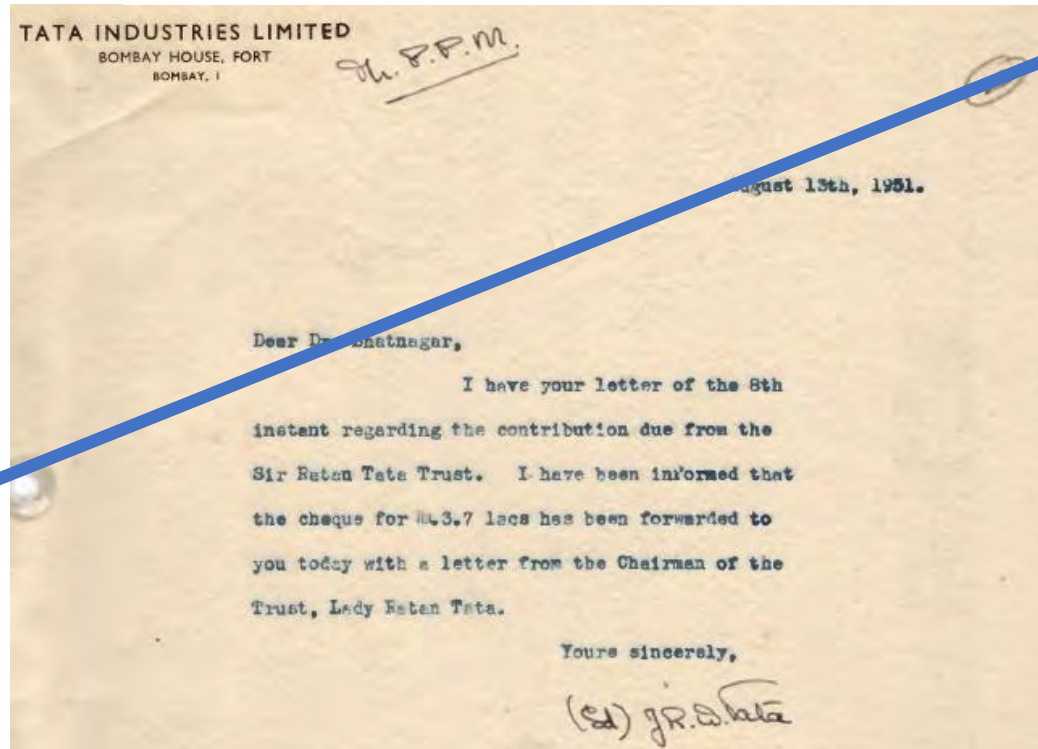
Yours sincerely,

J. J. Tata

Sir Jehangir Ghandy, Kt., C.I.E.,
Tata Iron & Steel Co. Ltd.

MCD/ary/mp.Jamshedpur.

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.301. I trust efforts to obtain further donations from the public will be continued with unabated zeal.



JRD Tata chairing the Executive Council of CSIR-NAL.



Creation of TIFR

In May 1945, the Trustees of the Sir Dorabji Tata Trust decided to sponsor an Institute for Fundamental Research, in co-operation with the Government of Bombay.

“The Tata Institute of Fundamental Research”

Dr H.J. Bhabha was the Director of the Institute
First Meeting of TIFR Council (May 18, 1945)

In this meeting, a tentative proposal for the budget of Rs 80,000 was passed for the year 1945-46.

The income available was :

- Rs 45,000 from the Sir Dorab Tata Trust
- Rs 25,000 from the Government of Bombay
- Rs 10,000 from the Council of Scientific and Industrial Research



Dr. S S Bhatnagar at laying of Foundation Stone of TIFR, Jan. 1, 1954

- **The Council of Scientific and Industrial Research sanctioned an annual block grant of Rs 75,000 to the Institute during the year 1946-47 and requested for representation on the Council of the Institute.**
- **Sir S.S. Bhatnagar, Director CSIR, was appointed as a representative of the Central Government on the Council of the Institute.**
- **1948-49: The Department of Scientific Research sanctioned an additional grant of Rs 30,000 for the purpose of constructing suitable accommodation in the new premises.**



Creation of Atomic Energy Commission



Dr. Bhatnagar with Prof. P.M.S. Blackett and Dr. H. J. Bhabha



Dr. S S
Bhatnagar &
Dr. Homi J
Bhabha

- In March 1946, the Board of Scientific and Industrial Research (BSIR), under the **Council of Scientific and Industrial Research (CSIR)**, setup an **Atomic Research Committee** under **Bhabha's leadership** to explore India's atomic energy resources and to suggest ways to develop and harness them
- Atomic Research Committee, appointed by the CSIR recommended in 1948 that **TIFR** should be the Center of all large-scale research in nuclear physics in India. Thus, Atomic Energy Programme emerged at TIFR.
- A committee was set up to appoint a team of ten scientists and train them in techniques of Nuclear Physics. **CSIR also sanctioned a sum of Rs. 32,400** for the training of this team of scientists.
- The Indian Atomic Energy Commission was first setup in August 1948 in the Department of **Scientific Research**.

Credit: Dr. Arun K Grover, TIFR and

<https://www.tnpscsthergupettagam.com/articles-detail/science-and-technology-in-modern-india-iii?cat=gk-articles>



S&T addressing Societal Problems



Implementation of Democracy Challenges

Ensuring voting rights

The indelible ink developed by CSIR-NPL, transferred to Mysore Ink, 1961. Now used in many countries all over the world- including the largest democracy of the world!





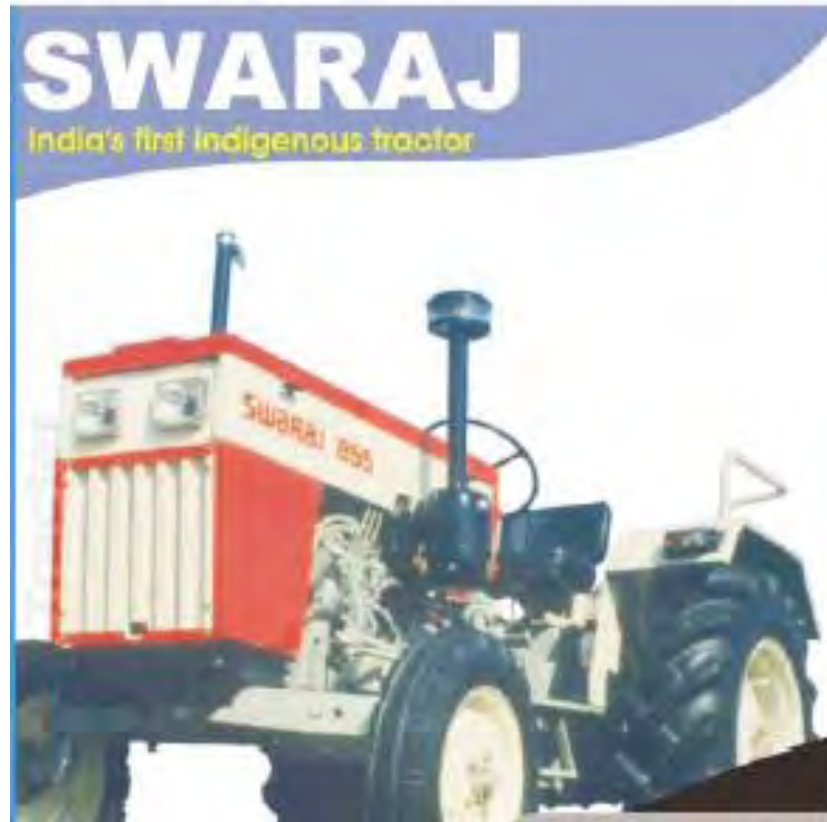
The Green Revolution



- **Norman Ernest Borlaug** was an American agronomist who led initiatives worldwide that contributed to the extensive increases in agricultural production termed the **Green Revolution**.
- In 1961 to 1962, **Borlaug's dwarf spring wheat strains were sent for multilocation testing** in the International Wheat Rust Nursery, organized by the U.S. Department of Agriculture.
- In March 1962, a **few of these strains were grown in the fields of the Indian Agricultural Research Institute in Pusa, New Delhi, India**.
- In May 1962, **M. S. Swaminathan**, a member of IARI's wheat program, requested of Dr B. P. Pal, director of IARI, to **arrange for the visit of Borlaug to India** and to obtain a wide range of dwarf wheat seed possessing the Norin 10 dwarfing genes.
- The letter was forwarded to the **Indian Ministry of Agriculture** headed by Shri C. Subramaniam, which arranged with the **Rockefeller Foundation for Borlaug's visit**.



CSIR's role in Green Revolution



Over 1 million tractors on Indian soil



- Over 1 lakh tractors sold
- Rs. 1400 crore per annum
- 2500 exported

Menthol Mint (*Mentha arvensis*) Production

Licensees/Beneficiaries

- Farmers - 81.57% farmers small/marginal

Quantum of Production/Turnover

- Production rose from about 6,000 tons in 1990s to 34,000 tons in 2018-19

Market Value Generated

- Cumulative additional income of about Rs. 5,000 crores per annum accrued and about Rs. 3300 crores earned through export of 21,500 tonnes menthol mint oil and menthol crystals in 2017-18



Impact*

- Benefit of ~Rs. 72,000/- per hectare with menthol mint as an additional crop and more than 4 lakh farm families are engaged in its production.
- About 33,000-34,000 tonnes of Mentha oil produced in 2017-18 and made available to consumer industries for value addition, export and product development. Contributes about 5000 crores to the National economy.
- Increase in net income of the farmers by 57.82% through adoption of CSIR-CIMAP's improved technologies and high yielding varieties.

* NPC Impact Assessment Report 2018



Covid-19 Mitigation

SARS-CoV-2 Diagnostic Innovations

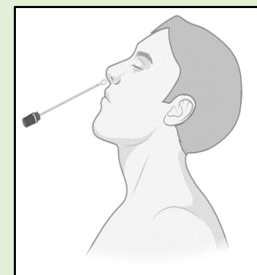
FELUDA

TataMD CHECK

1. **World's first** CRISPR Cas-9 based COVID-19 testing
2. Paper-strip based simple test that delivers results in **45-50 minutes** in a laboratory
3. The test is traceable, transparent, and trusted, with digital quality control and **AI-based result reporting tool**



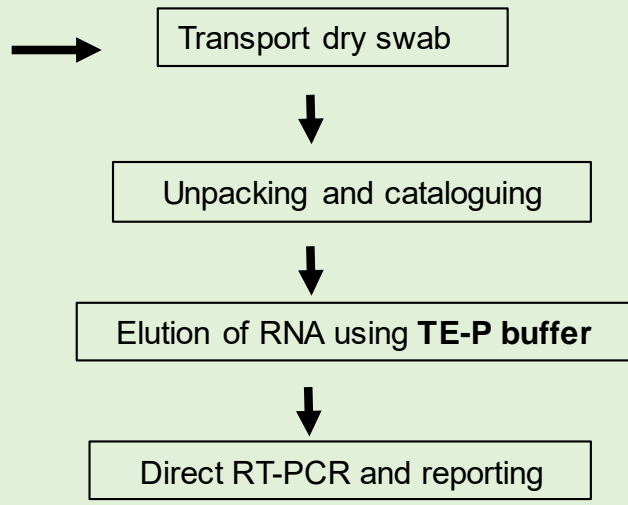
Dry-Swab Method



Swab collection

No risk of leakage

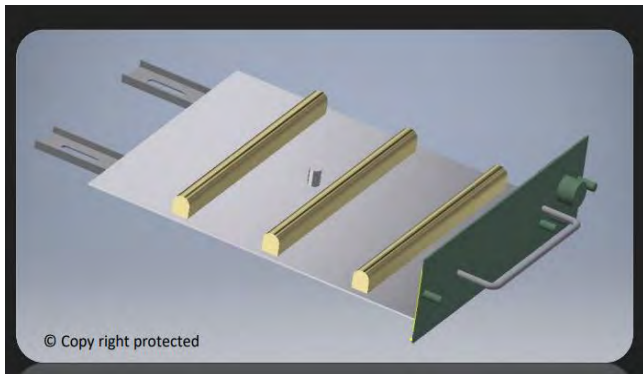
No RNA isolation



50% less time; 30-40% less cost & 3-4 fold higher throughput

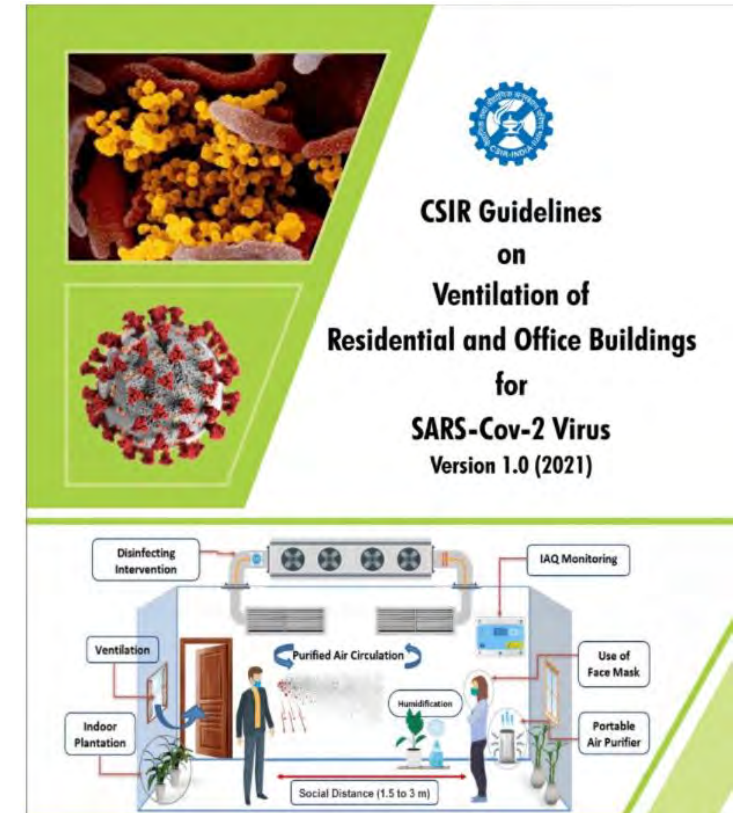
Airborne Transmission of SARS-CoV-2

- CSIR-CSIO has developed an **UV-C air duct disinfection system**
- The method validated at CSIR-IMTECH on SARS-CoV-2 viral cultures
- Can be used in auditoriums, large conference rooms, classrooms, malls etc
- UV-C deactivates over 99 % of viruses, bacteria, fungus and other bio - aerosols etc.
- Can be used as a **retrofit solution to AHUs** of buildings, transport vehicles and other spin off applications.
- **Transferred the technology to 28 industries/MSMEs**



Deployed at Parliament of India
Pilot on Indian Railway Coaches and Ac Buses

Airborne transmission is a major risk in indoor settings



Recommended Air Changes per Hour are provided

Medical Grade Oxygen (MO₂) Concentrator System

- ✓ CSIR-IIP: Advanced PVSA technology
- ✓ Suitable for 24/7 operation in hospitals
- ✓ Scalable design
- ✓ Can cater to the need of 5-25 critical patients
- ✓ Deliver O₂ at 4 - 5 bar_a pressure
- ✓ Small footprint: 50-100 sq. ft.
- ✓ Operating Cost for Medical Grade Oxygen: INR 13/NM³
- ✓ CE and ISO Medical Device Compliance Certification obtained
- ✓ Technology Partner: GASKON Engineering



Successfully Commissioned at Aundh Chest Hospital, Pune
Coupled to Liquid O₂ plant and GO₂ Plant

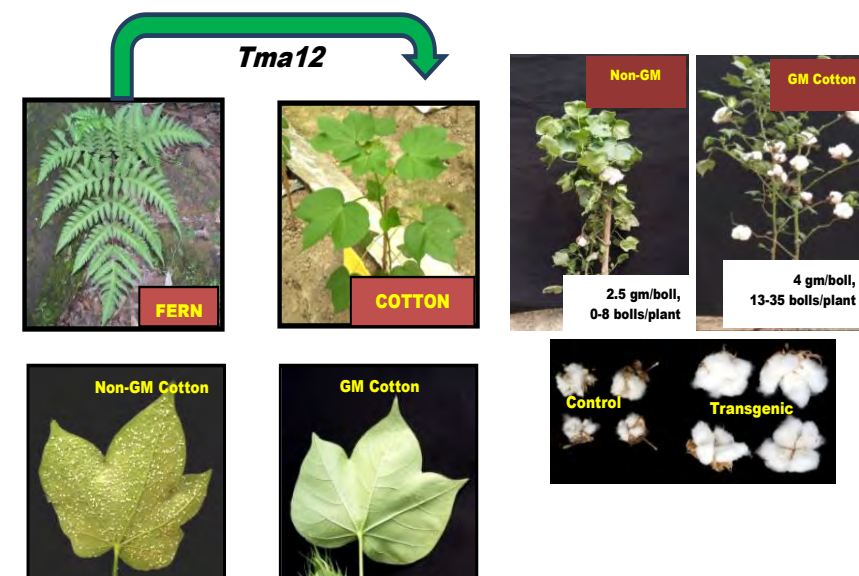
- A total of 120 Plants to be commissioned as part of DRDO plan
- Funding from PM-CARES
- CSIR-IIP has commissioned 108 nos. of 500 LPM PVSA oxygen plants by October 2021 across India spanning 14 states and 01 UT



Future Technological Aspirations of the Nation

Whitefly Resistant Cotton

- Global annual crop loss due to whitefly infestation estimated at 40-50%
- Genetically Modified cotton variety developed against whitefly attack
- Insecticidal protein identified from edible fern – safety established in experimental rat models; gene introduced in cotton
- Transgenic cotton plants found safe to non-target and beneficial insects
- Technology ready for introduction in commercial variety



In 2015, two-third standing Bt-cotton crop in North West India (Punjab, Haryana, Rajasthan) infested with whitefly causing an estimated loss of Rs 4,200 crore

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

Atmanirbhar Bharat: IAF aircraft to fly on 'made in India' bio-jet fuel

This clearance will enable Indian armed forces to use bio-jet fuel produced using indigenous technology across all its operational aircraft. This will also enable early commercialization of the technology and its mass production.



Approval for use on military aircrafts by CEMILAC 30 Nov 2021

Only 2nd Country in the World to Fly Biofuels Flight with Indigenous Fuel



Purple Revolution in J&K



CSIR- IIIM Field Station, Pulwama on
10.07.2021: Inaugurate Lavender harvesting

- For more than 35 years R&D studies have been done on the **agro- and processing technologies of Lavender for achieving higher productivity and quality indices**
- **A high oil yielding variety known RRL-12 was developed by CSIR-IIIM, Jammu.**
- **5-6 folds more income** (Rs 4.00 - 5.00 lakh per hectare) than the traditional crops
- **Area Covered:** 900 acres with an **annual production of 3000 Kgs of Lavender oil.**
- **Women Self Help Groups** under National Rural Livelihood Mission have benefitted from various activities



Hydrogen Mission

India's Aspiration for National Hydrogen Mission

Ensuring sustainability in each part of the
hydrogen value chain

Hydrogen 212

- ❖ Hydrogen generation at less than **2 \$/kg**,
- ❖ Storage-Distribution-Fuelling at less than **1 \$/kg**
- ❖ Replace incumbent fossil technology by hydrogen with ROI less than **2 years**

CSIR Knowledgebase Developed

- ❖ **India's first indigenous fuel cell car with Industry partner KPIT**
- ❖ First indigenous 5 kW scale PEM and SO electrolyzer technologies with **Industry Partner Thermax**
- ❖ Indigenous 2.5 kW power generation unit for telecom towers
- ❖ Indigenous hydrogen plasma smelting reduction reactor for steel making

Collaborations Proposed

- ❖ Ministry of New and Renewable Energy (MNRE)
- ❖ Department of Science & Technology



High Altitude Platforms (HAP)

Major Applications

- Telecommunication
- Surveillance
- Remote Sensing
- Disaster Recovery

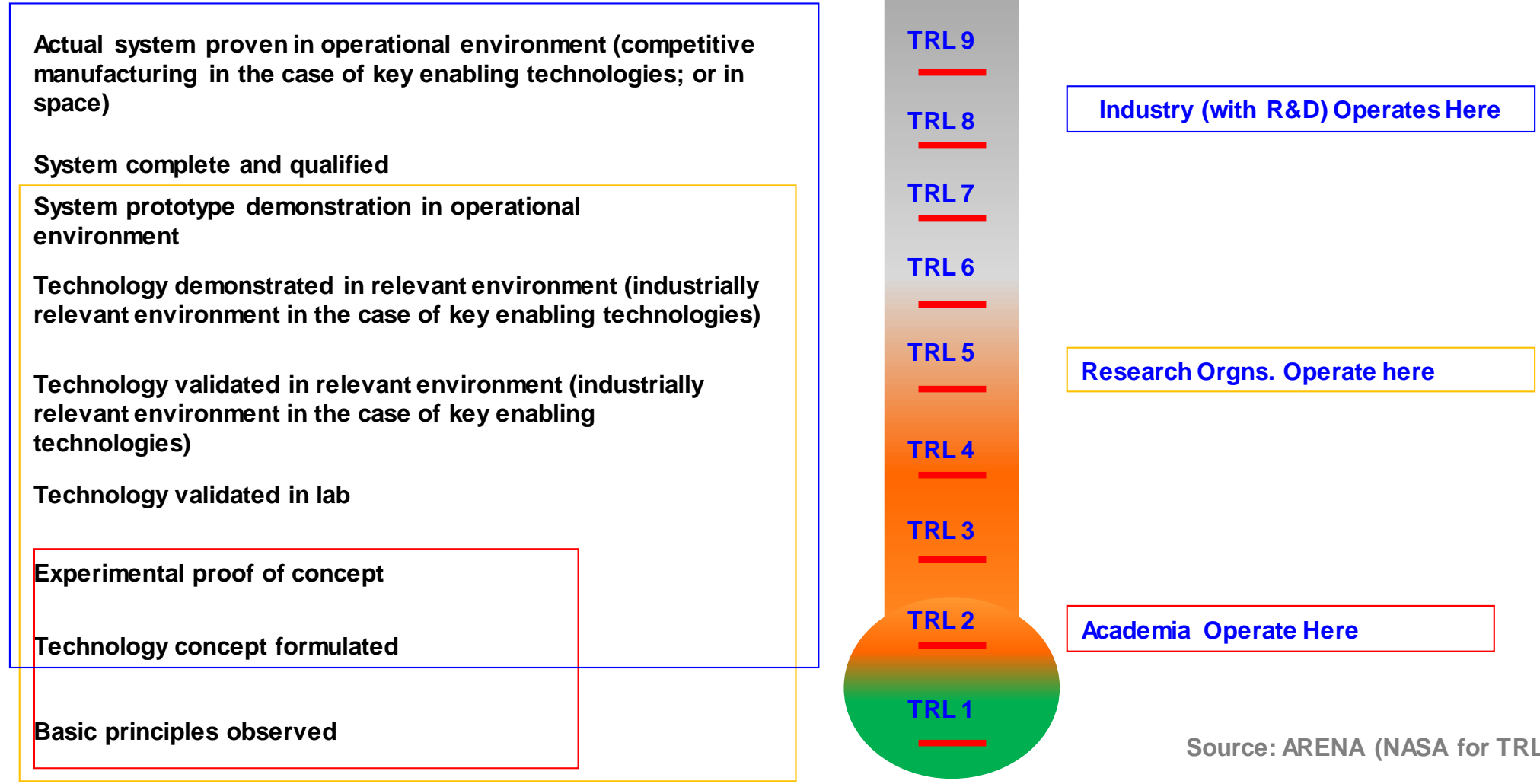




How does translate research findings for industrial use



Technology Readiness Levels

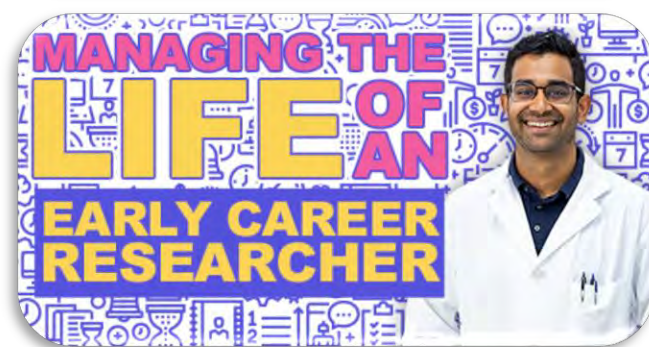


Source: ARENA (NASA for TRL)



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Science, Technology and Innovation

Key Drivers for Aatmanirbhar Bharat



Featuring Dr. Shekhar Mande

Secretary, DSIR and Director General, Council of Scientific
& Industrial Research, Ministry of Science and Technology, India



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Science, Technology and Innovation: Key Drivers for *Aatmanirbhar Bharat*



Dr. SHEKHAR MANDE
Secretary, DSIR and Director General,
Council of Scientific & Industrial Research, Ministry
of Science and Technology, India



DR. DEEKSHA GUPTA
Associate Director-India, Editorial, Society Programs
& Services, American Chemical Society

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