Office of the Principal Scientific
Adviser to the Government of India

vigyan dhara
विज्ञान धारा

From the Office of the PSA

September 2022

India in Focus

Event Report: The First Centre–State Science Conclave

— Neena Ratnakaran

"Science is like that energy in the development of 21st century India, which has the potential to accelerate the development of every region and every state. At a time when India is on the verge of leading the fourth industrial revolution, the role of India's science and people associated with this field is very important. In such a situation, the responsibility of the policy-makers and those of us who are associated with governance and administration increases," said Hon'ble Prime Minister Shri Narendra Modi.

Read more on page 2

The Centre–State Science Conclave, the first of its kind, was held at Science City in Ahmedabad, Gujarat, on 10th and 11th of September. Image credits: Department of Science and Technology, Government of India

Ms. Rashmi Pimpale, CEO, RICH in her office Image credits: RICH

In Conversation

A Dialogue with Rashmi Pimpale, Chief Executive Officer, Research and Innovation Circle of Hyderabad

— Madhura Panse

The Research and Innovation Circle of Hyderabad (RICH) was launched in 2017 by the Telangana government as a 'one-of-a-kind initiative', with the goal of mining innovations from research labs and bringing them to market. *"We called it 'unlocking the national treasure,"* said Rashmi Pimpale, Chief Executive Officer (CEO) of RICH.

Read more on page 5

Industry–Academia Engagement

Waves of Change and New Frontiers: An Interview with Dr. N. Kalaiselvi, CSIR's First Woman Chief

— Written by Zeba Khatri, Edited by Dr. Siuli Mitra

The Council of Scientific & Industrial Research (CSIR) is a contemporary research and development (R&D) organisation that strives to achieve socioeconomic transformation by promoting industrial and technological advancements across diverse fields of science—from geophysics, pharmaceuticals, biology, and nanotechnology to aeronautics, environmental engineering, and information technology.

Read more on page 10

Dr. Kalaiselvi taking over charge as the Director General of CSIR Image credits: CSIR

A demonstration of the RPOW project at work in the Chandrapur Block of the Rayagada District of Odisha Image credits: Bhubaneswar City Knowledge and Innovation Cluster

Science and Technology Clusters

'Restore Promise of Water (RPOW)': A Brief Report on BCKIC's Work in the Chandrapur Block of Rayagada District in Odisha

— Dr. Prashant Singh and Sudhir Kumar Jha

India accounts for about 17% of the world's population, and harbours only 4% of global freshwater resources. This signifies great potential for a shortage of water, and a desperate need to improve freshwater availability. However, in India, water bodies are an integral part of almost every district. They are meant to be the key source of water for the local ecosystem and the underground water table.

Read more on page 14

PM-STIAC Initiatives

Recognising the Swachhta Saarthi Fellows' Contribution to Waste Management in India

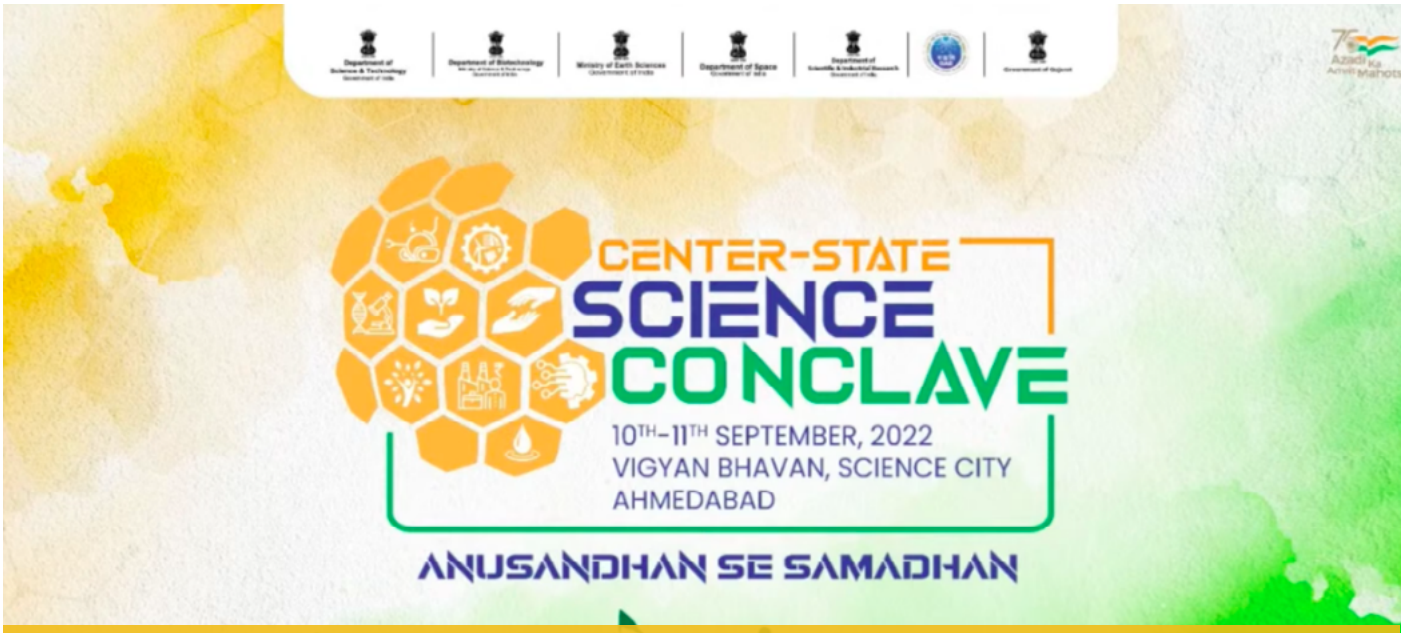
— Anvi Mehta and Krittika Sengupta

Waste management is a major cause of concern in India, owing to the failure of local authorities in managing high quantities of waste, especially in urban areas. Approximately 50 million metric tonnes of municipal solid waste is generated in India each year, with urban cities generating between 1,30,000 to 1,50,000 metric tonnes every day.

Read more on page 17

Releasing the Waste to Wealth Technology Booklet Image credits: Office of the Principle Scientific Adviser to the Government of India

INDIA IN FOCUS



The Centre–State Science Conclave, the first of its kind, was held at Science City in Ahmedabad, Gujarat, on 10th and 11th of September.
Image credits: Department of Science and Technology, Government of India

Event Report: The First Centre–State Science Conclave

— Neena Ratnakaran

"Science is like that energy in the development of 21st century India, which has the potential to accelerate the development of every region and every state. At a time when India is on the verge of leading the fourth industrial revolution, the role of India's science and people associated with this field is very important. In such a situation, the responsibility of the policy-makers and those of us who are associated with governance and administration increases," said Hon'ble Prime Minister Shri Narendra Modi, while virtually inaugurating the Centre–State Science and Technology Conclave held at Vigyan Bhavan, Science City, Ahmedabad, on 10th and 11th September 2022.

The Prime Minister stated that this conclave was an excellent representation of *'sabka prayas'* (everyone's efforts) and was crucial for achieving India's goals for the next 25 years in the field of science and technology (S&T). He went on to point out that India's rank in the Global Innovation Index has jumped from 81 to 46 in just 6 years, and that efforts towards making India a global center of research and innovation in this *Amrit Kaal* need to continue.

Indeed, in recent years, the Government of India has embarked upon a mission to strengthen its science, technology, and innovation (STI) ecosystem. During the conclave, Dr. Akhilesh Gupta, Secretary and Adviser at the Department of Science and Technology (DST), summarised the key challenges faced by the country today for strengthening its STI sector. According to him, *"a major limitation is that the connect between institutions in states and those of the Centre is very poor and state-to-state collaborations are also very limited."* Through the session, it was also pointed out that there is huge variability

Speech by Hon'ble Prime Minister Shri Narendra Modi during the virtual inauguration of the Centre–State Science and Technology Conclave held at Vigyan Bhavan, Science City, Ahmedabad, on 10th and 11th September 2022.
Image credits: Department of Science and Technology, Government of India

in terms of quality, capacity, systems, and output among the STI ecosystems of different states, making information sharing a difficult task. Other challenges include the fact that only a few states have an STI policy, while many state S&T councils have not been proactive. This two-day event, the first of its kind, is meant to be a brainstorming session for the Centre and the states to take stock of these challenges and chalk out a collaborative pathway to achieving a sustainable and prosperous future.

After all, as the Hon'ble Prime Minister points out in his inaugural speech, a shift in the STI ecosystem is needed to fuel the progress of our nation in the next 25 years. He asserts that local challenges must beget local solutions, the government must collaborate more with the scientific community, states should maximize their utilisation of national resources and institutes, and they should incentivize and support innovation in every possible way.

Post the inaugural address, state ministers from 12 states gave an overview of the recent achievements in their respective states and laid down their expectations from this brainstorming session. The panel was moderated by Dr. Jitendra Singh, the Hon'ble Minister of State (independent charge) for the Ministry of Science and Technology and the Ministry of Earth Sciences. Dr. Singh pointed out that the main objective of this conclave was to bring the representatives of the states and Centre together to identify the most appropriate technologies for each state and to deliberate on the best way of cooperatively implementing the necessary technologies.

This was followed by three plenary sessions that addressed India's Vision 2047 in the S&T sector. These included a mapping of the priorities and technological needs of different states in setting up efficient STI clusters, and a discussion on how the private sector can invest and participate more in progressing national and state research and development (R&D), and thus, the overall economy. There were also talks on how sustainable start-ups can be boosted, how state–state interaction can be enhanced, how science education and communication can be improved, and more.

The day closed out with a recollection of the Centre–State collaborations that have occurred in the recent past. The different

Dr. Jitendra Singh, the Hon'ble Minister of State (independent charge) for the Ministry of Science and Technology, speaking at the concluding session of the Conclave.
Image credits: Department of Science and Technology, Government of India

secretaries of the various departments under the Ministry of Science and Technology presented an overview of recent successful projects and ongoing projects conducted in coordination with several states. A few examples are the State Science and Technology program—an initiative by DST that aims to promote the nation's STI ecosystem through Centre–State partnerships—and the Mission COVID Suraksha and Dare2eraDTB projects started by the Department of Biotechnology (DBT). Success stories of the Centre for Scientific and Industrial Research (CSIR) were also mentioned, including Mission Hydrogen, E-mobility, and the development of a diabetic-friendly and bacterial blight–resistant Samba Mahsuri rice crop. The Secretary of the Ministry of Earth Sciences spoke about the services that it provides to the different states, such as ocean-related services to coastal states and meteorological and geohazard services. The Department of Atomic Energy (DAE) highlighted its accomplishments in various sectors, including its recent success with afforestation using hydrogels. The secretary of the Department of Space and Chairman of ISRO spoke about various applications that are implemented by ISRO for different states, including providing inputs for crop intensification as part of the National Food Security Mission. These and other such cases showcased the great potential for S&T innovation when institutions of the Centre and states work together, making the case for the need for many more such collaborations to be realised.

The second day of the event comprised five more sessions with pointed discussions on various themes such as past and future technological interventions in agriculture, innovations to improve digital healthcare, potable water, clean energy for all, the One Health Mission to ensure holistic societal, agricultural, and environmental health, and the Deep Ocean Mission for exploring the sustainable use of ocean resources.

The conclave concluded on a positive note, with Dr. Jitendra Singh assuring that measures will be put in place to improve coordination between the Centre and states and ensure a smooth flow of data among them. He highlighted ongoing work to develop a dashboard for this collaboration and noted that a nodal officer will be appointed in each state to oversee this development. The establishment of a Centre–State Science Council was also suggested, and it was decided that, going forward, this Conclave will be held annually in different states.

ABOUT THE AUTHOR

Neena Ratnakaran is a freelance science writer and editor.

IN CONVERSATION

Ms. Rashmi Pimpale, CEO, RICH
Image credits: RICH

A Dialogue with Rashmi Pimpale, Chief Executive Officer, Research and Innovation Circle of Hyderabad

— Madhura Panse

The Research and Innovation Circle of Hyderabad (RICH) was launched in 2017 by the Telangana government as a 'one-of-a-kind initiative', with the goal of mining innovations from research labs and bringing them to market. *"We called it 'unlocking the national treasure',"* said Rashmi Pimpale, Chief Executive Officer (CEO) of RICH. Registered as a Section 8 Company under the Companies Act of 2013, RICH is one of the first Science and Technology (S&T) clusters envisioned by the office of the Principal Scientific Adviser (PSA) to the Government of India. RICH acts as a facilitator to foster greater collaboration between the different entities that operate in the research, innovation, and commercialisation space.

Now, five years on, we spoke with Ms. Pimpale, who elaborated upon RICH's vision for transforming India into the global centre for S&T. She also shared some success stories of the organisation and provided us with some wonderful insights from her professional journey. Starting out as a young pharmacist, Ms. Pimpale worked in the pharma industry for over a decade before joining RICH as the director of the life sciences vertical, and then moved up to take the helm of the organisation as the CEO.

The organisational structure of RICH

RICH has a rather lean structure, with a team of 11 people, including the Director General, sector heads—who are subject matter experts and lead each of RICH's three main verticals: food and agriculture, life sciences, and sustainability; project managers who assist

the sector heads, a business manager who handles the administration, accounts, and HR; a communications manager who handles social media and PR, and an information analyst who looks after the databases. In addition, RICH also has a coordinator who works closely with the CEO and acts as a link between the different verticals, especially for the high-impact projects. These people form the core team of RICH.

But given RICH's role of facilitating collaborations for any given project, how does a team of a mere 11 people manage to connect with so many stakeholders for so many projects? Through its unique model of operation: Ms. Pimpale clarified that though all projects and activities at RICH are managed and implemented by the core team, RICH also acts as a convenor by roping in relevant external experts. Each project is led by one of the sector heads who creates multidisciplinary working groups comprised of representatives from the participating stakeholders such as research and academic institutions, industry, government partners, NGOs, and so on.

Ms. Pimpale further highlighted that although RICH is a government-launched initiative, all its team members are hired from an open market through a rigorous screening and interviewing process, and hold remarkably high professional qualifications and experience in their core sectors.

RICH's vision for the next 25 years

While discussing the conception and current objectives of the three verticals, Ms. Pimpale said, *"When we step back a little and look at how we've chosen the three focus areas, that's been a very strategic decision."*

Speaking of the life sciences vertical, she said that it was envisioned to harness the fertile innovation ecosystem of Hyderabad, which, being the pharma capital of India, is home to 800 life sciences companies with a combined value of about $50 billion, and contributes to about 35% of India's total pharma production. The primary objective for this vertical is to strengthen the position of Hyderabad as the life sciences capital of Asia, with a special focus on med-tech innovations.

The agriculture vertical was conceptualised keeping in mind Hyderabad's distinction of being the seed capital of India, and the fact that Telangana produces over 20 lakh tonnes of seeds annually, which are cultivated over seven lakh acres of land and contribute to 60% of the national seed requirement. The main objective of this vertical going forward is to position Hyderabad as a global leader in precision agriculture—one that supplies quality seeds to farmers in a sustainable and eco-friendly manner and empowers farmers with climate-resilient technologies.

Speaking of the sustainability sector, Ms. Pimpale said that although it is a relatively new area for RICH, the primary focus areas chalked out are energy, electric vehicles (EVs), and waste management.

Ms. Pimpale stressed that one of the most important factors to consider while transforming India into the global centre for S&T is enabling the faster adoption of newer technologies. This is now a national goal and RICH is aligned with this goal through its various flagship programmes to identify innovators who can solve societal challenges and empower and support them in their journey towards commercialisation.

"The focus of our work is to identify complex problems, engage various stakeholders to create a network of individuals and organisations that could solve these problems, and bring them together to work towards that common goal. In this process, we hope to improve the local and global connectedness of the research and innovation ecosystem players and drive a lasting

change—I think that will be the core of what we do even going forward."

RICH brings together various kinds of stakeholders in the research and innovation ecosystem to accomplish this goal. Anyone from scientists to start-ups and individual grassroots innovators can seek support from RICH in the form of incubators, accelerators, funders, mentors, regulatory experts, and intellectual property experts, to bring their product to the market.

Flagship programmes and success stories of RICH

When asked about the different flagship programmes of RICH, Ms. Pimpale began by describing the National Reagents Consortium project spearheaded by the Office of the PSA, which was crucial in solving supply-chain problems during the pandemic, through the setting up of systems to manufacture reagents indigenously, quickly, and affordably for RT-PCR tests. She further added that the project was a classic example of different entities (government, research institutions, the industry, start-ups, and micro, small and medium enterprises) coming together and solving a big national problem, thus implementing RICH's vision perfectly. Some of the other flagship programmes and success stories from the life sciences vertical that she spoke about were: AID, the Acceleration Initiative for Devices and Diagnostics programme; Project Tej, the next step after AID, where start-ups are connected with hospitals for clinical validation; and Mission 10X, which assists deep-tech and med-tech start-ups in commercializing their market-ready prototypes. All of RICH's initiatives can be explored on their website: https://rich.telangana.gov.in/News-and-Events.html

Elaborating upon the social gap that RICH fills through these projects, Ms. Pimpale explained that, unlike digital start-ups, life sciences and agriculture start-ups require clinical and field trials to get their products to the market, and usually, start-ups find it difficult to get their foot in the door with a hospital, government department or a research institution, due to lack of credibility or connections. This is where RICH comes in. Apart from initiating collaborations between start-ups and the relevant entities, RICH also coordinates interactions between all incubators and accelerators in Telangana by organising monthly meetups and knowledge-sharing sessions as part of their efforts towards consolidating the strength and expertise of the local ecosystem.

Further, while talking about the agricultural sector, Ms. Pimpale said that, unlike other sectors, the range of stakeholders in the agricultural sector is quite large and diverse—spanning from a rural or tribal farmer in the remotest location of Telangana to a tech-savvy start-up. Highlighting the various initiatives in the agriculture vertical at RICH, Ms. Pimpale spoke about emerging technology pilots conducted in collaboration with PJTSAU (State Agriculture University), Department of Agriculture, Emerging Technology wing of government of Telangana and AgriTech start-ups; data standardisation efforts conducted in partnership with the Department of Horticulture and the National Association of Software and Service Companies (NASSCOM); and various capacity-building activities at Tier 2 and Tier 3 educational institutions. RICH has also created a compendium of AgriTech start-ups that highlights promising technologies and innovations in the spheres of sensors, robots, platforms, farm machinery, and drones, among others.

Recently, RICH has also begun leading the Kisan Mitr platform launched by the office of the PSA. Over the past year, RICH has been working extensively with the farmer community to try and understand their problems and figure out interventions that could help them. Talking about the main

learnings over the past year, Ms. Pimpale said that *"So far, we've had conversations with more than 100 farmers to understand the climate-resilient agricultural practices that they follow. We have received some very interesting insights into this aspect of farming which we plan to document and publish soon."*

Regarding the upcoming developments in the sustainability sector, Ms. Pimpale reiterated that the primary goal here, as with other verticals, is to identify the gaps in the ecosystem and make interventions to bridge those gaps. RICH's major foray into this sector is through a recent Memorandum of Understanding (MoU) with the National Institute for Micro, Small and Medium Enterprises (NI-MSME), for developing a centre of excellence (CoE) on energy and electric vehicles (EVs). She said that the CoE will be the fulcrum for knowledge creation, knowledge management, and knowledge dissemination, and will have multiple components—research, training, and commercialisation. RICH would engage suitable knowledge partners and technology partners with experience in clean technologies for setting up various training centres/labs at the CoE and conduct scientific research in collaboration with premier research and academic institutions. Going forward, RICH's main focus will also be on working extensively with startups in the energy, waste management, and particularly the EV space—which has a huge potential and is also getting a strong push from the central government.

"I think in all of this, the most interesting part is that when we go looking for solutions for (existing) problems, most of these solutions are found locally, which are being worked on by some innovator or scientist who has identified problems in his proximity and has designed a solution," said Ms. Pimpale.

The Women in STEM initiative and personal learning

Aside from work in these three key verticals, RICH recently launched the Women in Science, Technology, Engineering, and Mathematics (STEM) initiative in collaboration with the Biocon Foundation. Talking about the initiative, Ms. Pimpale said that it will undoubtedly play an important part in the greater mandate to promote science and technology within the next 25 years, as it focuses primarily on the entry and retention of women in STEM careers. Citing observations from reports by the Ministry of Human Resource Development, she said that the main reason for the skewed gender ratio in STEM careers is the lack of retention, rather than lack of entry of women into STEM fields. She added, *"Women are very likely to face the dual role syndrome when it comes to professional decisions. They're largely affected by their domestic responsibility as well. So, current work systems can prove to be a structural impedance for women. In this case, piecemeal interventions are not going to work, a lifelong support approach is needed."*

The Women in STEM programme is RICH's attempt to address this gap by providing marginalised women students in STEM from tier two or tier three cities with experiential learning opportunities in the form of internships or projects at premier institutes or companies in Hyderabad. Additionally, the initiative will also provide them with mentorship and handholding support beyond the stipulated internship period, by initiating one-on-one interactions with women scientists from all over India. Ms. Pimpale asserted that the main aim of the programme is to create a self-sustaining network of women in STEM who can empower each other and visualize STEM as a sustainable career option.

As the conversation drew to an end, we asked Ms. Pimpale to share some insights

and learnings from her journey and how she uses these learnings to steer RICH as an organisation.

She reminisced about the gender-directed roles in the pharma industry and admitted that while not much has changed on that front since she started out, organisations are now beginning to realize the importance of gender diversity and providing better working facilities for women. She also added that it is the responsibility of the leadership to make sure that gender diversity does not remain a mere performance indicator, and create a working environment for women that is conducive to their growth, that makes considerations for the unique social challenges that they face, and one that can help them work their way up the career ladder.

Talking about her own experiences on the way upwards to a leadership position, Ms. Pimpale mused that when one moves on to higher positions of responsibility, it is inevitable to encounter differences in opinions, strong biases, and a lot of unwarranted behaviour. Ms. Pimpale said, *"What I think needs to be done is to accept that we all have our innate biases. But, whenever we are taking a major decision, are we able to go beyond our biases and make sure that those biases are not affecting our decisions? I think if we can objectively analyse (the situation), and we have that awareness, a lot (of difficult problems) could be solved."*

While giving a special message to young girls and women aspiring to build a career in STEM or to be in a leadership position, she said, *"Women should be more open to speaking their mind, should not be afraid to give their opinions and should not be hesitant to showcase their work."*

Ms. Pimpale concluded, *"What I believe is, if you're sincere and thorough in your work, if you are empathetic towards others, and are willing to take people along, then you can build credibility and trust (for yourself and your work). And I think these attributes somehow become your strongest allies, and never fail you."*

ABOUT THE AUTHOR

Madhura Panse is an educator, career counsellor, and freelance science writer.

INDUSTRY–ACADEMIA ENGAGEMENT

Dr. Kalaiselvi taking over charge as the Director General of CSIR
Image credits: CSIR

Waves of Change and New Frontiers: An Interview with Dr. N. Kalaiselvi, CSIR's First Woman Chief

— Written by Zeba Khatri, Edited by Dr. Siuli Mitra

The Council of Scientific & Industrial Research (CSIR) is a contemporary research and development (R&D) organisation that strives to achieve socioeconomic transformation by promoting industrial and technological advancements across diverse fields of science—from geophysics, pharmaceuticals,biology,and nanotechnology to aeronautics, environmental engineering, and information technology. As CSIR embarks on a journey to accomplish India's vision for 2047, it will be led by Dr. N. Kalaiselvi, an electrochemical researcher by training and the first woman to serve as the Director General (DG) of the organisation.

As a young scientist, Dr. Kalaiselvi began her research career at Tamil Nadu's Karaikudi-based CSIR-Central Electrochemical Research Institute (CSIR-CECRI)—a laboratory often referred to as the *"difficult situation lab"* because of its remote location and limited connectivity. She went on to head CSIR-CECRI before being appointed to her current role.

In this conversation with us, she discusses the contours of her journey to head CSIR, what keeps her motivated, what she learned, and her vision for the future of CSIR in terms of its role in meeting India's growing technological needs and achieving the Sustainable Development Goals.

Road to CSIR

Dr. Kalaiselvi recalls starting her career as a teacher of science and engineering. In 1997, she joined CSIR-CECRI, where she evolved from an organic chemist to an expert in

Foundation Day at CECRI
Image credits: CSIR

electrochemistry, and finally, to the Director of the institute in 2019.

As the Director, Dr. Kalaiselvi applied her insights to ramp up the technological outputs of CSIR-CECRI. While preparing for CSIR-CECRI's 75th anniversary in 2022, she pioneered a program to help researchers bring stalled projects to closure. *"Occasionally, projects reach 90% completion and then get delayed in the final lap due to last-minute hiccups. As we entered CECRI's 75th year, we asked our researchers to identify the obstacles they faced while developing selected technologies and gave them the necessary funding and other infrastructural support to wrap up unfinished projects and produce mature technologies. Through this program, 4 out of 19 projects were completed within 12 months, and another 2–3 will also be completed soon,"* she recalled. This incident (which required no additional infrastructure investment) was not only a source of immense satisfaction for Dr. Kalaiselvi but also served as a testament to her leadership and administrative acumen.

In August 2022, Dr. Kalaiselvi was appointed as the DG of CSIR that has 38 labs of CSIR. Having previously held leadership positions at different levels, Dr. Kalaiselvi says she has found herself in familiar waters with this new role, describing it as akin to learning new words in a known language. She opines, *"the system I am working in is one I'm well-accustomed to. The only difference is that my role has been re-defined, and my responsibilities have expanded."*

Continuing the legacy of CSIR and DSIR

As the DG of CSIR, Dr. Kalaiselvi also holds the position of Secretary, Department of Scientific and Industrial Research (DSIR), which is a department under the Indian Government's Ministry of Science and Technology. She clarifies, *"CSIR is an arm of DSIR. The two bodies serve complementary functions with the same goal—industrial advancement. While DSIR handles project approval and recognition, CSIR drives science and technology. In this way, the two act in synergy."*

Looking toward the future of CSIR and DSIR, Dr. Kalaiselvi expresses her gratitude to Dr. Shekhar C. Mande, the former DG of CSIR, for his clearly defined vision for 2030. In line with the plans laid out for *'Amrit Kaal'* (India's vision for 2047) by Prime Minister Narendra Modi, Dr. Mande prepared a 'CSIR in 2030' Performance Appraisal Board (PAB) Vision based on inputs from individual research groups. Now, for Dr. Kalaiselvi, the plan is to follow this thematic vision in cooperation with the entire CSIR family and then extend or leverage the progress achieved to meet India's 2047 goals.

Fulfilling India's vision for 2047

The first step towards fulfilling India's promise for *Amrit Kaal* lies in realising the United Nation's (UN's) Sustainable Development Goals (SDGs) by 2030. As a

central entity for different areas of science and technology, CSIR will play a critical role in this mission, aligned with the vision of PAB. CSIR's mission roadmap towards this goal has multiple subdivisions.

Dr. Kalaiselvi highlights that one of CSIR's highest priorities is helping India meet its goals as part of the COP26 agreement. *"CSIR is spearheading multiple projects for technological advancements aimed at meeting SDGs. These include reducing greenhouse gas emissions and India's carbon footprint, and improving access to clean water, sanitation, and healthcare and overall citizen well-being,"* she notes.

Providing additional details about the clean energy goals, she delineates some key approaches being implemented by CSIR. These include:

- Successful development of indigenous carbon dioxide (CO_2) adsorption technologies for reducing CO_2 emissions from industries, which will soon be implemented at the national level;
- Additional technologies that allow the conversion of trapped CO_2 into valuable end-products, like a basic raw material called adipic acid, reducing raw material input and further decreasing carbon footprints;
- Large-scale CSIR Hydrogen Mission for the generation of hydrogen-based clean energy using electrolysers, which could be used in fuel cells; and
- Energy storage devices, i.e., batteries, for hydrogen-based energy, which could be used to produce fuel-cell operated two-wheelers and three-wheelers.

CSIR 800

Technologies are ineffective if they lack accessibility. This is where the CSIR 800 initiative comes in. *"Through CSIR 800, we are aiming to reach the "unreached" parts of the country, where almost 800 million people live. The goal is to understand the problems faced by individuals in remote areas and address them by employing technologies,"* Dr. Kalaiselvi explains.

Before COVID-19, Ph.D. scholars from the Academy of Scientific & Innovative Research (AcSIR) and other institutes would visit rural areas to understand the problems faced by villagers, before developing science and technology interventions to solve them. While this became challenging due to COVID-19, another program called CSIR–HARIT (Harnessing Appropriate Rural Interventions and Technologies) started as part of which technologies with direct social relevance were disseminated to rural areas. One of the biggest triumphs of CSIR–HARIT, explains Dr. Kalaiselvi, is the development of blight-resistant Samba Masuri (an important rice variety), which has almost doubled the farmers' income and helped produce high-quality crops. Together, these approaches

Independence Day 2022
Image credits: CSIR

for improving technology access will be key in strengthening India's work to attain SDGs.

Partnering with industries

CSIR's activities are inherently collaborative and conducted in partnership with interdisciplinary teams across various academic and research institutes. However, industries are the most important partners within the CSIR ecosystem. They serve as the link between CSIR and the public, making new technologies available through a series of processes including strategic application, mass production, product packaging, and marketing. *"Industries ensure the wide-spread adoption of technologies. They partner with CSIR and take the technology we develop to the next stage—the market—promoting technology-mediated progress and improvements in the standard of living,"* remarks Dr. Kalaiselvi.

Personal motivations

Dr. Kalaiselvi has achieved many milestones, and the road she is taking with CSIR promises to be an exciting one. When asked about her sources of inspiration, Dr. Kalaiselvi says that she is a great believer in learning from every interaction and every environment one finds oneself in. *"As someone with a keen sense of observation, I try to imbibe a learning point, no matter how small, from every conversation. Many people have inspired me,"* she states. She greatly admires Dr. A.P.J. Abdul Kalam, not only for his work as a scientist but also for the dignity with which he conducted himself while serving in different positions. *"Dr. Kalam's book, 'Wings of Fire,' can ignite the mind,"* comments the literature lover. *"Another book that inspires me is 'Don't Say Yes When You Want to Say No' by Herbert Fensterheim,"* she adds, while also commenting on her affinity for regional, especially Tamil, literature.

Dr. Kalaiselvi holds close to her heart the value of transparency and emphasizes the need to have faith in oneself and others. Indeed, her penchant for open communication has helped her solve a plethora of problems in regular conversations as well as science and technology and reach new frontiers of research and administration. As the first woman DG of CSIR, she is a beacon of hope and inspiration for women across the country. Harnessing the power of the unassuming tolerance that she finds in womanhood, she seeks to propel CSIR into a new era of world-class interdisciplinary research, guiding innovation and growth across industrial sectors and bolstering socioeconomic development and equity as India grows into a 100-year-old republic.

ABOUT THE AUTHOR

Zeba Khatri is a freelance science writer and communication consultant, and a self-confessed philomath.

CSIR Leadership Meet 2022
Image credits: CSIR

SCIENCE AND TECHNOLOGY CLUSTERS

A demonstration of the RPOW project at work in the Chandrapur Block of the Rayagada District of Odisha.
10,000 cubic meters of soil was removed from the waterbodies, creating a water holding capacity of 1 crore litres. The same soil is put in farmers' fields, thus reducing fertilizer costs. The rejuvenated waterbody also creates livelihood opportunities for rural women through pisciculture.
Image credits: Bhubaneswar City Knowledge and Innovation Cluster

'Restore Promise of Water (RPOW)': A Brief Report on BCKIC's Work in the Chandrapur Block of Rayagada District in Odisha

— Dr. Prashant Singh and Sudhir Kumar Jha

India accounts for about 17% of the world's population, and harbours only 4% of global freshwater resources. This signifies great potential for a shortage of water, and a desperate need to improve freshwater availability. However, in India, water bodies are an integral part of almost every district. They are meant to be the key source of water for the local ecosystem and the underground water table.

For instance, the Chandrapur Block of the Rayagada District of Odisha is endowed with diverse and distinctive traditional waterbodies such as ponds, tanks, (*bandha* and *pokhari* in Odia), etc. Every water body plays a massive role in maintaining and restoring the ecological balance by providing drinking water and livelihood opportunities, along with recharging the groundwater and controlling floods in the region. However, in recent times, the people of the Chandrapur Block of the Rayagada District have been facing unprecedented water crises in the summer/pre-monsoon period each year. Due to low or delayed rainfall at this time, these water bodies are now unable to provide an adequate amount of water. This has severely impacted agriculture as well as the livelihood of the people living in this region.

This situation is not unique to the Chandrapur Block in Odisha. It is mirrored in several other regions of the country, where people have been struggling with constant water shortage problems. An assessment of the problem indicated that waterbody rejuvenation could be a potent solution.

Given that adequate availability of water is a prerequisite for ensuring the survival and quality of human life, the Bhubaneswar City Knowledge Innovation Cluster (BCKIC) Foundation aimed to provide a permanent solution to this problem. With support from the IITians for Influencing

Before (left) and after (right) implementing the RPOW project at three waterbodies "Jasoda bandha," "Patra Bandha," & "Jigyan Sagar" in the Dangasorada village of the Chandrapur block of the Rayagada District, Odisha.
Image credits: Bhubaneswar City Knowledge and Innovation Cluster

India's Transformation (IIT–IIT) initiative—a pan-India IIT alumni network working towards scaling up social impact programmes in the country at the national level—we chose three water bodies in the Rayagada District, for restoration. This rejuvenation project became the pilot effort in this region as part of IIT–IIT's 'Restore Promise of Water (RPOW)' programme, through which they aim to contribute to water body rejuvenation across India by increasing their water holding capacities. Our project was very well supported by the Strategic Alliance Division, Office of the PSA.

The Chandrapur Block is located 79 km east from the district headquarters of Rayagada. It has a total population of 28,952 (as per the 2011 Census). In the Chandrapur Block, the goal of implementing the RPOW project was to enhance the storage capacity of the three chosen waterbodies, to store an additional four crore litres of water annually. With a community-focused programme that involved 250 farmers, 10,000 cubic meters of highly nutritious soil (silt) was excavated from the water bodies, resulting in a substantial increase in their water storage capacity. Additionally, the silt obtained in the process is being used in agricultural lands, and will positively impact the fertility of soil, thereby reducing fertilizer costs for farmers in the long run.

The implementation of the RPOW project in Chandrapur has helped establish a win-win relationship between the people of the community and their local water bodies. With a long-term vision, BCKIC looks forward to rejuvenating multiple water bodies of the block to positively impact the water table in the region and ensure the promise of water for the people of Odisha.

ABOUT THE AUTHOR

Dr. Prashant Singh is the CEO of BCKIC.
Sudhir Kumar Jha is the Manager of Technology, Innovation and Management at BCKIC.

PM-STIAC INITIATIVES

Mr. Shirish Panda, Scientist "D", Office of the Principle Scientific Adviser to the Government of India; Dr. Monoranjan Mohanty, Scientist G/Adviser, Office of the Principle Scientific Adviser to the Government of India; Dr. (Mrs.) Parvinder Maini, Scientific Secretary, Office of the Principle Scientific Adviser to the Government of India; Dr. Sanjay Kumar Sharma, Professor, IIT BHU; and Ms. Malyaj Varmani, Vice President, Invest India, releasing the Waste to Wealth Technology Booklet
Image credits: Office of the PSA

Recognising the Swachhta Saarthi Fellows' Contribution to Waste Management in India

— Anvi Mehta and Krittika Sengupta

Waste management is a major cause of concern in India, owing to the failure of local authorities in managing high quantities of waste, especially in urban areas. Approximately 50 million metric tonnes of municipal solid waste is generated in India each year, with urban cities generating between 1,30,000 to 1,50,000 metric tonnes every day. The *Waste to Wealth Mission* is one of the many initiatives by the Government of India which aims to address waste management concerns in the country.

Waste to Wealth is one of the nine scientific missions of the Prime Minister's Science, Technology, and Innovation Advisory Council (PM-STIAC), spearheaded by the office of the PSA. The aim of the mission is to identify, develop, and launch technologies to recycle and treat waste and use it to generate energy and other valuable resources.

As part of this mission, the Swachhta Saarthi Fellowship—a fellowship programme to facilitate community participation in the micro-management of solid waste—was launched in 2021, in association with Invest India. The fellowship empowers people engaged in community waste management as "Swachhta Saarthis," who in turn increase community participation to spread awareness about waste management, conduct real-time surveys to understand the status of waste management in their localities, and develop different methods to help solve the crisis.

The year-long fellowship has three categories, and is awarded to students, community workers, self-help groups, and municipal/sanitary workers who are trying to design sustainable and eco-friendly solutions for waste management. The categories are as follows:

- Category A: Open to school students from 9th to 12th standard, who are engaged in community waste management;
- Category B: Open to college students (undergraduate, post-graduate, and research students) engaged in community waste management; and
- Category C: Open to citizens working in the community and through Self-Help Groups (SHGs), and municipal and sanitary workers working beyond their job requirements.

On 30th September and 1st October 2022, the Swachhta Saarthi Samaroh 2022 was organised to recognise the first cohort of Swachhta Saarthi Fellows (SSFs) who have worked on waste management projects for a year. Held at the Indian Institute of Technology (IIT), Delhi, the two-day event saw 120 fellows recognised and felicitated for their incredible work.

The event began with Ms. Malyaj Varmani, the Vice President of Invest India, formally congratulating and welcoming the Fellows and their families to the event. She then invited Dr. Monoranjan Mohanty, Scientist G/Adviser at the Office of the PSA to the Government of India, to come onstage to speak to the Fellows. *"All the Fellows have played an enormous role in sensitising the communities on waste management. I want to push you to think of cost-effective and easily accessible technologies to convert this waste to wealth,"* emphasised Dr. Mohanty during his welcome address.

The chief guest of the event, Dr. (Mrs.) Parvinder Maini, Scientific Secretary at the Office of the PSA, congratulated the Fellows for contributing to India's waste management efforts in her speech. *"You have been selected for your innovative ideas and determination to do something good for the country and the world. I salute every one of you for the commendable work you have done. The originality of your ideas and the will to demonstrate your work for a more significant cause shows your undaunted commitment to addressing waste management,"* she remarked.

Another esteemed guest, Dr. Sanjay Kumar Sharma, a Professor at IIT BHU, spoke about the responsibility that Swachhta Saarthi Fellows carry. *"Development and destruction go hand-in-hand, and it is our responsibility to stop that. As Swachhta Saarthis, the Indian government has given you the responsibility to be agents of change, who encourage cleanliness in your community,"* he advised.

Chief guest Dr. (Mrs.) Parvinder Maini addressing SSF Fellows
Image credits: Office of the PSA

The Fellows were also given a chance to share their personal experiences surrounding waste management within their communities. For instance, Aashima Jha, who is a Category B Fellow, observed a new health hazard during the COVID-19 pandemic: face masks and personal protective equipment being discarded by people in public spaces. She decided to do something about it and started upcycling discarded face masks to create planters, to grow saplings from vegetables and fruits. A Fellow from Category C, Veerbhadra Swamy, spoke about how he spread awareness on waste segregation in a small district in Karnataka. Despite being physically challenged, Veerbhadra would walk for several kilometres every day to conduct workshops and training sessions. Sharing these experiences helped the guests of the event better understand the Fellows' perspectives of the programme, and how it has benefitted them.

Dr. (Mrs.) Parvinder Maini at the exhibition set up by the SSF Fellows
Image credits: Office of the PSA

Although there were several other activities, the major attraction of the two-day event was the exhibition set up by the Fellows to display their projects.

Apart from the exhibition, workshops were organised for each category of Fellows on the first day of the event, to give them a chance to interact with various stakeholders in the waste management industry.

For Category A Fellows, a Foldscope Microscopy Workshop was organised, which was an initiative by the Department of Biotechnology, Ministry of Science and Technology, Government of India. Super mentors including Dr. Uma Chaudhary, Dr. Rafikh Shaikh, and Mr. Mo Pandiarajan taught the Fellows not only how to build a Foldscope, but also how to use one for daily science experiments. The workshop was a fantastic way to broaden the minds of the students and encourage them to explore scientific waste management methods.

Category B and Category C Fellows also got to interact with Mr. Manish Dabkara, International Carbon Markets Leader, and Chief Managing Director (CMD) and Chief Executive Officer (CEO) of EKIESL, on the "Overview on Carbon Credit and Sustainable Future." The Fellows are already involved in community-based solutions to negate carbon emissions, and thus, were especially interested in learning about the benefits of mass projects to avail carbon credits and on participating in the emerging carbon market.

Additional events on the first day included an interactive session on "Applying the Technology-Business-Design Approach to create Wealth from Misplaced Resources," conducted by Dr. Vijayraghavan Chariar, who is a Professor at the Centre for Rural Development and Technology, IIT Delhi, the Co-founder of JoyisYou, and the Chairman of Ekam Eco Solutions. This event provided the Fellows with a platform to discuss ethical ways to start a waste management business and core practices that need to be followed to create a more significant impact on the community and the environment.

A riveting panel discussion on "Entrepreneurship Opportunities in Waste Management" was also held, and included Ms. Shipra Mishra, CEO and Managing Director (MD) of City Knowledge Innovation Cluster, Delhi Research, Implementation, and Innovation (CKIC-DRIIV); Mr. Nick Booker, Founder of IndoGenuis; and Mr. Apurv Misal, Marketing Head of Phool.co. They interacted with the Fellows and answered their queries surrounding entrepreneurship in waste

management. The case study on Phool.co—a business selling incense sticks made from flowers polluting the water bodies of Kanpur—proved to be highly inspirational for the Fellows.

On the second day, the Guest of Honour, Dr. Bhagwan Singh Chaudhary, a Professor at Kurukshetra University, Haryana, addressed the SSFs, saying, *"I congratulate the Office of the PSA to the Government of India and Invest India for bringing fellows from across the country to this platform. I would like to mention to all the Fellows that this is not the end of your association with us. Your association with the Government of India is valued, and you are ambassadors of the Office of the PSA to the Government of India."*

As the two-day event drew to a close, Dr. Manoranjan Mohanty congratulated the Fellows again, and assured them that the Office of the PSA would continue to support and guide them. Mr. Vijay Kumar from ITC WOW awarded 18 Fellows with ₹5000 each and spoke about ITC's commitment to support SSFs in their respective states.

For the next batch of SSFs, 120 applicants have already been selected from a pool of over 1300 applicants. The current as well as future SSFs are torchbearers of the Waste to Wealth mission's aim—to use waste effectively and convert solid waste into valuable resources. In a year, the Fellows have sensitised more than 3.5 lakh people and conducted more than 2,700 workshops and awareness sessions. In addition, the SSFs who have completed the fellowship are being supported by Invest India and the Office of the PSA, to connect with individuals and organisations who can take their work forward and help them make an even bigger impact on the Indian community as a whole.

ABOUT THE AUTHOR

Anvi Mehta is an author and creative lead.
Krittika Sengupta is a part-time content writer and editor.

SSF Fellows and guests at the closing ceremony of the Swachhta Saarthi Samaroh 2022
Image credits: Image Credits: Office of the PSA