

Science Beyond Borders: Policies, Opportunities, and Challenges

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Introduction

The insightful panel discussion, *Science Beyond Borders: Policies, Opportunities, and Challenges*, was conducted during the India International Science Festival (IISF) 2024, held from 30 November to 3 December in Guwahati, Assam. IISF, an initiative of the Ministry of Science and Technology and the Ministry of Earth Sciences, Government of India, in association with Vijnana Bharati, aims to engage the public with science in an interactive and enjoyable manner. This session brought together distinguished experts and policymakers to explore the multifaceted dimensions of global scientific partnerships, aligning with the festival's overarching goal of fostering a culture of scientific temper and international cooperation.

In an era of global challenges such as climate change, public health crises, food security, and energy needs, science and technology have emerged as powerful instruments for fostering international cooperation. Science diplomacy—the use of scientific collaborations among nations to address global issues—has gained prominence as a driver of both scientific progress and international relations. The panel discussion aimed to address the critical role of cross-border scientific collaborations in addressing these pressing concerns.

Chaired by Prof. Ashutosh Sharma, President of the Indian National Science Academy (INSA) and former Secretary, Department of Science and Technology (DST), the panel featured leading experts: Dr Nitin Seth, Director, Indo-French Centre for the Promotion of Advanced Research (CEFIPRA); Shri R. Madhan, Director, Indo-German Science and Technology Centre (IGSTC); Dr Praveen Kumar S, Head, International Cooperation, DST; Dr. Rama Swami Bansal, Head, International S&T Affairs Division, Council of Scientific and Industrial Research (CSIR); and Dr Yelloji-Rao Mirajkar, International Convener, Global Indian Scientists and Technocrats (GIST) Forum.

The session explored multidimensional aspects of international scientific cooperation, including policy frameworks, intellectual property (IP) concerns, mobility gaps, and the need for equitable partnerships. This report synthesises the discussions while providing broader insights into science diplomacy and its implications for India.

Rationale for International Scientific Collaboration

Science thrives on the free flow of ideas, expertise, and resources. Historically, international collaborations have been driven by groundbreaking discoveries. Examples such as the European Organization for



Nuclear Research (CERN), the International Space Station (ISS), the Human Genome Project (HGP), and the Intergovernmental Panel on Climate Change (IPCC) illustrate the transformative potential of cross-border partnerships. Together, these initiatives reflect the spirit of *Science Beyond Borders*, underscoring the immense value of global cooperation in advancing scientific knowledge, addressing global challenges, and promoting a sustainable and equitable future for all.

From an Indian perspective, international collaborations have been instrumental in advancing research capabilities and addressing national priorities. Institutions like IGSTC and CEFIPRA serve as successful models of bilateral scientific cooperation. Shri R. Madhan, Director, IGSTC, highlighted that modern scientific collaborations extend beyond conventional knowledge exchange, including infrastructure sharing, workforce development, and diverse problem-solving in critical areas. By enabling Indian researchers to access specialised laboratories, advanced instruments, and valuable datasets, infrastructure sharing empowers them to work on pioneering technologies at the global forefront. Similarly, initiatives like exchange programs, fellowships, and joint research endeavours are pivotal in capacity building, equipping scientists with the skills and experience necessary to address emerging challenges. Moreover, the inclusion of diverse perspectives through international partnerships fosters innovative approaches to tackling complex global issues, reinforcing the transformative potential of cross-border collaborations in science and technology. Such partnerships are essential for addressing global problems like pandemics, renewable energy, and water resource management.

Science Diplomacy: A Strategic Tool for Geopolitical and Scientific Advancement

India has positioned itself as a key player in science diplomacy through initiatives such as the India-Africa S&T Cooperation, the BRICS Framework for Science and Technology, India's Space Debris Mitigation with Japan, Australia-India Green Hydrogen Cooperation and India-France AI Partnership, to name a few. Dr Seth highlighted that Indo-French collaborations, particularly in renewable energy, health sciences, and artificial intelligence (AI), exemplify win-win partnerships that drive innovation and capacity building.

Prof. Ashutosh Sharma, President of INSA, aptly noted that science is both cooperative and competitive. While international partnerships foster collaboration, nations remain protective of their IP and technological advancements. Balancing cooperation with national interests is central to effective science diplomacy.



Role of Policies in Enabling Cross-Border Science

Policies serve as vital enablers for international collaborations by establishing clear frameworks that address key aspects of joint research and innovation. They provide guidelines for IP sharing, ensuring clarity on the ownership and commercialisation of outcomes from collaborative efforts, which is crucial for fostering trust among partners. Additionally, policies on data governance create rules for secure and ethical data sharing, particularly in sensitive and rapidly evolving fields such as AI and genomics. These policies further reduce barriers by simplifying regulatory processes related to international travel, research funding, and technology transfer, enabling seamless collaboration and the effective exchange of knowledge, resources, and technologies across borders.

Dr Rama Swami Bansal, Head of ISTAD at CSIR, stressed the importance of reciprocal frameworks in collaborations, aligning with India's draft Science, Technology, and Innovation (STI) Policy 2020, which advocates leveraging global partnerships to achieve technological self-reliance while contributing to global innovation ecosystems.

However, challenges remain. As Dr Praveen Kumar S, Head of International Cooperation at DST, highlighted, while data policies are critical for future collaborations, they also create complexities. The exponential growth of data in fields such as AI, quantum computing, and climate modelling calls for robust international data security and privacy regulations.

Mobility Challenges: Addressing the Imbalance

Cross-border mobility of researchers is fundamental to scientific collaborations. However, panellists noted that while Indian researchers frequently travel abroad, reciprocal exchanges remain limited. Dr Nitin Seth, Director, CEFIPRA, discussed efforts to enhance mobility under Indo-French programmes, focusing on short-term mobility schemes for students to gain international exposure. He also emphasised the balanced hosting of workshops and seminars in both India and France, fostering collaborative learning and mutual understanding.

Despite India's state-of-the-art infrastructure—particularly in institutes under CSIR and the Indian Institutes of Technology (IITs)—barriers such as academic calendar mismatches, cultural differences, and perceptions about working conditions discourage researchers from other countries. This mobility gap is not unique to India. Researchers from developing nations face challenges in securing travel funding

and institutional support for international exchanges.

To enhance mobility, the panel suggested:

- Developing Short-Term Research Programs: Offering 15-30 day research exchanges aligned with global academic calendars.
- Promoting Thematic Partnerships: Creating focus areas such as AI, climate technology, and health sciences to attract foreign researchers.
- Strengthening Research Ecosystems: Enhancing infrastructure, support systems, and cultural acclimatisation for visiting scholars to ensure a conducive research environment.

Balancing Intellectual Property and Global Cooperation

IP sharing remains a contentious issue in international collaborations. As Shri Madhan pointed out, conflicts often arise when IP ownership is undefined at the start of a project. The panel advocated for project-specific agreements that clarify IP rights while ensuring equitable benefit-sharing. Additionally, there is a growing need for a global IP framework akin to multilateral arrangements under the BRICS framework. Such a system would provide standardised regulations, enabling scientists to focus on research without legal ambiguities.

Dr Yelloji-Rao Mirajkar, GIST Forum, introduced a unique perspective, advocating for public-domain outputs in collaborations involving NGOs and global forums. For certain sectors, prioritising open science over proprietary interests can accelerate progress on pressing global challenges.

Conclusion

India's leadership in global science diplomacy is increasingly evident through initiatives such as the G20 Presidency's focus on scientific collaborations, strengthened partnerships with the Global South, and the Indo-Pacific Science and Technology Cooperation. As Prof. Ashutosh Sharma summarised, India must adopt a balanced approach—prioritising national interests while contributing to global innovation ecosystems, reinforcing the ethos of “Vasudhaiva Kutumbakam”—the world is one family.

The *Science Beyond Borders* discussion underscored the significance of international scientific collaborations in fostering innovation and addressing global challenges. By addressing challenges like policy gaps, mobility imbalances, and IP conflicts, nations can unlock the full potential of cross-border partnerships. For India, science diplomacy presents a strategic opportunity for leadership in global scientific initiatives. Through well-structured policies, reciprocal collaborations, and investments in the research ecosystem, India can solidify its position as a hub for international scientific cooperation. As science continues to transcend borders, fostering equitable, transparent, and impactful partnerships will remain crucial to shaping a sustainable and prosperous future. The future of science lies not in isolation but in collaboration—where nations unite to solve the greatest challenges of our time.