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Editorial

The year 2026 underscores a defining paradox for the global scientific community: deepening geopolitical fractures alongside an urgent need for collective action. Ongoing conflicts, notably the Russia–Ukraine War and the US/Israel–Iran War, have disrupted not only political and economic systems but also the fabric of international scientific collaboration. Research partnerships have slowed or stalled, mobility of scientists has been constrained, and emerging concerns such as energy insecurity and conflict-induced [environmental degradation](#)—ranging from pollution to ecosystem damage—have intensified. These developments highlight a critical reality: science can no longer be insulated from geopolitics.

In this evolving context, science diplomacy has moved from being a peripheral concept to a strategic necessity. Positioned at the intersection of science, policy, and international relations, it offers a mechanism to sustain dialogue when traditional diplomatic channels are strained. While it may not resolve conflicts, its value lies in preserving communication, fostering trust, and maintaining long-term collaborative bridges. In an era defined by transboundary challenges—climate change, public health crises, and the governance of emerging technologies—science diplomacy is not optional; it is indispensable.

Yet, the current global order also reveals the limitations of this approach. The assumption that science is inherently universal and apolitical is being tested in a multipolar world where national interests increasingly shape research agendas and partnerships. The fragmentation of global science ecosystems, as witnessed during recent conflicts, signals a shift from open collaboration towards more strategic, and at times guarded, engagement. This evolving reality calls for a more pragmatic and structured approach to science diplomacy—one that balances openness with strategic considerations.

These themes found clear resonance at the Raisina Dialogue 2026, India’s flagship platform on geopolitics and geoeconomics. Over the years, the Dialogue has progressively integrated science and technology into its deliberations, reflecting their growing role in shaping global power dynamics. The launch of the [Raisina Science & Diplomacy Initiative](#) at the 2026 edition marks a significant step in institutionalising this engagement.

Parallel efforts in other parts of the world reinforce this trend. The European Union’s recent move to establish a structured [framework for science diplomacy](#) reflects an intent to act more cohesively in international research and innovation engagement. Encouragingly, the Global South is increasingly shaping this evolving landscape. Recent developments illustrate this shift. In South Africa, sustained capacity-building [initiatives](#), including science diplomacy training programmes, are nurturing a new generation of professionals equipped to operate at the science–policy–diplomacy nexus.

Similarly, countries like Malaysia are [positioning](#) themselves within regional and global science diplomacy frameworks, leveraging platforms such as ASEAN to strengthen cooperation in science and technology. In Sri Lanka, the launch of the [book](#) *Science Diplomacy: National, Regional and Global Approaches in a Changing World* marks a significant intellectual contribution to the field, reflecting a growing engagement of scholars and practitioners with science–policy interfaces. This diversification is vital for ensuring that science diplomacy reflects varied regional priorities and global realities.

This issue of the *Science Diplomacy Digest* brings together diverse perspectives that resonate with these global developments. The opening article by the Geneva Science and Diplomacy Anticipator (GESDA) team, following their engagement in New Delhi in March 2026, presents reflections from the Raisina Science and Diplomacy Initiative discussions. Prof. Tateo Arimoto, Senior Advisor to the President of the Japan Science and Technology Agency, underscores that science diplomacy is no longer a supplementary activity but a core capability for managing geopolitical uncertainty and governing technological change. Similarly, Clara Solé, Head, Internationalisation & Science Diplomacy, ICM-CSIC,

Barcelona, Spain, emphasises that while science diplomacy may not resolve geopolitical rivalries, it plays a critical role in shaping how interdependence is governed—making it a strategic imperative in an era of uncertainty.

This issue also features several insightful contributions that collectively highlight the expanding scope and growing significance of science diplomacy. As the global order continues to evolve, strengthening inclusive and resilient scientific cooperation will be essential to addressing shared challenges. We hope this issue offers valuable insights and stimulates further dialogue in this rapidly emerging field.

Monika Jaggi
Editor, *Science Diplomacy*

Reflection //////////////////////////////////////

From Reaction to Anticipation: Science Diplomacy in a New World Order

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When Finnish President Alexander Stubb opened the 2026 Raisina Dialogue with the words – “The Global South will decide what the next world order will look like. And India, as a major power, will be a key force in shaping it” – he announced that the axis of global power is shifting. And the inaugural Raisina Science & Diplomacy Initiative (SDI), jointly launched on March 5th by the Observer Research Foundation and the Office of the Principal Scientific Adviser to the Government of India, confirmed that science and technology sit at its very centre. It also marked a historic milestone: for the first time in its eleven editions, the Raisina Dialogue formally incorporated science diplomacy, signalling its entry into the mainstream geopolitical conversation.

GESDA came to New Delhi in early March 2026 carrying that conviction and a question that has animated our work for several years: is science diplomacy keeping pace with the acceleration of science itself? What follows are reflections drawn from the Raisina SDI discussions on what that means and what comes next.

Science Anticipation to Govern a Multipolar World

GESDA co-chaired the inaugural Raisina SDI with the message that science anticipation – the methodology at the heart of GESDA’s work – belongs at the table where strategic decisions about the world’s future are taken.

The discussions captured the tensions that will define the next decade of science diplomacy. How to navigate the growing friction between technological sovereignty and the inherently open, transnational nature of science? Are existing multilateral mechanisms fit to govern disruptive technologies, when these are advancing faster than our institutions can follow? The answer, heard repeatedly around the table, is that they are not – and that this gap is most acutely felt in the Global South.

Raisina Dialogue pushed us to collectively tackle the core dilemma of science diplomacy in the emerging world order: how do nations balance collaboration and competition in a fast-moving race for advantage in technologies – quantum, AI, synthetic biology, neurotechnology – that will reshape economies, militaries and societies in the next decades?

ⁱ *The Geneva Science and Diplomacy Anticipator (GESDA) is an independent foundation created by the Swiss Confederation, the Canton and City of Geneva, to connect science anticipation with global diplomacy. GESDA’s mission is to anticipate emerging scientific breakthroughs and help translate them into inclusive, ethical, and cooperative solutions to global challenges.*



GESDA's answer: by shifting governance from reactive to anticipatory. Every one of the technologies currently dominating geopolitical and security discourses – AI, quantum computing, brain-computer interfaces, synthetic biology – is being discussed primarily in response to risks that are already appearing. Multilateral institutions cannot keep pace with the acceleration of science and are scrambling to catch up with deployments already embedded in markets and militaries. The result is that ethical frameworks, human rights considerations, equity implications, and dual-use risks are addressed too late, when options have already narrowed, and fractures have become evident.

Science anticipation offers a different logic. Rather than reacting to scientific developments once they are mature, it acts within the critical window between when transformative advances become conceivable and when they are deployed at scale. The intent is not primarily to prevent risk but to ensure that opportunities are not missed, that benefits are shared broadly, and that the governance conversations we need are seeded now, for the profit of future generations. This is why the [GESDA Science Breakthrough Radar](#) – which maps the research advances expected to transform society at 5-, 10- and 25-year horizons, based on the judgement of human experts rather than algorithmic prediction – is not simply a foresight tool. It is a diplomatic instrument.

Much of the debate focused on the growing role of non-state actors in science diplomacy – large technology corporations, deep-tech start-ups, venture capitalists that now fund innovation, control platforms, shape standards, and determine access to digital infrastructure. Here becomes essential the role of **honest brokers**: neutral and agile multilateral platforms that can convene research, diplomacy, industry, and citizens without advocacy for any particular outcome. In a geopolitical space where neutrality is often treated as passivity, GESDA practices what we describe as 'active neutrality' – a distinctly Swiss tradition. The honest broker is not neutral about the success and integrity of the process, but remains neutral about which policy choices stakeholders ultimately make. In a domain where facts intersect with values and sovereign interests, that distinction is what makes inclusive deliberation possible at all.

The Anticipatory Leadership Lab: Science Anticipation in Practice

To put science anticipation into practice, the Embassy of Switzerland in New Delhi and GESDA, together with the Office of the Principal Scientific Adviser to the Government of India, convened an Anticipatory Leadership Lab attended by around 60 leaders from science, government, diplomacy, business, and civil society across India.

The GESDA Anticipatory Leadership Labs are structured multistakeholder dialogues grounded in the Science Breakthrough Radar, guiding participants through three steps: first, they see the future of science; then they use the future to build the present; and conclude by creating their action plan. Each table worked with frontier science domains – quantum, AI, neurotech, synthetic biology – and asked: what are the plausible implications for India at five-, ten- and twenty-five-year horizons? What opportunities risk being missed? What governance conversations need to begin today?

State Secretary Alexandre Fasel of Switzerland, speaking at the Lab, articulated the Swiss government’s position: that understanding and anticipating scientific breakthroughs is no longer a diplomatic luxury but a necessity, and that science and technology have become a core currency of international affairs, influencing prosperity, sovereignty, and security. Prof. Ajay K. Sood, Principal Scientific Advisor to the Government of India, observed that the conventional reactive governance cycle – where institutions convene, deliberate, and respond only after disruption has arrived – served adequately in eras of slower, linear change. But it is no longer adequate in our era of science acceleration.



The Lab showcased not only the quality of analysis but also the depth of appetite. Senior Indian officials, scientists, and diplomats engaged with the Radar’s horizons not as hypothetical scenarios but as strategic intelligence. The Lab in New Delhi was a first step toward a longer-term partnership, in which a full immersion in the GESDA methodology, co-designed with Indian institutions, will be anchored in India’s own priorities and knowledge systems.



The Next Generation: ORF Fellows Travel to the Quantum Future in 2035

As part of the ORF's Raisina Young Fellows Programme 2026, GESDA hosted the Quantum Diplomacy Game: a multi-stakeholder simulation that places participants – government, industry, science, civil society – inside the governance dilemmas of quantum computing before they fully materialise. The game asks: how do you build frameworks before the technology is mature and power concentrates in too few hands? How do you ensure that a technology whose full implications are not yet known is nonetheless governed with equity, ethics, and global access in mind?

One of the Fellows noted that geopolitical shocks usually arrive without warning, leaving people feeling powerless. But sitting around a table with people from different disciplines, countries, and economic realities, deliberately thinking twenty-five years forward, reminded her that agency is possible – that starting a multistakeholder dialogue across countries, regions, and sectors early on is one of the most powerful tools available.



India's next generation of scientists and diplomats will inherit a world shaped by decisions being made right now on quantum governance, AI standards, synthetic biology frameworks, and neurotechnology ethics. Their role in making these decisions depends, in part, on whether they have been trained to think in anticipatory terms. GESDA's Anticipatory Science Diplomacy Games are an instrument for doing that.

What's Next?

GESDA returns from New Delhi with three convictions reinforced. The first is that India is very much aligned with Switzerland on shaping the emerging architecture of anticipatory science diplomacy as a priority. The Raisina SDI is the institutional expression of that commitment. The scale, democratic pluralism, pioneering Digital Public Infrastructure, ambitious National Quantum Mission, and tradition of multi-alignment give India a distinctive leadership role – recently illustrated with the AI Impact Summit, which has now passed the baton to International Geneva.

The second conviction is that the Global South cannot afford to wait for mature technologies to arrive before engaging in governance conversations. Anticipation is often framed as a luxury amid the urgencies of the present. But the challenges visible on the horizon today will become the crises of ten years from now. Countries that do not participate in shaping the trajectory of emerging technologies will find themselves on the receiving end of governance frameworks decided elsewhere. The [Open Quantum Institute](#) – GESDA's anticipatory governance initiative for quantum computing, incubated at CERN and active from Ghana to Uruguay, from Philippines to Costa Rica, with India as a founding Advisory Committee member – is proof that this approach is not utopian.

The third conviction is about the practice of science diplomacy itself. The field has matured enormously since its formal articulation in the early years of this century. The Raisina SDI represents something new: a multi-stakeholder, forward-looking, institutionally embedded platform that can become a reference point for how science diplomacy is practised in a multipolar world. GESDA, with its unique contribution to that landscape when it comes to science anticipation, is proud to be its co-chair. We take that responsibility seriously as active partners in building the kind of anticipatory architecture the world urgently needs - using the future to build the present.

Bridging STI Policy and Foreign Policy: Advancing Action-Oriented Science Diplomacy

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Introduction

Science diplomacy is entering a new phase. For several decades following the end of the Cold War, international scientific cooperation expanded within an increasingly globalised environment. Scientific exchange, collaborative research programs, and transnational networks flourished. Science diplomacy was widely understood as an instrument of soft power that strengthened mutual trust and facilitated international cooperation.

Today, however, the environment in which science operates is undergoing a structural transformation. Geopolitical tensions are intensifying, while emerging technologies—particularly artificial intelligence and quantum technologies—are advancing at unprecedented speed. At the same time, a small number of large technology companies now exert significant influence over diplomacy.

These developments are reshaping the relationship between science, technology, and international politics. As a result, science diplomacy must also evolve. Understanding this transformation requires attention to the historical evolution of national science, technology, and innovation (STI) policy.

From Globalisation to Geopolitical Fragmentation

Since the Second World War, the objectives of STI policy have evolved in response to societal demands, geopolitical contexts, and technological opportunities. During the Cold War, science policy was closely linked to national security and strategic competition. In the decades that followed, globalisation and market-driven economic growth became dominant forces, shaping innovation policies in many countries. International competitiveness and economic growth became central policy goals. Within this context, science diplomacy emphasised international research collaboration, open scientific exchange, and the expansion of global scientific networks. Scientific cooperation was widely regarded as a means of strengthening soft power and building trust among nations.

Today, this paradigm is changing. STI policy has evolved from a sectoral policy to the center of national strategy. Governments increasingly view technological capabilities as critical assets for economic, national, and geopolitical security. Supply chains for semiconductors, advanced materials, and digital infrastructures have become strategic concerns, while export controls, technology protection measures, and international standard-setting have become important elements of diplomatic practice.

At the same time, the rapid rise of large technology companies has introduced new actors into global technology governance. Their control over data infrastructures, digital platforms, and technological

ecosystems increasingly shapes innovation trajectories, market structures, and regulatory debates across borders.

This shift does not mean that international scientific collaboration has lost its importance. On the contrary, many global challenges—such as climate change, pandemic preparedness, energy transitions, and biodiversity loss—require deeper international scientific cooperation. The challenge, therefore, is not to choose between openness and protection, but to manage both simultaneously. Science diplomacy now operates at the intersection of cooperation and strategic competition.

Linking STI Policy, Science Advice and Science Diplomacy

In this evolving landscape, it is useful to view science diplomacy within a broader governance framework linking STI policy, science advice, and science diplomacy. STI policy provides the strategic direction that shapes national research priorities, technological capabilities, and innovation systems. Science advice translates scientific knowledge and technological assessment into evidence-informed policy choices. Science diplomacy then operates externally, connecting these national capabilities and policy objectives with international cooperation, negotiation, and governance. In this framework, science advice functions as a critical bridge between domestic STI policy and international science diplomacy, enabling governments to align scientific expertise, national strategy, and global engagement.

Today, policy decisions related to emerging technologies are often made under conditions of high uncertainty, incomplete evidence, and rapidly evolving technological trajectories. Science advice must therefore become more anticipatory and strategic. Governments increasingly require analytical and design capacities that combine scientific expertise, strategic foresight, and risk analysis. Strategic intelligence in STI policy has thus become essential for modern governance.

Science advisers must operate across a broader range of policy domains. Emerging technologies intersect with new industrial policy, national security policy, regulatory governance, and international diplomacy. In this complex landscape, science advisers help policymakers navigate interactions among technological development, societal impacts, and geopolitical dynamics, while maintaining scientific integrity and independence.

These evolving responsibilities require new competencies, education, and training for the next generation of science advisers and science diplomatic practitioners.

National Institutional Actions: The Case of Japan

Countries are experimenting with different institutional approaches to strengthen science advice and science diplomacy, depending on their distinct political systems and cultural contexts.

Japan provides an illustrative example. As in many countries, science diplomacy is primarily promoted through the Ministry of Foreign Affairs and its diplomatic service. However, two additional institutional mechanisms have emerged as increasingly important.

First, Japan has increasingly utilised research funding programs as instruments of international engagement. Funding mechanisms that support international research collaboration and talent mobility are designed not only to advance scientific knowledge but also to strengthen diplomatic relationships and regional trustworthy networks. STI policy and research funding systems can therefore function as practical tools of science diplomacy.

Second, Japan has taken steps to strengthen the institutionalisation of scientific advice within policy processes. Embedding scientific expertise in strategic policy discussions allows governments to incorporate evidence-based analysis into foreign policy and technology governance.

These developments highlight a broader lesson. Effective science diplomacy depends on robust national science advisory ecosystems.

Operationalising Science Diplomacy through STI Policy Instruments

A persistent challenge is that science diplomacy is often discussed as a concept, while the policy instruments that could operationalise it remain underutilised. In many countries, STI policy and foreign policy still operate in parallel rather than in close integration. Research funding programs, innovation partnerships, and science advisory mechanisms could serve as practical tools of diplomacy, yet their strategic use remains limited. Bridging this gap—linking STI policy instruments with diplomatic objectives—will be essential for transforming science diplomacy from a normative idea into an action-oriented practice.

Strengthening Global Science Diplomacy Infrastructure

At the international level, several organisations play complementary roles in supporting science advice and science diplomacy. International institutions such as the International Science Council (ISC), the International Network for Governmental Science Advice (INGSA), the Foreign Ministries Science and Technology Advice Network (FMSTAN), and scientific assessment bodies such as the Intergovernmental Panel on Climate Change (IPCC) contribute to the global architecture of scientific cooperation and policy advice.

In an increasingly fragmented geopolitical environment, these institutions can function as important global public goods by providing stable platforms for dialogue, knowledge exchange, and trust-building among scientists, policymakers, and diplomats.

Science diplomacy also involves a broad spectrum of actors. In the rapidly changing world, the traditional distinction between Track 1 and Track 2 diplomacy only partially captures this complexity. In practice, science diplomacy operates across a continuum that involves governments, scientific institutions, international organisations, the private sector, and civil society.

Conclusion

The global system is entering a period of profound transformation. Rapid technological change and growing geopolitical fragmentation are reshaping the environment in which science operates. In this context, science diplomacy can play an important stabilising role. It can help sustain international cooperation in addressing global challenges while contributing to the governance of emerging technologies. However, science diplomacy will not be effective if it remains primarily a conceptual framework. It must be grounded in practical policy instruments. Integrating STI policy with foreign policy—through research funding programs, innovation partnerships, and science advisory mechanisms—offers a pathway for translating scientific cooperation into strategic diplomatic practice. Science diplomacy is therefore becoming not merely a supplementary activity, but a core capability for managing geopolitical uncertainty and governing technological change in the 21st century.

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European Science Diplomacy at a Moment of Strategic Reckoning

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The 2nd European Science Diplomacy Conference unfolded against a backdrop that felt less transitional and more transformational. Science diplomacy is no longer a niche practice situated at the margins of research cooperation or foreign policy. It is becoming a structural component of how Europe understands power, sovereignty, competitiveness, and global responsibility.

What emerged from the discussions was not simply endorsement of science diplomacy's relevance. Rather, the conference revealed a field in the midst of consolidation and tension. European science diplomacy is being institutionalised through a common framework at precisely the moment when geopolitical fragmentation, technological acceleration, and strategic rivalry are redefining the terms of global engagement. The question is no longer whether Europe should pursue science diplomacy, but how it can do so without undermining either its openness or its strategic interests.

Openness Under Pressure

European research cooperation has long been grounded in multilateralism and the circulation of knowledge. The often-repeated formula – “as open as possible, as closed as necessary” – captures an ethos that has shaped EU research policy for decades. Yet the conference made clear that this balance is becoming increasingly delicate.

Science and technology are now inseparable from economic resilience, industrial policy, and national security. Rapid technological development has intensified the strategic value of research. In this environment, openness is no longer an unquestioned virtue but a condition to be calibrated.

The proposal to integrate a “fifth freedom” – the free movement of knowledge – into the Single Market reflects recognition that Europe's economic model must evolve in response to this new reality.¹ Knowledge is not merely an input to innovation; it is a geopolitical asset. At the same time, concerns about dual-use technologies, intellectual property, and research security underscore a growing awareness that interdependence can create vulnerability.

The tension is structural. If Europe closes itself in the name of security, it risks undermining the collaborative foundations of its scientific excellence. If it remains indiscriminately open, it risks strategic dependency. Science diplomacy sits precisely at this intersection.

Institutionalisation as a Response to Fragmentation

The emergence of a European Framework for Science Diplomacy signals a shift from fragmented

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practice to coordinated strategy.² For years, science diplomacy initiatives across Member States evolved organically through diaspora networks, embassy initiatives, or ministry-level experimentation. The framework reflects a recognition that coherence is now necessary.

National examples discussed during the conference illustrate different pathways toward institutionalisation. France's early strategy and its current update reflect adaptation to a more competitive global landscape. Slovenia's creation of a science diplomacy department and dedicated embassy fund shows how operational mechanisms are being embedded within foreign ministries. Spain's engagement with scientific networks abroad demonstrates the importance of transnational communities. Denmark's continued scientific engagement despite political tensions highlights the resilience of research ties.

These examples do not point toward uniformity, but toward convergence. Science diplomacy is moving from being an optional add-on to becoming part of Europe's strategic toolkit. Yet institutionalisation does not eliminate ambiguity. Rather, it formalizes the space in which competing priorities – economic, security-related, normative – must be reconciled.

The Securitisation Dilemma

Perhaps the most revealing debates concerned the securitisation of science. The discussion extended beyond classical national security to encompass economic competition and technological leadership. The categories of "critical technologies" and "dual use" now occupy central policy space.

A metaphor captured the dilemma: is science a dial or a switch? If treated as a switch, research can be abruptly curtailed through classification or exclusion. If treated as a dial, openness can be adjusted with proportionality.³

The risk of over-securitisation is evident. If every critical technology is framed as a potential weapon – whether military or economic – the logic of precaution may overwhelm the logic of collaboration. Yet the counterpoint is equally compelling: ignoring risk is no longer viable in a context where technological dependencies can have systemic consequences.

What emerged from the debate was not a binary answer, but an insistence on symmetry between risk and benefit. Security measures must be proportional and effective, not reflexive. Science diplomacy, in this sense, becomes a mechanism of calibration. Its role is to prevent necessary safeguards from sliding into indiscriminate closure.

Multilateral Governance and the Politics of Knowledge

Ocean governance discussions offered a concrete illustration of science diplomacy in action. Negotiations on biodiversity beyond national jurisdiction and seabed governance demonstrate how scientific expertise shapes legal regimes. At the same time, they expose structural inequalities.

Research funding influences whose knowledge informs policy. Implementation gaps reveal the limits of negotiated agreements. The growing role of private actors in data collection raises questions about access, ownership, and accountability. Meanwhile, traditional and indigenous knowledge remains marginal in many formal processes, partly because it does not conform to dominant methodological standards.

These dynamics are not unique to ocean governance. They reflect broader political economies of knowledge production. Science diplomacy does not operate in a neutral epistemic space; it is embedded in hierarchies of funding, methodology, and influence.

Similarly, anticipatory governance initiatives emphasize that diplomacy must engage with emerging technologies before crises unfold. The lesson from recent global challenges is that delayed coordination carries high costs. Anticipation, however, requires trust, foresight, and sustained investment – resources unevenly distributed across regions.

Science Diplomacy, Peace and Strategic Competition

Throughout the conference, science diplomacy was also framed as a pathway toward peace. Examples of scientific collaboration in politically sensitive contexts illustrate how technical engagement can open channels that formal diplomacy struggles to sustain.

Yet this normative aspiration coexists with a more realist recognition: diplomacy is rarely detached from national interest. The question is whether science diplomacy can expand the space for mutual gain, or whether it ultimately mirrors geopolitical competition.

Engagement with the Global South makes this tension visible. Africa's limited share of global R&D investment underscores structural disparities. But the Global South is not confined to Africa. Asia and Latin America are equally central to the future of global science, innovation, and sustainability. Climate adaptation, biodiversity protection, health resilience, and digital governance cannot be addressed without meaningful participation from these regions.

If Europe approaches partnerships primarily through a lens of strategic competition, concerned that "others" might gain influence, cooperation risks becoming transactional. If, instead, partnerships are grounded in shared agenda-setting and capacity-building, science diplomacy can strengthen global resilience while enhancing Europe's credibility.

Global South as a Measure of Credibility

The European Framework aspires to coherence within Europe. Its broader significance, however, will be judged by how it engages beyond itself.

Three issues are particularly salient. First, funding asymmetries shape agenda-setting power. When those who finance research also define priorities, partnerships can become structurally unequal. Genuine co-creation requires mechanisms that redistribute not only resources, but voice.

Second, institutional models are not universally transferable. Establishing science diplomacy units or dedicated embassy funds may be feasible within European administrative systems, but less so in contexts where public institutions face resource constraints. Flexibility and contextual adaptation are essential.

Third, normative commitments such as academic freedom, integrity, and openness must be advanced through dialogue rather than projection. If these principles are framed as conditions imposed rather than values negotiated, trust erodes.

In this sense, the Global South can serve as a measure of whether European science diplomacy can reconcile strategic autonomy with equitable partnership. The credibility of the framework depends not only on internal alignment but on external perception.

Governing Interdependence

The conference conveyed a field that is no longer searching for relevance but grappling with responsibility. European science diplomacy is consolidating at a time when interdependence is both indispensable and contested.

The central challenge is governance: how to manage interdependence without sliding into either naïve openness or defensive fragmentation. The European Framework seeks to institutionalize that balance. Whether it succeeds will depend on sustained political commitment, proportional security measures, and partnerships that extend beyond Europe's immediate strategic horizon.

Science diplomacy cannot resolve geopolitical rivalry. But it can shape how interdependence is governed. In an era defined by uncertainty, that task is neither technical nor secondary. It is strategic.

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Quantum Diplomacy, Data Security, and India's Digital Future

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India is living through a digital revolution at a scale few countries have attempted. From [Aadhaar-enabled identity services](#) and [UPI-based real-time payments](#) to [National Health Systems Resources](#), [telecom networks](#), and [advanced biomedical research](#), data has become the invisible infrastructure of governance, science, and the economy. India's digital public infrastructure is advancing from the classical to the quantum era. Its four strategic pillars: communication, sensing, computing, and cryptography promise transformative benefits in various sectors, i.e., pharmaceuticals, finance, artificial intelligence (AI), logistics, space exploration, and energy. However, the same leap in computing power introduces a profound risk for data security systems.¹⁻³ As new technologies advance, widely used encryption and digital signature methods will become vulnerable. Many critical data types, such as identity records, healthcare data, financial archives, and scientific repositories, must remain confidential. India will therefore need a shift to post-quantum cryptography (PQC), a new generation of data security systems designed to resist attacks from powerful quantum computers.⁴ PQC should be the immediate imperative because of the 'harvest now, decrypt later' threat, i.e., data encrypted today can be collected and decrypted later once sufficiently capable quantum capabilities evolve. In other words, while quantum risks may take years to hit, the countdown has already begun.¹⁻³

Science Diplomacy and Quantum Risks

Science diplomacy is often described in terms of scientific alliances, collaborations, and large mega science projects. In the quantum era, diplomacy also plays an important role in coordinating transition timelines to quantum-safe data security, setting technology standards, managing critical digital infrastructure, and ensuring that systems remain interoperable, mitigating quantum risks. This matters because India's digital ecosystem is deeply connected to the world. If countries adopt different security baselines at significantly different paces, interoperability can weaken, and trust can erode. In practical terms, stalled or uneven upgrades can translate into greater friction in sensitive international exchanges: more audits, tougher compliance requirements, delayed partnerships, and reputational 'trust deficits' that affect finance, research collaboration, and digital governance.⁵⁻⁶

The Missing Strategy in India's Quantum Ambitions

India has formally acknowledged the strategic importance of quantum technologies through the [National Quantum Mission](#), under the Government of India (GoI). Defence Research and Development Organisation

* Views in the article are of the author and do not belong to the organisation they represent.

(DRDO) and Indian Space Research Organisation (ISRO) have demonstrated their competence in secure communication methods for defence and space applications. These achievements show that India is not starting from scratch, and quantum-safe communication is already a strategic priority in sensitive domains.⁷⁻⁸ The Indian Computer Emergency Response Team ([CERT-In](#)) and the Ministry of Electronics and Information Technology ([MeitY](#)), along with industry partners, have begun promoting 'quantum cyber readiness' through advisories and whitepapers, including joint reports with firms such as SISA.⁹ These documents have already speculated that future quantum computers could compromise today's data security approaches. They rarely address public digital systems and integrate the scientific, policy, and long-term societal risk dimensions for nationwide PQC transition. Upgrading to deeply embedded and often legacy cryptographic components of the digital ecosystem will require careful planning and coordinated action at scale.⁴ Without crypto-agility – the ability to update encryption without rebuilding entire systems – future upgrades will be slow, expensive, and difficult to manage. The key science diplomacy risk here is asymmetry, or a quantum divide, which is not only about who has quantum computers first; it is about who can operate secure, interoperable infrastructure across borders and who becomes dependent on someone else's stack.⁵⁻⁶

Diplomatic Arena for Quantum-Safe Standards

In science diplomacy, technical standards often function as geopolitical infrastructure. One of the prime examples is the ongoing global effort to standardize PQC, led by the U.S. National Institute of Standards and Technology ([NIST](#)).⁴ The de facto standards or monopoly can create geopolitical vulnerability. The stakes are immense for India and imply that PQC readiness is not only about algorithms, but also about platforms that run them. If global standards converge, cross-border services and data flows become seamless and secure. However, if the world fragments into incompatible cryptographic zones, securing international finance, trade, and research will become fraught with friction. This transforms PQC from a simple transition plan into a strategic imperative for participation in global security governance.

The European Commission is also encouraging EU member states for a coordinated PQC transition, supported by the European Union Agency for Cybersecurity ([ENISA](#)) assessments.⁵⁻⁶ Within this landscape, Finland stands out for translating the quantum threat into practical national governance through its preparedness framework, most notably 'Data Security Impacts of Quantum Computing – Preparedness Recommended', prepared by the National Emergency Supply Organisation's Digipool and [VTT Technical Research Centre of Finland Ltd.](#)¹⁰ Also, Finland's National Cyber Security Centre ([NCSC-FI](#)) has issued operational guidance on PQC transition complemented by policy briefs from VTT, 'Kvanttiturvalliset salausmenetelmät Suomessa' summarising Finland's PQC capability-building and preparedness work.

These assessments reveal that other organisations lack basic visibility into their own cryptographic practices. Awareness of the quantum threat is relatively high, but concrete action, such as planning for transition, allocating resources, or training personnel, is limited. Finland has one of the finest national level 'quantum preparedness' guides currently available, translating the quantum threat into a practical transition manual for organisations that run critical services, with an indicative timeline that starts with inventory work during 2024-2026, planning across 2025-2028, and transition execution through 2026-2030.¹⁰

India has now articulated a national quantum-safe security plan, but the real test will be implementation, sectoral coordination, certification capacity, vendor readiness, and international interoperability.¹¹ Adapting the Finnish approach would help India to strengthen both domestic resilience and international trust for their post-quantum strategic plans.

Table 1: Recommendations for different stakeholders in India

Stakeholders	Primary Focus	Key Actions
Government	Coordination and minimum requirements	<ul style="list-style-type: none"> • Mandate cryptographic inventories for critical sectors and digital public infrastructure. • Publish time-bound milestones. • Create a national coordination forum linking MeitY/DST, sector regulators, critical infrastructure operators, and cybersecurity experts.
Industry	Implementation and transparency	<ul style="list-style-type: none"> • Publish PQC transition timelines to enable coordination with partners. • Prioritise PQC transition for infrastructure components that issue, manage, and rely on digital certificates.
Academia	Capacity building and standards participation	<ul style="list-style-type: none"> • Expand training in Quantum technologies. • Encourage active participation in standards bodies and open technical forums that shape strategic positioning.
Individuals and SMEs	Risk assessment and basic preparedness	<ul style="list-style-type: none"> • Keep OS/browsers core systems updated (so that quantum-safe upgrades can be adopted quickly). • Prefer vendors that demonstrate crypto-agility. • Classify data by longevity and reduce retention of high-sensitivity data.

Conclusion: Data Security as Science Diplomacy

Quantum technologies introduce a diplomatic paradox: they demand collaboration to build interoperable, secure systems while also intensifying strategic competition. The PQC transition process will test stakeholders’ strategic awareness and operational readiness.¹² Data security will increasingly become a diplomatic concern alongside a technical one. Trust in cross-border data flows and international research collaboration will depend on shared commitments to quantum-safe systems. In this context, standards coordination, interoperability, and preparedness will shape the reliability, credibility, and resilience of partnerships in digital governance and data-intensive science and technology programs.¹³ India has the talent, ambition, and strategic incentives to lead its quantum capabilities into civilian readiness – through clear timelines, comprehensive inventories, prioritisation, and crypto-agile procurement – while simultaneously engaging internationally to help shape the standards and trust frameworks that will define the next era of digital governance. In the quantum era, data security will increasingly function as diplomacy, as the infrastructure of trust can be negotiated, standardised, and demonstrated.

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Tech Diplomacy in An Era of Technology

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India regards technology as a key vector for economic growth and national power. India's S&T policy framework highlighted education, R&D, and innovation while pursuing self-reliance. Technology helped leapfrog stages of development and built capability in strategic areas. The integration of S&T policy with development priorities optimised resource allocation, enhanced capacity, and advanced governance priorities. Technology diplomacy accessed technology developed overseas and established innovation bridges, as well as cooperation in multilateral fora.

Integration of Development and Technology Policy

In ancient India, seminal contributions in mathematics and philosophy fostered a scientific temperament that enabled advances in economics and governance. This made India a prosperous country, though much of the progress was lost during the colonial period.

In modern times, India's S&T policy evolved over three phases: the *post-independence* framing of S&T priorities and policy, establishing infrastructure for education and research, and focusing on development and strategic sectors; the *post-economic* reform's emphasis on technology for growth, integration in supply chains and improved governance; and the *post-digital* era's adjustments for globalisation with emphasis on knowledge economy and importance of critical materials and technologies, framing new rules and leveraging technology diplomacy.

India's S&T endeavour was visionary for a developing country. It aligned technology policy with development priorities, supported a brilliant scientific community, and expanded its overseas collaborations. The [Scientific Policy Resolution](#) (1958) and [Technology Policy Statement](#) (1983) reflected on the potential of S&T for economic growth, while specific approaches were developed in the Report on Developing [S&T Clusters](#) (2020), [Semiconductor Mission](#) (2021), [Engagement Strategy for Quantum](#) (2025), [Nuclear Energy Mission](#) (2025), etc. The diplomatic initiative was outlined in the [S&T Policy](#) (2003), the Report on [International S&T Cooperation](#) (2021), and the Raisina [Science Diplomacy Initiative](#) (2026).

Geopolitics and The Era of Technology

In an era when technology and innovation dominate transformation in the globalised world, it is necessary to adopt a dynamic approach and align development priorities with technology and diplomacy. It is recognised that scientific achievements benefit from collaboration, yet protectionism prevails as nations and corporations seek to maintain an edge in technology.

Technology is embedded in geopolitics and geoeconomics. Thus, technology diplomacy expands cooperation in technology and innovation by leveraging economic opportunity. It is shaped by the stage of development, citizens' aspirations, the extent of globalisation, and scientific collaborations. India's top priorities include strategic security, the knowledge sector, critical minerals, and critical technologies for resilient value and supply chains, and addressing global challenges.

Technology and Strategic Security

On strategic security, the thrust areas are defence, advanced nuclear technology, and space. In defence, where technology transfers are often resisted, DRDO led India's aspiration for indigenous technology and local manufacturing. It coexisted with technology collaborations, co-development, and licensed production with partner countries. Recent reforms encouraged partnerships between the public and private sectors and with foreign entities, promoted technology infusion, and fostered civilian-military engagement in the defence sector. It facilitated an ecosystem for start-ups and innovations in missiles, drones, electronic defence, lasers, metallurgy, etc.

In space, ISRO's success in launch capability, building a satellite network, and space exploration was achieved with tight budgets and high indigenous content, but also included foreign cooperation. ISRO's cooperation agreements with 61 countries and multilateral institutions improved technology, capability, and efficiency. In turn, ISRO extended its support to several developing countries. The entry of private entities has given new momentum to space development.

In atomic energy, India's early start faced technology denial after our peaceful nuclear explosions; Russia remained a significant partner. Only after the civil nuclear agreement with the USA and domestic civil liability legislation did it attract foreign partners. India plans to add an additional 100 gigawatts of generation capacity by 2047, and the recent Nuclear Energy Mission seeks public-private partnerships to set up small modular reactors, large nuclear plants, and advanced technologies. BARC's recent prototype SMR could have export potential. India is a key partner at CERN and ITER, and DAE has civil nuclear cooperation agreements with a dozen countries.

Technology and The Knowledge Sector

In an era of disruptive technology, the development of [India Stack](#) marked a transition to a digital knowledge economy. With the use of AI and quantum computing across new industries and services, and in IT applications in agriculture, fintech, edtech, medtech, and evidence-based development policy, India is uniquely placed at the heart of an AI revolution that promotes productivity and inclusivity while governing business concentration. Reliable partnerships across the different layers of the AI ecosystem, along with a governance model for the India Stack, can stimulate practical applications that improve human life and enable India to lead from the front. India's successful open-source Digital Physical Infrastructure can be effectively deployed in both developed and developing countries, providing an attractive alternative to meet both development and security objectives.

Critical Materials and Technology for Resilient Supply Chains

New and digital technology has permeated all spheres of activity in India. India's need for critical materials and technologies is crucial, and its policy approach is dynamic, tracking global trends and plugging into reliable, resilient value and supply chains.

The initial [Critical Materials List](#) (2023) included 31 items deemed essential for economic development and national security. Minerals and rare earths were assessed for economic importance and supply risk. The policy was for resilient supply arrangements from reliable partners, in view of disruptions by dominant players. Following the adoption of the National Critical Minerals Mission

(2025), a number of Centres of Excellence for Critical Minerals were established for R&D and robust external collaboration.

On critical technologies, India does not have a list but monitors the development of new technologies that are assuming importance, especially those linked to data and information systems, energy security, new industry, and national security. The policy advocates strong and enduring collaborations with reliable partners, both bilaterally as well as in groups such as BRICS, EU, and Quad, to establish reliable and resilient linkages in R&D and its outcomes, and to connect the production cycle.

Technology to Address Global Challenges

Technology cooperation is key to meeting targets on the Sustainable Development Goals and addressing challenges in development, climate change, energy transition, cybersecurity, and new rules. The global community risks serious disruption in the absence of reforms.

On climate change, India developed criteria for common but differentiated responsibility of developing countries, shared sustainable technologies, and promoted adaptation and mitigation measures. India's efforts to harness renewable energy and improve energy efficiency reduced its hydrocarbon dependency, while building disaster-resilient infrastructure increased its capacity to address non-traditional threats.

India also engaged in the triad of tech-digital-cyber diplomacy, for technology products and their regulatory environments. On cyber diplomacy, India attached importance to data sovereignty and security, shaping cyber norms and a rule-based order. India is actively engaged in the [UN Global Digital Compact](#) and regional initiatives at ARF, BRICS, G20, and SCO.

Expanding profile of Technology Diplomacy

India's technology diplomacy follows a whole-of-government approach that engages foreign governments, scientific establishments, and corporates in R&D and manufacturing to improve access to technology, minimise impediments to its free flow, and build resilience. India's matrix for priority technologies with key partners facilitates the strategy for engagement and collaboration.

New initiatives at regional or mini-lateral groupings supplement bilateral efforts. BRICS has been at the forefront of S&T collaboration with the BRICS Innovation Network, the Young Scientists Conclave, and cooperation in advanced materials, AI, and biotechnology. Similarly, Quad has forged S&T collaborations in critical technologies, cybersecurity, digital infrastructure, pandemic preparedness, and support for new-generation technology leaders. With the EU, identified areas of focus include digital governance, green energy, resilient supply chains, and strategic technology.

India has engaged the diaspora in scientific endeavours in national projects. Specific initiatives have focused on institutional linkages, exchange of researchers, participation in cutting-edge research in India, mentoring youth entrepreneurs in start-ups, and supporting leadership roles in S&T.

The start-up ecosystem has matured with a vibrant research environment, a supportive financing network, and a bullish capital market. The recognition of Indian start-ups in foreign markets can facilitate scaling up domestic operations and transboundary transactions. Diplomatic efforts to promote technology hubs and build innovation bridges are the way forward.

With economic development, R&D activities have expanded, but investment in R&D remains limited. The share of R&D investment to GDP was 0.64% in 2024 (2.4% in China and 3.5% in USA). Government R&D expenditure was the mainstay; the private sector contributed just 36% (77% in China and 75% in USA). Further, the link between higher education, industry, and research needs to be strengthened, and 'lab-to-land/market' time needs to be reduced.

India needs a cadre of technology ambassadors to manage external scientific interactions, engage in multilateral rulemaking negotiations, and focus on new and emerging technologies. More S&T

specialists are needed to work alongside diplomats in technical negotiations with multilateral bodies and in Free Trade Agreements. Multilateral negotiations on the blue economy, climate change, data and cyber issues, and space applications have reached a critical point that demands greater attention.

Conclusion

India is a significant technology power but needs to allot more resources to technology diplomacy to respond to geopolitical challenges. Technology cooperation, which initially grew with globalisation, has become challenging as nations and corporations seek to retain control with protectionist tendencies amidst geoeconomic flux. This makes the task of technology diplomacy both challenging and exciting.

Why Science Diplomacy is Particularly Important for Biotechnology

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Contemporary societies are characterised by unprecedented levels of material convenience, sustained by a persistent drudgery of economic productivity. The costs of this model, however, have become increasingly visible. These costs are routinely absorbed by ecosystems in the present and will be paid for, with considerable interest, by our future generations.^{1,2}

Despite mounting scientific evidence and growing public awareness, global production systems remain largely misaligned with ecological limits. Incremental reforms have not matched the scale of the challenge. The structural incentives of the global economy still reward short-term output over long-term resilience.

Biotechnology offers a rare opportunity to alter this trajectory. It does not require abandoning modern standards of living; rather, it reimagines how those standards are produced. Yet, in the near term, many biotechnological solutions remain more expensive than incumbent technologies. Here lies the paradox: many of these solutions are technically viable but economically disadvantaged in the short term. They are cleaner, but costlier. They are promising, but unfamiliar. And in markets structured around immediate price competition, that difference is decisive.

Hence, biotechnology's societal impact depends on collective agreement: consensus on the seriousness of the problems it seeks to address, shared approaches to risk governance, and willingness to absorb upfront costs whose benefits may materialise only decades later. Unfortunately for biotechnology, its success requires more than mere scientific or technical merit. This is a classic collective action problem, but with uniquely high stakes.

Addressing this market failure requires sustained, proactive governmental intervention, particularly through public investment in research and development and procurement policies that deliberately privilege biotechnological alternatives. Furthermore, given the scale and transboundary nature of the challenges involved, such interventions cannot remain confined to any one nation. They instead require coordinated global action to accelerate the development and adoption of biotechnology. This makes science diplomacy not merely facilitative but structurally necessary. Without effective mechanisms for international coordination, biotechnological innovations are likely to remain limited to the laboratory, even when they offer superior long-term outcomes compared to incumbent ones.

Agreeing on the Problem

Biotechnology solutions span multiple domains. In some, the problem definition is uncontested. Gene therapies addressing unmet medical needs, for example, face little debate regarding the existence of

the underlying problem. When substitutes are absent, and suffering is visible, the political will to act is comparatively strong.

In other domains, however, biotechnology confronts a more fundamental barrier: the absence of consensus on the problem itself, or at times, on its urgency. Climate change illustrates this challenge. Although multilateral agreements such as the Paris Agreement reflect broad recognition of the need to reduce emissions, political contestation persists. Prominent leaders have publicly dismissed or minimised climate science, weakening collective resolve and signalling policy instability.^{3,4} Such narratives erode investment confidence and reduce the perceived necessity of long-term transitions. When the problem is framed as exaggerated or distant, solutions that are more expensive in the present appear unnecessary, leading to policy inertia.

Why Cleaner Biotech Struggles to Compete?

Insights from behavioural and social science help explain this dynamic. Construal Level Theory suggests that problems perceived as temporally or spatially distant, such as long-term climate impacts, are evaluated in more abstract terms, thereby reducing their perceived urgency relative to immediate and tangible costs.⁵ This psychological distance is reinforced by economic discounting, whereby future benefits are systematically undervalued in comparison to present expenditures.⁶ Additionally, the high switching costs make it difficult for biotechnology to replace incumbent technologies. For example, transitioning from conventional jet fuel to sustainable aviation fuels produced through biomanufacturing requires retrofitting refineries, adapting fuel distribution infrastructure, securing reliable biomass inputs, and obtaining international certification approvals. In the absence of a mandate and price support, such alternatives are unlikely to appeal to innovators. Together, these mechanisms help explain why cleaner biotechnological pathways may appear insufficiently attractive when assessed through a short-term economic lens. Yet, what appears fiscally prudent today will impose vastly greater and perhaps irreversible costs tomorrow. In biotechnology, delay is not neutral. Investing in climate-resilient crops only after repeated harvest failures, or in novel antimicrobials only after resistance becomes widespread, means acting after damage has compounded. Preventive investment demands foresight; foresight demands political alignment.

Beyond the economic lens, biotechnology raises profound ethical questions that further necessitate diplomatic engagement. Technologies such as gene editing, particularly for use in humans, challenge existing norms around consent, equity, and governance.⁷ As advances in synthetic biology and artificial intelligence expand what can be learned from, and changed in, biological systems, shared ethical frameworks will become essential. Disagreement over acceptable use can stall deployment just as effectively as technical or economic barriers. The responsible use of biotechnology, therefore, rests on an international alignment of values.

Science Diplomacy for a Cleaner Future: From Coordination to Commitment

Science diplomacy must move from passive coordination to active commitment. In the case of biotechnology, however, cooperation must extend beyond traditional models of assisting research collaboration and facilitating ongoing trade.

First, global assessment mechanisms focused specifically on biotechnology's role in climate mitigation, health security, and food systems should be institutionalised. Just as the Intergovernmental Panel on Climate Change has shaped climate discourse, structured assessments of biotechnological pathways could anchor negotiations in shared evidence and reduce epistemic fragmentation.

Second, diplomatic systems must embed scientific capacity. Science advisers within foreign ministries, structured Track 1.5 dialogues, and regular cross-sector forums should be institutional rather than episodic. Diplomatic literacy must keep pace with biotechnology's rapid evolution.

Third, and most urgently, science diplomacy must be used to create markets. Early-stage biotechnologies struggle because demand is uncertain and fragmented. Coordinated procurement commitments, harmonised standards, and predictable regulatory pathways can transform emerging innovations into scalable industries.

The Montreal Protocol provides a clear historical precedent. By aligning regulation, finance, and implementation timelines internationally, it transformed emerging alternatives to ozone-destroying chemicals into commercially viable technologies. The remarkable speed with which COVID-19 vaccines were researched and manufactured through the support of advanced purchase agreements is another example. Biotechnology today requires similar resolve.

Finally, science diplomacy must address governance, ethics, and inclusion. Biotechnology raises complex ethical questions, particularly around gene editing, data ownership, and unequal access, that cannot be resolved unilaterally. Diplomatic engagement is essential to develop shared norms on biosafety, ethical use, and responsible innovation. At the same time, capacity-building must be an explicit objective. Ensuring that low- and middle-income countries participate not only as consumers but as contributors to biotechnology research, manufacturing, and governance is necessary both for equity and for effectiveness. Technologies that cannot be produced, regulated, or adapted locally will fail to deliver global impact.

Conclusion: From Potential to Policy

Biotechnology holds transformative potential. But potential does not self-actualise. It depends on collective decisions about urgency, risk, cost-sharing, and ethical boundaries. Science diplomacy provides the infrastructure through which those decisions can be made coherently rather than chaotically. It aligns problem definitions, reduces uncertainty, coordinates investment, and embeds shared norms. The central question is no longer whether biotechnology can contribute to a cleaner, more resilient future. The question is whether governments are willing to coordinate before crises intensify beyond control. In a century defined by biological capability and planetary limits, inaction is not neutrality. It is a choice with devastating consequences. Science diplomacy will determine whether biotechnology remains an underutilised promise or becomes a foundation of systemic transition.

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From Global South Voice to Climate Leader: India's Diplomatic Push

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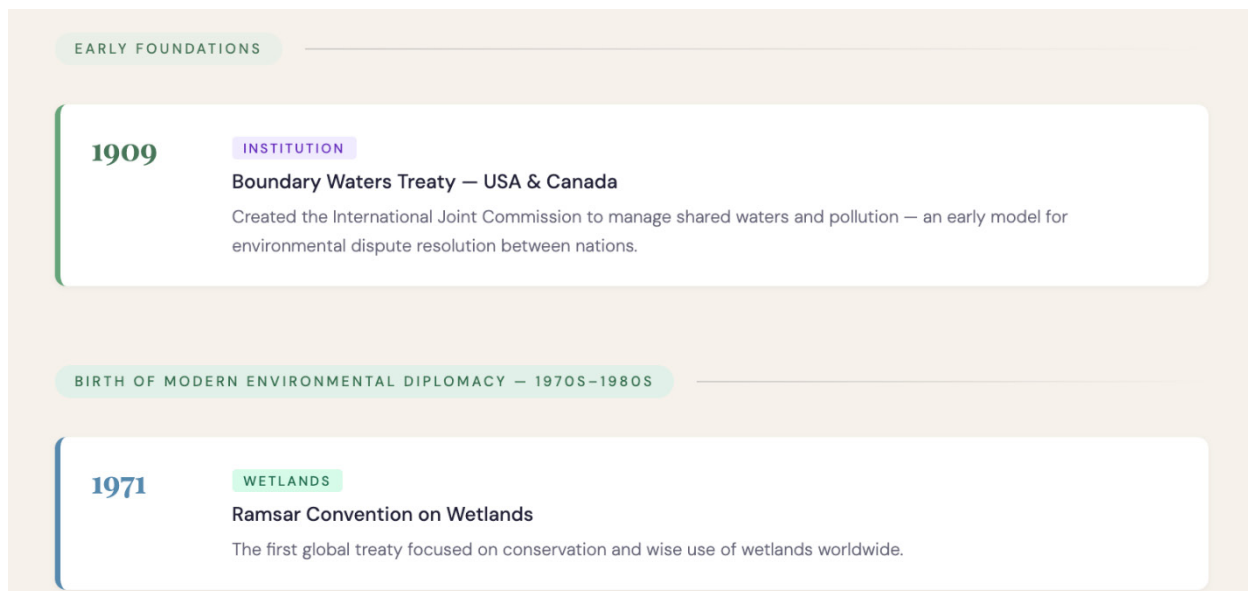
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Introduction

Environmental diplomacy employs international negotiation, cooperation, and law to safeguard the environment and harmonise national interests and developmental needs. It is the process by which states and other parties, including the United Nations (UN) bodies, non-governmental organisations (NGOs), and businesses, engage in dialogue and enter into appropriate agreements. Environmental diplomacy treats problems such as climate change, deforestation, water sharing, and marine pollution as mutual security and development issues, rather than domestic ones.¹

Numerous environmental issues (greenhouse gas emissions, mobile species, ocean plastics, transboundary air quality) do not respect political boundaries, and thus collective regulations and institutions are required. The outcomes impact daily life by making air and water cleaner and stabilising the climate. They also ensure long-term availability of resources used in industries such as agriculture, fisheries, and energy. Collaboration on environmental matters may build trust and spill over into improved political and economic relations between states.²

Figure 1. Chronological Milestones in Environmental Diplomacy³⁻⁵



1972

INSTITUTION

Stockholm Conference & UNEP Founded

The UN Conference on the Human Environment launched global environmental diplomacy, produced the Stockholm Declaration, and established the UN Environment Programme (UNEP).

1973–83

CONSERVATION & POLLUTION

MARPOL, CITES & Migratory Species

Key treaties on marine pollution (MARPOL, 1973), trade in endangered species (CITES, 1975), and conservation of migratory animals (CMS, 1983).

1987

OZONE

Montreal Protocol

Set binding limits on ozone-depleting chemicals, becoming the benchmark for successful multilateral environmental agreements.

FROM ENVIRONMENT TO SUSTAINABLE DEVELOPMENT – 1990S

1992

RIO CONVENTIONS

Rio Earth Summit (UNCED)

Produced the Rio Declaration, Agenda 21, and the three "Rio Conventions": UNFCCC, Convention on Biological Diversity (CBD), and UNCCD – embedding sustainable development in global diplomacy.

1994

CLIMATE

UNFCCC Enters into Force

Committed signatories to stabilising greenhouse gas concentrations to prevent "dangerous anthropogenic interference with the climate system."

1995

CLIMATE

COPI – Berlin Mandate

First UNFCCC Conference of the Parties launched negotiations that would lead to a binding climate protocol.

1997

CLIMATE

Kyoto Protocol at COP3

Created the first legally binding greenhouse-gas reduction commitments for industrialized countries.

CONSOLIDATION & REGIME CHANGE – 2000S–2010S

2001–05

CLIMATE

Kyoto Protocol Enters into Force

Despite U.S. withdrawal in 2001, the Protocol took effect in 2005, demonstrating the resilience of multilateral climate diplomacy.



India's Current Stance on Environmental Diplomacy

India has emerged as an activist, agenda-setting middle power in environmental diplomacy, striving to balance its development agenda, climate action, and equity. It positions itself as a representative of the Global South and consistently emphasises equity and Common But Differentiated Responsibilities⁶ (CBDR) concept in climate negotiations. At home, India can boast of concrete actions, such as ramping up renewable energy, reducing emissions, and phasing out ozone-depleting substances. However, it is sceptical of pledges for binding commitments on fossil-fuels and finance that may limit its development.^{7,8}

India is a signatory to all major international environmental treaties. These include the United Nations Framework Convention on Climate Change⁹ (UNFCCC) and Paris Agreement, the Biological Diversity Convention, the Ramsar Wetlands Convention, the Montreal Protocol and its Kigali amendment, as well as the Minamata Mercury Convention, the Desertification Convention, and even the REDD+ (Reducing Emissions from Deforestation and Forest Degradation, plus Conservation of Forest Carbon Stocks, Sustainable Management of Forests, and Enhancement of Forest Carbon Stocks). India will commence

reductions under the Kigali Amendment in 2028 and aims to bring them to only 15 per cent of the 2024-26 levels by 2047. India has already exceeded the reduction target set by the Montreal Protocol - 44% reduction compared to 35%. In Paris, it is already on track to achieve, or even exceed, its goals for emissions intensity. Non-fossil sources now account for more than half of total installed capacity.¹⁰

India has been a pioneer in several international initiatives, such as the [International Solar Alliance \(ISA\)](#) and the [Coalition for Disaster Resilient Infrastructure \(CDRI\)](#). These platforms help position the nation as a destination for solar power solutions and build resilience against climate catastrophes, especially for developing countries. There is also [Mission LiFE](#) and [LifeStyle](#), plus national efforts like Swachh Bharat and tree-dropping campaigns. India presents these examples to the world to show how a lifestyle change, development, and climate action can be combined. India is pushing not only for longer producer responsibility and single-use plastic bans, but also for negotiations on a global plastics treaty. These actions highlight its self-proclaimed planetary leadership.

Since the Paris Agreement, and particularly at COP28, COP29, and COP30, India has been vocal about the need for greater climate finance, technology transfer, and mitigation support. It argues that unless richer nations contribute sufficient funds, no real global action can be taken. At COP29 in Baku, India criticized the New Collective Quantified Goal on climate finance as too small to meet CBDR and the real needs of developing countries. India supports the principle of the Loss and Damage fund, but says it can not become fully operational unless developed countries make real and reliable contributions.¹¹

India, at COP30 in Belém, emphasised that climate action should be based on equity, climate justice, and CBDR-RC (Common But Differentiated Responsibilities and Respective Capabilities). It cautioned against approving new packages based on unclear or overly dependent finance as older commitments were not fulfilled, and demanded that developed nations should fulfil their own existing commitments and increase the size of climate finance to the amounts established in the BakuBelem Roadmap of about USD 1.3 trillion/year, with significant and grant based and concessional support and higher balancing between mitigation and adaptation funds. It also highlighted the need for a Just Transition Mechanism, placing equity first and countering one-sided trade policies such as Carbon Border Adjustment Mechanism¹¹ (CBAM). India applauded the Just Transition Mechanism as a huge victory for equitable low-carbon change. It wanted adaptation outcomes and financing to include space for questioning trade instruments that impose costs on poorer countries. At the same time, India highlighted its domestic achievements: its emissions intensity reduced by more than 36% since 2005, more than half its power generated by non-fossil sources, a new Nationally Determined Contribution (NDC) until 2035 and a first transparency report on the way, and massive domestic initiatives such as planting billions of trees, Mission LiFE (Lifestyle for Environment), renewables and green hydrogen. However, India was open about the gaps—no large phase-out of fossil fuels and no major leap in finance. Still, India lauded much of the agreement and backed Brazilian leadership. Some criticized the delays in India's updated plans and the ambition level for the 1.5°C goal, but India insisted that no individual action can be unilaterally taken in the name of climate action. It said this principle aligns with UNFCCC Article 3.5 and the multilateral spirit.^{10,12}

Current Opportunities and Constraints

Today, India's climate diplomacy is enjoying both benefits and limitations. On the upside, it can boast of sound domestic performance – reduction in emissions intensity, and rapid expansion of renewable energy potential. Agencies such as the [National Green Tribunal \(NGT\)](#) and the National Action Plan on Climate Change ([NAPCC](#)) provide it with a plausible policy foundation, enabling it to be heard more effectively at the negotiation table. Simultaneously, India has very high and growing energy demands, still depends on coal, faces development concerns, and has constrained public funds, which make it cautious about embracing externally formulated net-zero schedules or climate terms linked to trade. Going forward, India will be interested in rewriting global financial regulations to its benefit, strengthening its solar- and resilience-based relationships, and defining the interaction among trade, climate, and industrial policy, including through new arrangements with the European Union.¹³

Conclusion

Environmental diplomacy, as outlined above, uses scientific evidence and international law to reconcile national development with planetary boundaries. Issues such as climate change, air pollution, and plastic waste in our oceans can affect even countries far away, and laws in a single country cannot be enough to overcome these problems. The establishment of international agreements, treaties, and standards, both locally (bilateral) and globally (multilateral), is the main instrument of environmental diplomacy. It aims to strike a balance between the interests of the national economy and the overall duty to protect the global environment. This model of statecraft is based on scientific evidence to support political negotiations aimed at establishing binding commitments and cooperative structures for a sustainable future.

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Australia-Canada-India Technology and Innovation Partnership: Shaping the Future of Technology, Sustainability and Supply-Chain Resilience

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Following a meeting between Prime Minister of India Narendra Modi, Australian Prime Minister Anthony Albanese, and Canadian Prime Minister Mark Carney on the sidelines of the G20 Summit in Johannesburg, South Africa, in November 2025, the trilateral Australia-Canada-India Technology and Innovation (ACITI) Partnership was announced. The initiative aims to strengthen cooperation on critical and emerging technologies, complementing existing bilateral frameworks while leveraging the unique capabilities of the three countries. Its primary focus areas include green energy innovation, resilient and diversified supply chains, and strategic collaboration toward net-zero objectives, alongside large-scale adoption of artificial intelligence (AI) for social and economic advancement.¹ India's AI Impact Summit in February 2026 has advanced discussions on AI, a key component of ACITI, furthering the partnership's momentum.

The recent visit of the Canadian Prime Minister, Mark Carney, to India during 27 February-02 March 2026, followed by the India-Canada Joint Statement, signals a strategic reset and provides renewed momentum to the partnership.² The joint statement underlined the progress made under the ACITI partnership, noting the meeting of the three countries during the India AI Impact Summit 2026. A joint work plan has been committed to advancing practical trilateral collaboration in AI, spanning digital infrastructure, semiconductor and electronics manufacturing, high-performance computing, the Internet of Things (IoT), cybersecurity, and startup ecosystems. This vision was formalised through the signing of a trilateral MOU on Cooperation in Technology and Innovation, which codified a roadmap for tangible, innovation-driven outcomes.^{3,4}

The ACITI Partnership draws on the complementary strengths of each country. India brings a large talent pool in Science, Technology, Engineering, Mathematics and Medicine (STEMM), AI, and industrial research and development (R&D), coupled with growing domestic manufacturing capabilities and expertise in scaling technology solutions. Australia contributes a wealth of critical minerals, expertise in clean energy research, and applied resource and deep-tech innovation ecosystem, together with strong Environment & Social Governance (ESG) standards and a strategic position in the Indo-Pacific. Canada provides foundational AI research, advanced governance frameworks for AI, clean energy technologies, nuclear expertise, and an innovative ecosystem anchored by universities and industry hubs. Across three countries, critical minerals, clean energy technologies, AI, and advanced manufacturing remain priority areas. By combining these capabilities, the ACITI Partnership could create a functional, end-to-end framework for innovation, resilient supply chains, and green energy transition.

The partnership's emphasis on critical minerals, clean energy technologies, AI, and advanced manufacturing reflects a strategic response to global supply-chain vulnerabilities, particularly due to concentration in a few countries. In light of the joint initiatives such as the Canada-Australia Joint Declaration on Critical Minerals⁵ and India-Australia Critical Minerals Investment Partnership (CMIP)⁶, the three countries, through the ACITI, can help diversify supply chains, advance clean energy solutions, and operationalize AI for societal and economic impact, integrating efforts that no single country could achieve alone.

The trilateral framework is anchored in their respective bilateral relationships. India-Australia ties are strengthened under a Comprehensive Strategic Partnership. Strategic collaboration has increasingly centred around science, technology, energy and critical minerals. The Australia-India Strategic Research Fund (AISRF) anchors long-standing scientific cooperation, supporting applied research across clean energy, water security, health, advanced technologies, and downstream processing of critical minerals. Engagements in civil space science, technology, and education include collaborative space projects, mission support, satellite launches, and commercial partnerships. In energy and resources, energy security dialogues, joint task forces on solar and green hydrogen, renewable energy partnerships, and the Khanij Bidesh India Limited (KABIL)- Critical Mineral Facilitation Office (CMFO) joint-investment framework on critical minerals can be significant for resilient, diversified clean-energy supply chains.⁷ Australia is also a member of key India-led initiatives, including the International Solar Alliance, the Coalition for Disaster Resilient Infrastructure, and the Global Biofuel Alliance.

India-Canada collaboration in science and technology, clean energy, civil nuclear cooperation, space, and innovation ecosystems has shown resilience and strategic continuity. Bilateral frameworks include the Joint Science and Technology Cooperation Agreement, the India-Canada Centre for Innovative Multidisciplinary Partnership to Accelerate Community Transformation and Sustainability (IC-IMPACTS) Program, energy and nuclear dialogues, and collaboration in artificial intelligence, biotechnology, ICT, clean technology, and critical resources.⁸⁻¹⁰ Canada is also a member of the International Solar Alliance and the Global Biofuel Alliance. With substantial reserves of critical and rare-earth minerals, Australia and Canada on 01 November 2025 signed a Joint Declaration of Intent on Critical Minerals Cooperation, formalising a strategic agenda to promote and strengthen cooperation across the entire critical minerals value chain, from upstream production to midstream processing, refining, recycling and low-carbon technologies, while promoting investment facilitation, policy and regulatory alignment, and ESG and indigenous-inclusive governance. By institutionalising mechanisms for co-investment, sharing of best practices, and ministerial oversight, the agreement seeks to strengthen diversified, resilient, and standards-based supply chains.¹¹

Australia's Critical Minerals Strategy 2023-2030¹², Canada's Critical Minerals Strategy (2022)¹³, and India's National Critical Mission (2025)¹⁴ together reflect a convergence in national policy priorities that ACITI Partnership is uniquely positioned to harness. Australia's strategy focuses on expanding upstream extraction and downstream processing capacity, embedding high environmental, social, and governance standards, and building international partnerships. Canada's approach seeks to position the country as a reliable global supplier of responsibly sourced critical minerals, emphasising clean energy, advanced technologies, and commercialisation through research ecosystems.¹³ India's National Critical Mineral Mission complements these strategies on the demand and manufacturing sides, aiming to secure supply chains, strengthen value chains, and support large-scale deployment of clean energy and advanced manufacturing.¹⁴ Viewed collectively, these national frameworks recognise the significance of critical minerals. They show that shared climate goals, clean energy, and net-zero emissions commitments are interdependent components of a broader supply-chain ecosystem.

ACITI complements existing multilateral and minilateral initiatives, such as the Minerals Security Partnership, the Quadrilateral Security Dialogue, and the EU-US Trade and Technology Council, while remaining distinct in its operational focus. Across these alliances, energy transition, supply-chain security, and technological sovereignty remain key drivers. Unlike the Quadrilateral Security Dialogue (QUAD), which is primarily anchored in a strategic and security cooperation for a free and open Indo-Pacific,

ACITI is designed as a functional, innovation-driven framework centered on technology cooperation, resilient supply chains, and sustainability. The Minerals Security Partnership (MSP) closely aligns with ACITI's objectives in promoting diversified critical-mineral supply chains, and ACITI can add value by linking mineral cooperation with downstream processing, clean-energy technologies, and industrial innovation. Similarly, the Global Partnership on AI (GPAI) provides a governance framework for ethical and human-centric AI adoption. ACITI can operationalise this through applied research, deployment, and innovation ecosystems. India, Brazil and South Africa (IBSA) offer a South-South science and technology collaboration. ACITI should be seen within the broader trend of strategic supply-chain realignment, aimed at securing critical minerals through partnerships and cooperation among like-minded countries. In this context, ACITI occupies a unique space between bilateral mechanisms and broader multilateral strategic frameworks, creating a platform to translate shared strategic intent into innovation outcomes and supply-chain resilience.

The ACITI roadmap ahead needs to take into account different development priorities, regulatory mechanisms, asymmetries in capacities, together with geopolitical concerns. For the ACITI Partnership, operational mechanisms could include joint feasibility studies on processing facilities, pilot research programmes on battery materials, and coordinated ESG and traceability standards for critical minerals. Collaborations in AI, particularly in public sector applications such as health, agriculture, and cybersecurity, offer low-risk, high-benefit opportunities. Talent mobility, including trilateral fellowships, short-term research residencies, joint doctoral supervision, and industry-linked programmes, can foster knowledge circulation and support the creation of an innovation ecosystem from research to commercialisation. Together, fellowships, joint R&D, and tech entrepreneurship can create an innovation ecosystem from talent and ideas to deployment and market adoption. Private sector engagement is equally critical. Predictable funding models, co-investment frameworks, and risk-sharing arrangements can accelerate innovation, build confidence, and ensure the establishment of the ACITI Partnership as a functional and delivery-oriented framework.

For India, Australia, and Canada, the partnership serves multiple strategic purposes, which include reducing dependence on any single global supplier, accelerating clean-energy transitions, and establishing leadership in ethical AI, industrial R&D, and critical-mineral governance. ACITI, as a minilateral partnership, can collaborate effectively by combining talent, industrial capacity, and innovation ecosystems to shape resilient, sustainable global technology frameworks. It positions the three countries at the forefront of global technology governance. The broader strategic logic underpinning the ACITI partnership was reinforced at the World Economic Forum Annual Meeting in Davos, Switzerland, which further highlighted the need for cooperation on technology governance, the clean energy transition, and resilient supply chains to pursue shared objectives for a secure and sustainable future. The escalating instability in West Asia and regional tensions have further accentuated the persistent vulnerabilities of global energy markets due to geopolitical disruptions. Given the regional role in oil and gas production and the strategic significance of the Strait of Hormuz, highlighting the risks of concentrated energy supply routes, and recognising the growing intersection of geopolitics, economic security, and strategic governance of energy supply chains, ACITI further highlights the significance of such partnerships for fostering cooperation in critical minerals, clean-energy technologies, and advanced innovation ecosystems.

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Science Diplomacy Takes Centre Stage at Raisina Dialogue 2026

The inaugural Raisina Science & Diplomacy Initiative (SDI) was held on 5 March 2026 at Bharat Mandapam, New Delhi, as part of the Raisina Dialogue 2026. Jointly launched by the Office of the Principal Scientific Adviser to the Government of India and the Observer Research Foundation, it marked the first formal integration of science diplomacy into the Dialogue.

The initiative brought together around 80 global experts—including scientists, diplomats, policymakers, and scholars—in a closed-door format to deliberate on the role of science diplomacy in an era of strategic autonomy and disruptive technologies. Chaired by Prof. Ajay Kumar Sood and co-chaired by Sir Peter Gluckman, Prof. Marilyne Andersen, and Dr. Vijay

Chauthaiwale, the discussions underscored the growing centrality of science and technology to development, security, and global governance. Two roundtables focused on balancing national priorities with scientific collaboration, and on governance frameworks for emerging technologies. Key themes included strengthening science advice systems, fostering trusted international networks, advancing inclusive norm-setting, and promoting equitable technological diffusion. Envisioned as an annual platform, the Raisina SDI aims to shape global discourse on science diplomacy, with future discussions expected to further engage the private sector and strengthen multilateral approaches for governing emerging technologies.

European Commission Publishes Proposal for a Council Recommendation on a European Union Framework for Science Diplomacy

On 27 February 2026, the European Commission released a proposal for a Council recommendation establishing a European Union framework for science diplomacy. Building on expert inputs, including the European Framework for Science Diplomacy report and the 2nd European Science Diplomacy Conference, the proposal reflects broad stakeholder engagement, notably from the EU Science Diplomacy Alliance. Currently under negotiation in the Council of the European Union, led by the Cyprus Presidency, the initiative

seeks to strengthen a coherent and strategic EU approach to science diplomacy. As part of a wider set of measures—alongside the Research Security Monitor and the Global Approach Implementation Report—the proposal aims to enhance Europe’s global engagement in research and innovation. It focuses on reinforcing international partnerships while safeguarding strategic interests, ensuring that cooperation remains open yet secure, and increasing Europe’s attractiveness for global talent and innovation.

MoUs Signed

India and Brazil Sign TKDL Access Agreement to Strengthen Protection of Traditional Knowledge and Patent Examination Cooperation

The National Institute of Industrial Property (INPI), Brazil, and the Council of Scientific and Industrial Research (CSIR), India, signed a cooperation agreement on 21 February 2026 to provide Brazil access to India’s Traditional Knowledge Digital Library (TKDL)—a pioneering prior-art database documenting traditional knowledge. The agreement, exchanged during the State Visit of President Luiz Inácio Lula da Silva in the presence of Prime Minister Narendra Modi, strengthens bilateral collaboration in the protection of traditional knowledge and intellectual property

rights. Through this arrangement, the Brazilian Patent Office will use TKDL in patent examination processes to improve the assessment of novelty and prevent erroneous patents based on existing traditional knowledge. The partnership marks a significant step in India’s global efforts to combat biopiracy and misappropriation, while enhancing the efficiency and quality of Brazil’s patent system. Implementation will be guided by leadership from INPI and CSIR, reinforcing institutional cooperation in this critical domain.

India and Nepal sign MoU to Strengthen Cooperation in Forests, Wildlife, Environment, Biodiversity Conservation and Climate Change

The Union Ministry of Environment, Forest and Climate Change, Government of India, and the Ministry of Forests and Environment, Government of Nepal, signed a Memorandum of Understanding (MoU) on 25 February 2026 to strengthen bilateral cooperation in forests, wildlife, biodiversity conservation, and climate change. The MoU focuses on landscape-level biodiversity conservation, with emphasis on key species such as elephants, tigers, rhinoceros, snow leopards, Gangetic dolphins, and vultures. It also promotes the restoration

of wildlife corridors, improved protected area management, the exchange of knowledge and best practices, and the enhanced capacity of frontline enforcement agencies. Additionally, it addresses challenges such as wildlife crime and supports the development of green infrastructure in biodiversity-rich regions. This collaboration is expected to deepen India–Nepal environmental cooperation, strengthen transboundary conservation efforts, and support the sustainable management of shared ecosystems.

Announcements

JSPS International Fellowships for Research in Japan

Submission deadline: 28 April 2026

Further information at:

https://www.jsps.go.jp/file/storage/j-fellow/j-fellow_14/application_requirements/2026/2026_applicationguideline_e.pdf

New Publications

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Call for Proposals //

Indo-Swiss Joint Call for Geoscientific Research on Mountain Hazards

Last Date: April 8, 2026

Further information at: <https://www.snf.ch/en/05qUV3PJowxZa2He/news/joint-call-with-india-for-geoscientific-research-on-mountain-hazards>

India - Netherlands Hydrogen Fellowship Programme

Last Date: April 10, 2026

Further information at: <https://dst.gov.in/callforproposals/india-netherlands-hydrogen-fellowship-programme>

India-France Call for proposals in Applied Mathematics and Artificial Intelligence

Last Date: April 20, 2026

Further information at: <https://onlinedst.gov.in/Projectproposalformat.aspx?id=2381>

Indo-Swiss Joint Research Programme

Last Date: May 5, 2026

Further information at:

<https://dbt.gov.in/storage/media/callforproposal/qipNJGjNeNdg1t0EDsg3koJxMroE2fwiSOPme2Pz.pdf>

Forthcoming Events //

Exploring the nexus between Big Science and Science Diplomacy: an open debate on existing initiatives, key actors and potential synergies

Date: April 9, 2026

Further information at:
<https://indico.eli-laser.eu/event/247/>

Science Forum South Africa 2026

Date: December 2-4, 2026

Further information at:
<https://www.esastap.org.za/science-forum-south-africa-2026/>