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Science without Borders: Voices of the Indian Diaspora

Guest Editor: Rama Swami Bansal

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Guest Editorial

India's scientific diaspora has long been an invaluable asset in shaping the global landscape of research, innovation, and technological advancement. In recent years, the conversation has shifted from the notion of “brain drain” to “brain gain” and now to “brain circulation.” This evolving narrative highlights the dynamic nature of the Indian scientific community abroad and its potential to drive India’s growth.

The Indian scientific diaspora is one of the largest and most influential, with millions of professionals working across the globe, including the United States, United Kingdom, Canada, Australia, and Europe, in fields such as information technology, biotechnology, artificial intelligence, space science, and agriculture. These countries, known for their strong research ecosystems, attract top-tier talent from India. Meanwhile, India stands as one of the top exporters of scientific talent globally, with its diaspora continuing to contribute to the development of host countries.

India ranks among the world’s leading exporters of scientific talent, with a growing trend of its scientists contributing to groundbreaking research and international collaborations. However, as much as this exodus of talent has fueled innovation in foreign labs, it has also created an urgent need for India to turn its diaspora into a resource that will propel domestic scientific growth. The good news is that the shift toward brain circulation — where professionals engage with their home and host countries — offers immense promise. Rather than viewing the movement of scientists as a loss, India can leverage this diaspora to foster global partnerships, knowledge transfer, and joint research that benefits India and the world.

Recognising the importance of this talent pool, the Indian government has initiated programs to better engage with its diaspora. Initiatives such as **VAJRA** (Visiting Advanced Joint Research), **VAIBHAV** (VAIshvik BHArtiya Vaigyanik), and **GIAN** (Global Initiative of Academic Networks) are aimed at fostering knowledge exchange and collaboration between domestic and international research communities. The **PRABHASS** (Pravasi Bharatiya Academic and Scientific Sampark) initiative by CSIR strengthens ties, promotes collaboration, and enhances knowledge exchange between Indian and overseas Indian scientists. Expanding such programs and creating new ones could foster a new era of scientific collaboration and innovation, benefitting the global scientific community.

While these initiatives have made significant strides, India must deepen its engagement with its diaspora to capitalise on their expertise fully. This special issue focuses on the scientific diaspora, aiming to capture their perspectives and recommendations for strengthening India's science and technology ecosystem. The contributions underscore the pivotal role that the Indian scientific community abroad plays in shaping global research collaborations and influencing national development.

The perspectives of several prominent members of India’s scientific diaspora offer valuable insights into how India can better engage its global talent pool. Dr Raghavendra Jana from Skoltech, Russia, advocates for expanding programs like VAJRA to strengthen India-Russia collaboration, particularly in climate-smart agriculture. He emphasises leveraging each nation's strengths in environmental science, data analytics, and agricultural technology. Dr Harjeet Khanna of AgriFutures Australia explores the emerging trends of science diplomacy, digital collaboration, and philanthropy, noting initiatives like the Tata Institute for Genetics and Society, which is addressing global health challenges like malaria. Prof. Ravinder Rena, Professor of Economics at Durban University of Technology, South Africa, urges India to deepen ties with the Indian diaspora in Africa, particularly in sectors like renewable energy, agriculture, and healthcare. Dr Suresh Babu Naidu Krishna, also from Durban University, advocates for greater collaboration between India and African nations to address

climate change and health challenges while ensuring young scientists are equipped with the skills and opportunities needed to tackle future challenges.

The final article comes from the International Organization for Migration (IOM), Geneva, Switzerland. It discusses the IOM's Strategic Plan for 2024-2028, emphasising the multifaceted role of diaspora communities in advancing global health outcomes. The article also introduces the Global Diaspora Policy Alliance (GDPA), underscoring its role in fostering long-term partnerships to improve global health practices and policies.

The perspectives and recommendations of diaspora scientists underline the importance of creating an inclusive and collaborative scientific ecosystem that will not only benefit India but also contribute to solving global challenges. We hope this special issue offers valuable insights and contributes to shaping future Indian science and technology policies, leveraging the expertise of the global scientific diaspora to drive progress both in India and worldwide.

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Advancing Climate-Smart Agriculture through India-Russia Collaboration

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Climate-smart agriculture (CSA) is emerging as a crucial global strategy to ensure food security while mitigating the impacts of climate change. Countries like India, which are highly vulnerable to erratic weather patterns and temperature shifts, are increasingly adopting CSA to build resilience in their agricultural systems. Similarly, in Russia, vast agricultural areas face rising climate-related risks, which has prompted the need for more adaptive and sustainable farming practices. One key area of innovation that supports CSA is envirotyping — a technique that uses environmental data to assess crop performance and develop strategies for adapting crops to changing conditions. Collaborative efforts between India and Russia in this field could unlock significant potential for both nations, leveraging their complementary strengths in environmental science, data analytics, and agricultural technology.

Integrating Process- and Data-Based Models for CSA

India's agricultural technologies and hydrological modelling expertise align well with Russia's remote sensing and satellite-based analytics strengths. For instance, my work at Skoltech in Russia focuses on integrating process- and data-based models to improve the efficiency and sustainability of agricultural systems through environmental process modelling. Collaborative research in CSA and envirotyping, which involves tracking how crops respond to environmental conditions such as soil health, water availability, and climate fluctuations, can help both India and Russia enhance their agricultural productivity in the face of climate uncertainties.

Existing bilateral frameworks, including joint research calls by the Russian Science Foundation (RSF) and India's Department of Science and Technology (DST), as well as multilateral initiatives like BRICS STI, provide a strong foundation for expanding collaboration in this space. The potential for collaboration between Indian and Russian scientists in Earth observation (EO), remote sensing, and agricultural modelling presents an exciting opportunity to address food security in a climate-uncertain world.

Process-based models, which simulate physical and biochemical processes, and data-based models, utilising machine learning (ML) and big data analytics, are both integral to CSA. Envirotyping, through its

holistic assessment of environmental conditions, such as soil moisture, temperature, and precipitation, empowers farmers and scientists to make informed, data-driven decisions to optimise crop performance while managing risks related to climate change. By integrating physics-based models and measurements of soil health, hydrology, plant growth, and climate change, among others, in conjunction with remote sensing technologies and ML algorithms, we can predict the impacts of environmental factors on crops and develop strategies to improve their resilience.

My collaboration with the Indian Institute of Science (IISc), Bangalore, employs hydrological models to assess how soil and water dynamics affect crop yield. This research is particularly relevant in semi-arid regions of India, such as Karnataka, Maharashtra and Rajasthan, where efficient water management is critical for ensuring agricultural sustainability. Parallel research with SRM Institute of Science and Technology (SRMIST), Kattankulathur, uses ML-based models to predict rainfall patterns, droughts, and crop yields based on climate data and satellite inputs. These tools are crucial for guiding farmers on optimal planting times, helping them mitigate risks associated with unpredictable weather. Such process- and data-based models are invaluable not only for Indian agriculture, where many smallholder farmers rely mainly on monsoons, but also for Russia's southern agricultural regions, which are increasingly affected by droughts and changing precipitation patterns.

Russia's satellite remote sensing expertise complements India's advancements in agricultural technologies. Joint efforts can significantly enhance their capacity to implement climate-resilient farming techniques, benefitting growers in both countries.

Strengthening Earth Observation and Analytics

India's legacy in Earth observation and remote sensing, driven by the Indian Space Research Organisation (ISRO), has significantly advanced agricultural monitoring. Satellite missions such as RISAT and Cartosat provide essential data for soil health assessment, drought monitoring, and crop yield forecasting. These satellite platforms, with their ability to capture high-resolution imagery, allow for precise tracking of changes in land use, water availability, and vegetation health.

Similarly, Russia's Resurs-P and Kanopus-V satellite series, managed by Roscosmos, provide high-resolution multispectral data for land use, crop health monitoring, and environmental management. These satellites are equivalent to India's Cartosat and RISAT missions. The Resurs-P series captures detailed imagery that can be used for precision farming, while the Kanopus-V series focuses on monitoring environmental changes, especially in agricultural landscapes, making it an ideal tool for CSA.

Russian companies like Sitronics and Sovzond offer geospatial services that process satellite data into actionable insights, enabling models that predict climate-induced impacts on agricultural productivity. Collaborating with Russia can also deepen bilateral ties in agriculture and environmental research in the private enterprise space. The rise of private Indian companies like Satyukt Analytics, which provides real-time satellite-based analytics for agriculture, further strengthens the technological infrastructure available for such collaborations. Satyukt's services include crop health monitoring, irrigation advisory, and weather forecasting, all of which align with the goals of climate-smart agriculture. Other companies, such as CropIn and Skymet, offer digital solutions integrating satellite data with AI-driven analytics to assist farmers and policymakers in making informed decisions.

Pathways for India-Russia Collaboration

India and Russia have a long history of scientific collaboration, and CSA presents new opportunities to deepen these ties. The BRICS STI Framework Programme and joint research calls by RSF and DST provide funding avenues to encourage cross-border research in areas such as drought resilience, water management, and climate forecasting. However, these areas must be emphasised in the funding calls to encourage joint proposals. For example, my proposed collaboration with IIT-Delhi focuses on developing models for agricultural drought forecasting, combining satellite-derived data with process-based environmental models to predict the onset of droughts and recommend preventive measures. This kind of collaboration can be expanded to include Russian scientists working in similar areas, particularly those focused on the southern steppes of Russia, which face drought risks identical to those in India, presenting a unique opportunity to co-develop technologies that will benefit both nations. Joint initiatives between Russia's Roscosmos and ISRO, such as data-sharing agreements, could improve the accuracy of satellite-based agricultural models. By integrating India's agricultural know-how with Russia's geospatial technologies, we could develop predictive models that help farmers make decisions that enhance crop yields and water efficiency.

Collaborative projects could include:

Joint Satellite Platforms: Developing a combined remote sensing platform that integrates data from Indian and Russian satellites to provide real-time agricultural monitoring/

Research Consortia: Establishing a bilateral consortium on climate resilience, bringing together Indian and Russian scientists in soil hydrology, crop modelling, and water resource management.

Private Sector Partnerships: Encouraging joint ventures between Indian and Russian private companies to co-develop tools for farm-level decision-making.

Additionally, joint initiatives like BRICS Research Centres could serve as innovation hubs, fostering knowledge exchange between Indian and Russian scientists working in climate resilience, soil hydrology, and AI-driven agriculture. These centres could focus on developing precision agriculture techniques, such as smart irrigation systems, that use real-time soil and weather data to optimise water use in agriculture.

India has established several platforms to facilitate collaboration between the Indian scientific diaspora and local institutions. The VAJRA (Visiting Advanced Joint Research) Faculty Scheme, the Vaishvik Bharatiya Vaigyanik (VAIBHAV) Fellowship, and the Global Initiative of Academic Networks (GIAN) are a few key initiatives that aim to bring diaspora scientists and international researchers to Indian institutions for joint research. While these programs successfully attracted talent from regions like the United States and Western Europe, their reach in countries such as Russia remains limited. Scientists based in Russia and other Eastern European countries often have fewer opportunities to engage with these programs due to a lack of visibility and promotion.

Expanding these initiatives to include greater participation from Indian diaspora scientists in Russia could significantly enhance bilateral collaboration in CSA and environmental science. Creating more accessible platforms promoting calls for joint research, fellowships, and innovation projects in non-Western countries would help bring Indian and Russian scientists together more effectively.

Conclusions

To fully realise the potential of CSA and envirotyping as areas of India-Russia collaboration, it is essential to

enhance the existing bilateral frameworks and make them more accessible to a broader range of researchers. Expanding the reach of programs like VAJRA, VAIBHAV, and GIAN while creating new, dedicated platforms for collaboration would help bridge the gap between the scientific communities of both nations. Additionally, stronger cooperation between the public and private sectors, particularly in leveraging emerging technologies like AI and satellite analytics, can further accelerate the adoption of climate-smart agricultural practices in both countries.

By fostering more robust partnerships and addressing regulatory challenges, India and Russia can together contribute to solving some of the world's most pressing agricultural challenges while setting an example for international collaboration in climate resilience.

Emerging Trends and Opportunities for the Indian Scientific Diaspora

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The vast Indian scientific diaspora, estimated at over a million scientists and engineers worldwide, significantly impacts global science, technology, trade, and other areas of life. With globalisation, contemporary trends are emerging, offering these scientists opportunities to benefit both India and their host nations. This article explores these trends and the potential of this dynamic community.

Science Diplomacy: A Catalyst for Collaboration

Science diplomacy leverages scientific knowledge to foster international collaboration on pressing global challenges such as climate change and pandemics. The Indian scientific diaspora, with its expansive global network, plays a key role in this endeavour. Indian-origin scientists, especially in the US, Europe, and Asia, are increasingly involved in bilateral and multilateral efforts, acting as bridges for knowledge transfer and collaboration between India and their host countries.

India's growing reputation in the scientific community has further led to science diplomacy initiatives, including bilateral agreements for research and academic exchange with countries like the US, UK, Germany, and Australia. Through these efforts, the Indian diaspora has been instrumental in fostering these relationships, promoting Indian science abroad while bringing back valuable knowledge. Science diplomacy also allows Indian scientists abroad to contribute to global projects like space exploration and artificial intelligence, linking Indian expertise with international advancements.[1]

Boosting Research and Innovation in India

India's recent push for a robust research and innovation ecosystem has created new opportunities for the Indian scientific diaspora. One such initiative is the Pravasi Bharatiya Academic and Scientific Sampark (PRABHASS), launched by CSIR under the Ministry of Science and Technology. This platform facilitates the engagement of the Indian diaspora through mentorship, collaborative research, and networking, linking global expertise with India's development priorities. Another prominent scheme is the Ramalingaswami Re-entry Fellowship, which encourages Indian scientists abroad to return and undertake high-impact research. Such

initiatives foster closer collaboration between overseas Indian scientists and their counterparts in India, bridging the knowledge gap and driving innovation.

There is a growing trend of Indian-origin scientists participating in India-based startups, particularly in biotechnology, artificial intelligence, and space technologies. The Indian government promotes these sectors through initiatives like "Startup India" and "Make in India." These collaborations foster innovation, bridge knowledge gaps, and enable the commercialisation of cutting-edge technologies. Startups led by Indian-origin scientists, especially in biotechnology and pharmaceuticals, are emerging as key players globally. Collaboration between these startups and Indian research institutions presents opportunities for advancing homegrown innovation and technology commercialisation.[2]

Knowledge Diplomacy and Educational Exchange

One of the most prominent areas where the Indian scientific diaspora can contribute is in the realm of education. Educational exchanges, joint degrees, and collaborative research programmes are becoming more common between Indian institutions and leading universities abroad. Indian scholars abroad, through platforms such as the Global Initiative of Academic Networks (GIAN) and the Visiting Advanced Joint Research (VAJRA) Faculty Scheme, can return to India to share their knowledge and expertise. This reverse brain drain phenomenon is increasingly seen as a way to strengthen the Indian education system and improve its global rankings.

Through knowledge diplomacy, Indian-origin scientists and researchers are forming partnerships with Indian universities to create new research initiatives and education models. It could lead to enhanced faculty and student exchange programmes, joint research projects, and co-authored publications. Agreements like the India-EU Science and Technology Cooperation promote joint research and innovation in fields such as energy, health, and information technology.[3] Indian researchers abroad, often involved in innovative projects, bring valuable insights and methods that could be transformative for Indian education and research institutions.[3]

Addressing Global Challenges through Collaborative Research

Global challenges like climate change, health pandemics, and food security have necessitated the pooling of scientific resources and collaboration on an unprecedented scale. The Indian scientific diaspora has a significant role to play in addressing these challenges through international collaborative research. For instance, during the COVID-19 pandemic, Indian-origin scientists were at the forefront of developing vaccines, diagnostic tools, and therapeutic interventions. This collaboration between Indian scientists abroad and institutions back home underscores the potential of joint efforts in tackling global problems.

Climate change research is a prominent area where such collaborative efforts have been visible. Indian-origin scientists, particularly in the US and Europe, are contributing to major research projects that are shaping international climate policies. Collaboration between Indian and global scientists on climate-resilient agriculture, renewable energy, and sustainable technologies is growing rapidly. These joint ventures not only strengthen India's scientific capacity but also provide opportunities for Indian diaspora scientists to make significant contributions to global research efforts.[4]

Additionally, Indian scientists abroad are increasingly involved in addressing food security challenges, working on projects aimed at improving crop resilience, sustainable farming techniques, and food distribution

systems. By collaborating with Indian institutions such as the Indian Council of Agricultural Research (ICAR) and leading agricultural universities, these scientists play a key role in transforming India's agricultural landscape to ensure food security and sustainability.

Digital Technology and Remote Collaboration

The rise of digital platforms and tools for remote collaboration has opened new doors for the Indian scientific diaspora to contribute to India's scientific and technological growth. The COVID-19 pandemic accelerated the adoption of digital tools in science, making it easier for scientists worldwide to work together. Virtual labs, online conferences, and collaborative research platforms have allowed Indian-origin scientists to stay connected with their peers in India without needing physical presence.

Moreover, initiatives like the National Digital Library of India (NDLI) and Science and Technology Information Platform (STIP) have created repositories of scientific knowledge and research that scientists can access worldwide. Indian-origin scientists, particularly those in computer science, biotechnology, and data analytics, are increasingly collaborating with Indian institutions to work on projects remotely. This trend is likely to continue with digital technology, further democratising access to scientific research and making it easier for the Indian scientific diaspora to contribute to projects back home.[5]

Opportunities in International Scientific Organisations

International organisations such as the United Nations, World Health Organisation (WHO), and World Bank offer opportunities for Indian-origin scientists to contribute to global research and policy-making efforts. With India's growing influence on the global stage, Indian scientists abroad are increasingly taking leadership roles in these organisations. This involvement not only enhances the profile of Indian science globally but also provides opportunities for Indian scientists to shape international scientific discourse.

Indian-origin scientists are often involved in advisory roles in these organisations, offering their expertise on matters ranging from global health to environmental conservation. These scientists also engage in science advisory panels and committees that influence global policy decisions. This leadership in international organisations creates pathways for furthering India's scientific and technological interests on the global stage.[6]

Rise of Philanthropy in Science and Technology

Philanthropy, particularly in science and technology, has emerged as another avenue for the Indian scientific diaspora to contribute. Indian-origin philanthropists, especially those based in the US, have begun to make significant contributions to scientific research in India. These contributions are being channelled into building world-class research facilities, funding scholarships, and supporting technology transfer between India and other nations. The establishment of research centres funded by Indian-origin philanthropists is helping bridge the gap between India's growing scientific potential and the availability of resources.

For example, the Tata Institute for Genetics and Society (TIGS), supported by Indian-origin philanthropists, focuses on addressing global challenges like malaria through advanced genetic research. Similar initiatives funded by Indian philanthropists abroad are also focusing on climate change, health, and food security, offering immense opportunities for collaboration between Indian scientists abroad and research institutions in India.[7]

Conclusions

The Indian scientific diaspora represents a powerful force in the global scientific community, with its contributions spanning multiple fields and regions. Emerging trends such as science diplomacy, digital collaboration, and philanthropy are unlocking new pathways for these scientists to engage with both India and their host countries. By leveraging their unique position, the Indian scientific diaspora can continue to drive scientific progress and innovation, not only for the benefit of India but for the global community. As India's scientific ecosystem grows, the diaspora's role in shaping the future of science and technology will only become more significant.

References

1. Singh A (2022) India's Science Diplomacy: A Rising Power on the World Stage. *International Affairs*, 98(2): 315–333.
2. Kumar P (2020) The Indian Government's Push for Research and Innovation: Opportunities for the Diaspora. *Indian Economic Review*, 54(2): 183–205.
3. Rao R (2018) The Role of the Indian Diaspora in Global Education. *Higher Education Quarterly*, 72(1): 123–142.
4. Patel S (2021) The Indian Diaspora and Climate Change: A Review of Collaborative Efforts. *Climate Policy*, 21(3): 289–307.
5. Sharma A (2023) Digital Diplomacy and the Indian Diaspora: Opportunities and Challenges. *Asia Pacific Review*, 30(1): 1–20.
6. Menon A (2019) The Indian Diaspora and International Governance: A Case Study of the United Nations. *Global Governance*, 25(2): 213–232.
7. Jain N (2022) Philanthropy and Science in India: The Role of the Diaspora. *Economic and Political Weekly*, 57(4): 23–30.

Role of Indian Diaspora in South Africa – Recent Developments

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Introduction

India's cultural and commercial ties with Africa span over three millennia, with commerce predating cultural exchanges. While modern migration to Africa is largely linked to colonialism, the Indian diaspora in South Africa has deep roots, particularly from the mid-1800s to the early 1900s, when Indians were brought as indentured labourers by the British to work on sugar plantations. Over the past 160 years, the Indian-origin community has become integral to South Africa's socio-economic and political fabric.

Indians migrated to Africa in two primary capacities: a) As indentured workers in the sugarcane farms of South Africa's KwaZulu Natal province, and b) As small traders establishing businesses. Between 1829 and 1924, around 769,437 Indians migrated to Mauritius, South Africa, Seychelles and East Africa. These migrants later became integral to their host countries, especially in post-colonial Africa, playing key roles in the political and economic spheres.

Mahatma Gandhi's 21 years in South Africa were transformative, where he developed his principles of non-violence and civil disobedience. The long list of prominent anti-apartheid icons of Indian heritage in South Africa includes his granddaughter, Ela Gandhi, Fatima Meer, Ahmed Kathrada, Amina Cachalia, and Frene Ginwala, to name a few. Post-apartheid, the Indian diaspora remains influential in South Africa's governance, particularly within the ruling African National Congress.

Diaspora migration is often driven by socio-economic, climate, demographic, and political factors, with migrants carrying their socio-cultural heritage and forming distinct identities in their host countries. This article explores the dynamic interactions between the Indian diaspora and South Africa and offers policy recommendations to strengthen India's ties with its diaspora in Africa.

India's Role in Africa - Recent Trends

Since its independence in 1947, India has positioned itself as a self-reliant power with a vision of global

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respect and influence, which aligns closely with its engagement with Africa. India's Africa policy emphasises mutual development, not a donor-recipient dynamic, underscoring equal partnerships and shared growth. This partnership model is distinct from many Western countries, focusing on capacity-building and resilience, with India assisting Africa in areas such as defence, security, education, and infrastructure.

India has prioritised self-sufficiency in African security assistance by deploying Indian technicians and providing essential hardware such as offshore patrol craft and combat helicopters. India focuses on creating space to work together as equals, enabling the African side to exert agency and leadership roles.

At the G20 Summit in New Delhi (September 2023), the African Union was granted full membership. Calling Africa "India's top priority," Prime Minister Narendra Modi said, *"When we use the term 'Global South,' it is not just a diplomatic term. … In our shared history, we have together opposed colonialism and apartheid. It was on the soil of Africa that Mahatma Gandhi used powerful methods of non-violence and peaceful resistance. It is on this strong foundation of history that we are shaping our modern relations."*

India's role in Africa extends beyond government-to-government relations, with extensive engagement through the Indian diaspora. India's USD70 billion investment in Africa, led by the Confederation of Indian Industry, aims to reach USD150 billion by 2030. The Indian community in Africa, particularly in countries like South Africa, plays a pivotal role in education, trade, health, and industrialisation. As India's third-largest trading partner, after the EU and China, India-Africa trade has seen an 18% annual growth since 2003, reaching USD103 billion in 2023. The ongoing collaboration in sectors such as renewable energy, education, and healthcare continues to shape the future of India-Africa relations. Initiatives like the African Continental Free Trade Area and NEPAD (New Partnership for Africa's Development) enhance these partnerships.

India's technical cooperation programs, such as the Indian Technical and Economic Cooperation (ITEC) initiative, have trained over 200,000 African professionals. India's Pan African e-Network connects 54 African nations with India, facilitating cooperation in telecoms, medicine, and e-governance. This network, coupled with projects like the Solar Mamas, underscores India's commitment to Africa's sustainable development.

The Indian Diaspora: A Bridge between India and Africa

The Indian diaspora is an integral part of Africa's socio-economic landscape. With approximately 3 million Indian-origin individuals living across 46 of 54 African countries, the Indian diaspora accounts for 13 % of India's global diaspora. Many have acquired citizenship in their host countries and hold influential positions, making them key players in strengthening India-Africa relations.

Over the years, Indian diaspora communities have fostered development in host nations, creating mutually beneficial transnational ties. These partnerships, supported by governments, international organisations, and industries, drive economic growth, poverty reduction, and social progress. Their contributions are particularly evident in local economic projects and capacity-building efforts.

The knowledge economy has spurred mobility, particularly among Indian scientists, contributing to the development of human capital and the risk of brain drain. To mitigate this, India has implemented strategies to engage its scientific diaspora in African capacity-building initiatives, fostering knowledge exchange to boost science, technology, and innovation systems in low-income countries.

Indian scientific diasporas have become vital to addressing global challenges, advising African nations and supporting policies for their development. Although these diaspora-led efforts are not always aligned

with India's official science diplomacy strategies, the need for policies to formalise this cooperation is clear, particularly in sectors like education, health, and capacity building.

The Indian diaspora is particularly concentrated in South Africa, with 1.7 million people, especially in KwaZulu-Natal and Gauteng provinces. Known for their rich cultural traditions, they have significantly contributed to the country's political, social, and economic spheres. South African Indians, though diverse in religion, caste, and language, maintain strong cultural identities and play a critical role in the nation's political process.

The influence of Indian communities varies across Africa, with South Africa's Indian diaspora particularly dominant in politics and business, while other countries also benefit from their contributions to local development.

Conclusions

India's migration to Africa has evolved from a colonial-era labour force to a vibrant diaspora that plays a significant role in the cultural and economic integration of the two regions. Indian communities in Africa, particularly South Africa, have helped build a strong foundation for bilateral relations, contributing to governance, education, and business. India's collaboration with African nations has moved beyond aid, focusing on mutual development through capacity building and sustainable partnerships. As India's engagement with Africa continues to grow, the role of the diaspora remains pivotal in strengthening ties and promoting India's strategic and economic interests across the continent. Today, Indian Diaspora in South Africa constitutes about 3 % of the total population of South Africa, covering major linguistic, cultural or geographical areas of India (mainly Tamil and Hindi speaking).

Indian diasporas have an embedded disposition to reach out to their home governments and link them to the Indian Government and private sector. However, Indian and African leaders exerting efforts in areas of cooperation with greater interest in working together in this domain. Indian private sector should also diversify into innovative areas in Africa in addition to the traditional sectors like pharmaceuticals, education, and agriculture.

It is imperative that the development of the Indian partnership with Africa be guided by African priorities, as India believes in the unique philosophy of *Vasudhaiva Kutumbkam* (the world as one family). India needs to build as much local capacity and create as many local economic opportunities as possible for the unique people of Africa. The Indian diaspora will undoubtedly remain a key player in facilitating this relationship, enhancing both India's and Africa's global standing in the years to come.

Diaspora Scientists: Influencing Science and Technology Policies in Developing Countries

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Introduction

For decades, the migration of skilled professionals from developing nations to more advanced economies has been a critical topic of academic and policy discussions, often framed as a "brain drain."[1] While this concept dominated earlier narratives[2], the evolving global narrative now emphasises "brain circulation" where knowledge and talent flow bidirectionally, fostering innovation and development both in host and home countries.[3] The role of diasporas and their influence on national policies has been extensively studied.[4,5] Various geographical contexts, including China, India, and Russia, have investigated this subject in their regions.[6,7]

Diaspora scientists act as vital connectors, linking their countries of origin with the global scientific community. Their contributions extend beyond research to include strategic roles in shaping bilateral and multilateral relationships.[8] The historical and contemporary economic, social, and diplomatic ties between the Republic of India and the Republic of South Africa–two dynamic countries with rich histories and promising futures– highlight the transformative potential of such collaborations. These ties are further solidified through their active participation in forums like BRICS (Brazil, Russia, India, China, and South Africa). While diverse in their political and economic systems, these associations aim to promote equitable global development, with India and South Africa championing democratic governance and inclusive progress.

India's global reputation as a hub for scientific talent stems from its abundant pool of scientists, engineers, and researchers. Its institutes of higher learning and research have increasingly embraced international collaboration to foster innovation. Similarly, South Africa has emerged as a leader in leveraging physical research infrastructure to attract global partnerships. Landmark projects such as the Square Kilometer Array (SKA) and the Southern African Large Telescope (SALT) exemplify South Africa's commitment to world-class research and its ability to draw top-tier scientists.

The synergistic collaboration between India and South Africa underscores the broader role of diaspora scientists in shaping international science and technology policies. These professionals not only influence research agendas but also strengthen diplomatic and economic ties, fostering a more interconnected and resilient global scientific ecosystem.

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Success Stories: India-South Africa Collaborations in Science and Beyond

The partnership between South Africa and India is a testament to the power of bilateral cooperation across diverse fields. Since the restoration of diplomatic relations in 1993, the two nations have forged strong ties in areas such as politics, trade and investment, energy and minerals, information and communication technology (ICT), security, agriculture, arts and culture, sports and recreation, human resource development, and consular services. These collaborations highlight the depth and breadth of their relationship and underscore the role of diaspora scientists in driving impactful outcomes.

1. **Economic and Strategic Collaborations**
    - **Trade and Investment**: India is South Africa's second-largest trade partner in Asia, and South Africa is India's fifth-largest trading partner globally. Trade between the two countries has grown significantly, reaching over USD 10 billion, showcasing a robust economic partnership.[9]
    - **Strategic Partnerships**: The two nations actively collaborate on various fronts, including politics, trade, investment, minerals, energy, and technology. They also work together in multilateral organisations such as BRICS and the Indian Ocean Rim Association (IORA), focusing on sustainable development, technological innovation, and geopolitical stability.[10]
2. **Science, Technology, and Innovation**
    - **Research Investments:** South Africa's gross domestic expenditure on R&D (GERD) grew by 6.9% in 2021/22, from R25.965 billion in 2020/21 to R27.756 billion in 2021/22 (https://www.dsti.gov.za/). Applied research was the most prominent type, accounting for 48.1% (or R18.380 billion) of the total R&D activity in 2021/22. Basic research constituted 29.2% (R11.148 billion), while experimental development, the least common category, comprised 22.7% (R8.657 billion). Applied research dominated all sectors except higher education institutions, where fundamental research remained the primary focus.
    - **Industrial Leadership:** Leading scientific and technology research organisations like South Africa's Council for Scientific and Industrial Research (CSIR) have developed technologies that promote industrial growth and societal advancement, exemplifying the nation's commitment to innovation.
3. **Educational and Cultural Exchanges**
    - **Scholarship Programs**: Both countries have established scholarship programs to promote educational exchange. For example, the Indian Council for Cultural Relations (ICCR) offers scholarships to South African students studying in India, fostering mutual understanding and collaboration.[11]
    - **Diaspora Contributions**: Indian-origin scientists in South Africa have fostered research collaborations, bringing expertise from India's globally renowned institutions into South Africa's research ecosystem.
4. **Historical and Multilateral Connections**
    - **Legacy of Gandhi and Mandela**: The shared legacies of Mahatma Gandhi and Nelson Mandela forged a deep bond between India and South Africa. Gandhi's formative political activism in South Africa laid the groundwork for his leadership in India, while India's diplomatic and economic sanctions supported Mandela's anti-apartheid struggle.[11]
    - **BRICS Platform**: Both nations play key roles in BRICS, fostering cooperation on sustainable development, economic resilience, and innovation. This platform also enables collaborative opportunities for scientific and technological advancements.

Key areas of Scientific collaborations

Diaspora scientists play a pivotal role in bridging knowledge gaps and fostering collaboration between India and South Africa. Their contributions span multiple domains, including astronomy, biotechnology, nanotechnology, and chemistry. These professionals act as conduits for innovation, helping to align research priorities and transfer cutting-edge technologies across borders.

Both countries prioritise capacity building, particularly among youth, through joint initiatives in science and technology. These programs encourage collaboration in areas such as renewable energy, agriculture, health, and digital technologies while equipping young scientists with the skills and opportunities needed to tackle future challenges. These efforts also emphasise entrepreneurship, recognising its critical role in job creation and economic growth.

Conclusions

The science diaspora serves as a vital bridge between India and South Africa, fostering innovation and addressing shared challenges. By leveraging the expertise of their diaspora communities, these nations can advance their scientific and technological capabilities while strengthening bilateral ties. This collaboration not only benefits India and South Africa but also contributes to global progress, underscoring the transformative potential of science diplomacy.

The India-South Africa partnership exemplifies how science transcends borders to create shared solutions and inspire the next generation of global leaders. This dynamic relationship, enriched by the contributions of their science diasporas, highlights the power of collaboration in shaping a better future. By building on historical ties, both nations are crafting a modern narrative that underscores the significance of leveraging diaspora expertise to achieve mutual goals.

Recognising the predominantly youthful demographic of their populations, South Africa and India have also identified an urgent need to integrate their youth into the workforce. Entrepreneurship emerges as a crucial driver for job growth and economic resilience. With a shared interest in fostering grassroots innovations, the two countries are exploring new avenues to develop accessible, affordable, and readily available technical solutions that meet regional needs. Collaborative initiatives, such as joint calls for innovative projects, reflect this shared commitment to empowering young innovators and addressing pressing challenges through localised, creative approaches.

As both nations continue to invest in research, innovation, and capacity building, their relationship illustrates how the synergy of shared vision and collective effort can create opportunities for a more inclusive and sustainable future. The India-South Africa collaboration is a shining example of how leveraging the expertise of science diasporas and fostering innovation can transform societies and advance global progress.

References

1. Bonilla K, Arrechea S, Velásquez Pérez LG (2022) Connecting Scientists Residing Abroad: A Review of Converciencia as a Practice to Engage the Guatemalan Scientific Diaspora From 2005–2020. *Frontiers in Research Metrics and Analytics*, 7: 898496. https://doi.org/10.3389/frma.2022.898496
2. Cañibano C, Woolley R (2015) Towards a socio-economics of the brain drain and distributed human

capital. *International Migration*, 53(1): 115–130. https://doi.org/10.1111/imig.12020

3. Chatterji T, Götz G, Harrison P, Moore R, Roy S (2022) Capacity in motion: comparative COVID-19 governance in India and South Africa. *Territory, Politics, Governance*, 12(10): 1–21. https://doi.org/10.1080/21622671.2022.2154829
4. Davenport S (2004) Panic and panacea: brain drain and science and technology human capital policy. *Research Policy*, 33(4): 617–630. https://doi.org/10.1016/j.respol.2004.01.006
5. Tripathi AK (2023) Growing Together with Perennial Bond: 30 Years of India-South Africa Relations. https://organiser.org/2023/04/10/168354/bharat/growing-together-with-perennial-bond-30-years-of-india-south-africa-relations/
6. Bagwandeen M (2020) India-South Africa: A Success Story of Bilateral Cooperation. https://diplomatist.com/2020/11/20/india-south-africa-a-success-story-of-bilateral-cooperation/
7. Li W, Bakshi K, Tan Y, Huang X (2019) Policies for Recruiting Talented Professionals from the Diaspora: India and China Compared. *International Migration*, 57(3): 373–391. https://doi.org/10.1111/imig.12456
8. Meyer JB, Brown M (1999) Scientific diasporas: A new approach to the brain drain. *Management of Social Transformations, UNESCO-ICSU*. https://unesdoc.unesco.org/ark:/48223/pf0000116330
9. Panibratov A, Rysakova L (2021) The diaspora phenomenon: scholarly assessment and implications for countries and firms. *Journal of Global Mobility*, 9(1): 107–144. https://doi.org/10.1108/JGM-07-2020-0051
10. Hazarika A, Madhukullya S, and Lawrence DQ (2023) Strengthening India-South Africa Relations in the Backdrop of BRICS. *Howard on Africa In-Brief*. https://cfas.howard.edu/articles/strengthening-india-south-africa-relations-backdrop-brics
11. Yurevich M, Malahov VA, Aushkap DS (2019) Global Experience in Interaction with Scientific Diaspora: Lessons for Russia. *Herald of the Russian Academy of Sciences*, 89(4): 342–350. https://doi.org/10.1134/S1019331619040129

Transnational Talent in Science: Diaspora Engagement and Global Health

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The role of diaspora communities in science, particularly in global health innovation, is increasingly recognised as a vital resource for improving healthcare delivery, policy development, and emergency response. This article explores the critical involvement of diasporas in enhancing global health outcomes through partnerships, expertise transfer, and advocacy. It focuses on three key areas: the contributions of diaspora health professionals, the implementation of transnational and national initiatives, and their role in fostering health equity and innovation within the broader global context.

By leveraging their talents, networks, and cross-border collaborations, diaspora communities have become invaluable in addressing healthcare challenges worldwide. Their active engagement highlights the need for sustained partnerships to advance global health outcomes.

IOM's Strategic Approach to Diaspora and Health

The International Organization for Migration's (IOM) Strategic Plan for 2024-2028 underscores the multifaceted role of diaspora communities in advancing global health outcomes. This strategy focuses on integrating diaspora engagement into key objectives, particularly in saving lives, protecting people on the move, and facilitating pathways for regular migration.

Diaspora communities, comprising first, second, and third-generation migrants, contribute significantly to healthcare by utilising their expertise, resources, and networks to support vulnerable populations. Diaspora members act as essential actors in humanitarian efforts, providing practical health solutions, enhancing access to care, and supporting marginalised groups. Their roles as healthcare professionals, community leaders, and engaged citizens allow them to offer psychological support, protection services, and recovery assistance, making them vital to global health initiatives. Additionally, diasporas facilitate migration by supporting healthcare solutions throughout the migration cycle, advocating for protection, recognition, and opportunities for newcomers, and ensuring smoother migration pathways.

Diaspora healthcare professionals play a vital role in enhancing development in both their countries of origin and host communities through initiatives like Finland-supported MIDA FINNSOM, which, over 16 years,

has deployed 230 Somali diaspora experts to strengthen 50 health and education institutions, benefiting over 8,000 professionals, and IOM's partnership with the Rwandan government (2019-2022), engaging diaspora health professionals from Europe to provide services, transfer knowledge, and build capacity in ten Rwandan hospitals. Diasporas engage in philanthropy, knowledge transfer, and telemedicine initiatives, which help build local healthcare capacity and address brain drain from developing nations. These efforts also promote the integration of migrant healthcare workers into host country systems, fostering professional ties and cultural exchange.

Diasporas further drive innovation and research by partnering with academics and leveraging their networks, advancing healthcare solutions and improving practices, especially during emergencies. Their ability to create cross-sector partnerships enables coordinated responses to crises, such as the COVID-19 pandemic, where diasporas mobilised resources and expertise. For example, the National Federation of Chinese Migrants in Spain donated 270,000 masks and 5,000 protective suits, the Global Albanians Foundation conducted targeted donation campaigns for vulnerable groups, and the KEIHAN Foundation distributed 500 PPE packages to health staff in Afghanistan's most vulnerable provinces.

Philanthropic efforts by diasporas include financial investment in health infrastructure and advocacy for healthcare equity, focusing on underserved populations. Their advocacy helps shape health policies that prioritise dignity and humane treatment. Overall, diasporas are instrumental in building inclusive, resilient, and responsive global health systems, advancing health equity and improving outcomes across borders.

Global context: Health Equity and Resource Disparity

The global health sector still faces unequal distribution of health resources, including essential medicines, trained healthcare professionals, and healthcare facilities, among others. This disparity in healthcare infrastructure and resources exacerbates health inequities and disproportionately affects marginalised communities. Meanwhile, the global health workforce is strained by critical shortages of skilled healthcare professionals. This shortage is particularly acute in low- and middle-income countries, where the demand for healthcare services often outstrips the available workforce capacity. With this, retaining highly skilled healthcare professionals remains challenging for many developing countries, further exacerbating healthcare disparities.

In response to these global needs, engaging diaspora communities has emerged as a promising strategy to strengthen health systems, enhance healthcare delivery, and address the unmet health needs of populations in their countries of origin. Diaspora members possess valuable skills, expertise, and cultural insights that can be leveraged to fill critical gaps in the global health workforce, improve access to healthcare services, and drive innovation in health programming and policy. This approach not only supports Sustainable Development Goal (SDG) 3: Good Health and Well-being but also aligns with Objective 19 of the Global Compact for Migration (GCM). This objective advocates for enhancing the connection of transnational communities with their communities and countries of origin, aiming to foster sustainable development for all.

Furthermore, as a significant milestone in diaspora engagement, the adoption of the Dublin Declaration outlined a comprehensive plan of action to institutionalise and operationalise diaspora cultural, economic, social and human capital. Experience from the pandemic has highlighted the diaspora's capacity to engage in transnational initiatives in response to global health needs. Stakeholders need to be ready to promote the mutual recognition of qualifications to maximise the mobility of diaspora talent, recognise the varied

and diverse skillsets of diaspora members and tailor programmes, digitalise knowledge transfer and skills exchange. The diaspora can support health professionals in integrating into the health systems of their home or host countries by facilitating the recognition of their qualifications and skills. It enables them to provide culturally appropriate care to migrant communities.

Transnational Health across Humanitarian, Development and Peace Efforts

Diaspora communities play a crucial role in enhancing healthcare access, particularly in underserved and remote areas, by leveraging their skills and expertise. They are increasingly recognised as vital sources of external aid, helping to fill gaps in health systems in their countries of origin. Innovative models like telemedicine and remote consultations allow diaspora healthcare professionals to deliver essential services to migrant populations and those with limited access to care.

During the COVID-19 pandemic, diaspora communities demonstrated resilience by mobilising resources and expertise to support their communities. They provided critical assistance, such as sourcing personal protective equipment for healthcare workers in their home countries and combating misinformation. These efforts highlighted the vital role of diasporas in crisis response.

Beyond emergencies, diasporas contribute to strengthening healthcare systems through training programs, capacity-building initiatives, and direct healthcare services. Their deep cultural understanding and trusted relationships enable them to effectively engage in health promotion and education, addressing migration health challenges and promoting health equity. Moreover, diasporas foster innovation in healthcare by supporting research, developing new technologies, and implementing best practices from their host countries.

Diaspora organisations are also strong advocates for policies that promote health equity, ensuring migrants have access to comprehensive healthcare services and can navigate complex healthcare systems. They address unique health needs and barriers migrants face, such as language differences, legal status issues, and cultural gaps.

To fully capitalise on diaspora engagement in the health sector, long-term partnerships among governments, the private sector, academia, and diaspora organisations are essential. These partnerships should focus on mutual recognition of talent, developing governance frameworks, and integrating diaspora professionals into local health systems for sustainable impact. Strategies like knowledge exchange programs, diaspora support initiatives, and innovative funding models can further enhance the positive effects of diaspora contributions.

Diaspora engagement in health demonstrates the power of collective action and collaboration in advancing global health goals. By leveraging their diverse skills, networks, and resources, diaspora communities significantly improve healthcare access, promote health equity, and enhance health outcomes globally, especially when gender considerations are incorporated into these programs.

Moving Forward

The contributions of diaspora healthcare professionals extend beyond their immediate roles, as they foster synergies and partnerships that span various sectors and borders. Their involvement in developing sustainable and coordinated responses during emergencies, driving innovation and research, and engaging in philanthropy underscores their vital role in strengthening global health systems. By investing in health infrastructure, advocating for health rights, and promoting culturally appropriate care, diaspora communities contribute

significantly to health equity and access, particularly for underserved or vulnerable populations.

The establishment of long-term partnerships among governments, the private sector, academia, and diaspora organisations is crucial to fully harness the benefits of diaspora engagement in the health sector. These collaborations should prioritise mutual recognition of talent, the creation of governance frameworks, and the promotion of innovative models for transnational healthcare delivery. By embracing a collaborative and evidence-based approach, stakeholders can unlock the full potential of diaspora engagement, advancing global health outcomes and contributing to sustainable development. The Global Diaspora Policy Alliance (GDPA), with its focus on health and well-being, is set to play a pivotal role in driving these efforts, fostering long-term partnerships that will enhance health practices and policies worldwide.

In line with the Dublin Declaration, the establishment of the GDPA in 2024 is a key recommendation from stakeholders. Extensive multi-stakeholder consultations identified "Health and Wellbeing" as a critical focus within the GDPA's core structure, demonstrating a strong commitment to using a sectoral approach to diaspora engagement. This approach will enable better measurement of impact, talent matching, and fostering lasting partnerships. Historically, health has been a central focus for engaging diverse stakeholders, and the GDPA's Technical Working Group on Health, co-chaired by the Governments of the Philippines and Somalia, aims to provide a global platform to drive diaspora engagement, promoting innovative solutions across health policies and programs worldwide.

Resources

- IOM (2024) IOM Strategic Plan 2024 – 2028.
- IOM (2020) Global Diaspora reacting to COVID-19 crisis, Best practices from the field. International Organization for Migration, Geneva.
- Global Diaspora Summit 2022.
- IOM (2023) Regional Consultations: Towards the Global Diaspora Policy Alliance, International Organization for Migration, Geneva.

Science Diplomacy in the Veterinary Sector: A Propellant for "Viksit Bharat 2047"

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India's vision of becoming a developed nation, or "*Viksit Bharat*," by 2047 hinges on its ability to address various challenges, from food security to public health and sustainable development. While sectors like technology and education often dominate the discourse, the veterinary sector offers an equally vital yet underappreciated dimension. Veterinarians contribute not only to animal health and welfare but also to broader fields like human health (via the One Health approach), environmental sustainability, and economic growth. Amid rising concerns over zoonotic diseases, food shortages, and environmental degradation, veterinarians are uniquely positioned to offer impactful scientific and diplomatic solutions.

The convergence of veterinary science with critical sectors such as public health, food security, and environmental conservation presents unique opportunities for leveraging science diplomacy. Integrating this approach into the veterinary domain enables India to engage effectively in global partnerships, influence international policies, and address shared challenges. By harnessing the potential of veterinary science diplomacy, India can accelerate its progress toward becoming "*Viksit Bharat*" by 2047.

Role of Science Diplomacy in the Veterinary Sector

Science diplomacy within the veterinary field provides a platform for veterinarians to engage in cross-border collaborations, knowledge-sharing, and influencing global policies on pressing global issues. Examples of successful initiatives include:

- Global Health Security Agenda: Contributions to international frameworks designed to combat zoonotic diseases through expertise and best practices.
- PREDICT: A project of USAID's Emerging Pandemic Threats program focused on wildlife disease surveillance through international collaboration.
- FAO-OIE-WHO collaboration: Enhancing food safety and implementing the "One Health approach".

Here's how the inclusion of science diplomacy in the veterinary profession can help India achieve its long-term development goals by fostering international collaboration and innovative solutions:

Addressing Zoonotic Diseases*:* Zoonoses (diseases transmitted between animals and humans) are a major global health concern, exemplified by pandemics like COVID-19. With India's large livestock population and close human-animal interaction, the country is particularly vulnerable. Collaborating with international health bodies like the World Health Organization (WHO) and the World Organisation for Animal Health (WOAH) can help to develop robust surveillance systems, enable data sharing, and adopt best practices for early detection and control of zoonotic outbreaks. This proactive engagement enhances public health outcomes and strengthens India's leadership in global health.

Ensuring Food Security*:* Veterinarians are integral to the health and productivity of livestock, poultry, and fisheries, which are vital for food security and rural livelihoods. Global collaboration through organisations like the Food and Agriculture Organisation (FAO) and the World Trade Organisation (WTO) facilitates knowledge exchange and adoption of sustainable livestock management practices. Veterinarians can participate in bilateral and multilateral agreements addressing climate-resilient agriculture, ensuring food security while protecting the environment. These measures align with India's sustainable development goals by reducing the carbon footprint of livestock production and improving resource efficiency.

Capacity Building and Knowledge Exchange*:* Advancements in veterinary science—such as precision livestock farming, traceability, vaccine development, and biotechnology—require collaborative research and technology transfer. Science diplomacy facilitates partnerships with leading global institutions, offering opportunities for knowledge exchange through international partnerships, scholarships, and joint research projects. Such initiatives enable Indian veterinarians to adopt cutting-edge technologies, enhancing productivity and animal welfare standards across the country.

Veterinary Public Health in International Trade*:* As India expands its trade in livestock products, adherence to international health standards becomes crucial. Through science diplomacy, India can engage in discussions with trading partners and international regulatory bodies to set appropriate standards and resolve trade disputes related to animal health and safety. Veterinarians can help implement global food safety standards, such as those set by Codex Alimentarius, boosting India's competitiveness in international markets and contributing to economic growth.

Biodiversity and Wildlife Conservation*:* India's rich biodiversity faces mounting threats from habitat loss, climate change, and poaching. Veterinarians are essential in conserving endangered species and managing wildlife health. Collaborations with international wildlife organisations like Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) and the World Wildlife Fund (WWF) can address these challenges. Indian veterinary scientists can contribute to global research on disease ecology, wildlife conservation, and ecosystem management, thereby safeguarding biodiversity and strengthening global environmental efforts.

One Health Approach: The interconnectedness of human, animal, and environmental health under the One Health framework is central to tackling challenges like antimicrobial resistance and zoonotic diseases. By engaging in global One Health initiatives, Indian veterinarians can influence policy and collaborate on solutions addressing public health, food safety, and sustainability, furthering both domestic and international health agendas.

Climate Change Mitigation and Adaptation: Climate change poses challenges for livestock productivity and disease management. Indian veterinarians can collaborate on climate-resilient livestock practices and technologies to reduce greenhouse gas emissions. Participation in global frameworks like the United Nations Framework Convention on Climate Change (UNFCCC) can enable Indian veterinary professionals to develop policies that promote sustainable livestock systems, ensuring that the country contributes to global climate goals while securing its food supply.

Combatting Antimicrobial Resistance (AMR)*:* The misuse of antibiotics in veterinary and human medicine has led to the global crisis of AMR, threatening decades of progress in healthcare. India's veterinarians can collaborate with international organisations like WHO and WOAH to develop AMR surveillance, management, and regulation strategies. They can help influence national and international policies by ensuring the prudent use of antimicrobials in animals. Collaborative research initiatives can contribute to global efforts in developing alternatives to antibiotics, such as vaccines, probiotics, and biosecurity measures, which would have a lasting impact on both global public health and food security.

Veterinary Input in Sustainable Trade*:* As India's livestock sector expands, veterinarians will play an essential role in ensuring that animal products meet international safety and health standards. Science diplomacy can help align India's trade practices with international norms, boosting economic growth and ensuring sustainable development. Veterinary professionals can help resolve trade barriers related to animal health by engaging with bodies like the World Trade Organisation (WTO) and the Codex Alimentarius Commission. By improving animal health and welfare standards, veterinarians can help India increase its livestock and animal product exports, contributing to rural economic growth and national prosperity.

Strengthening Disaster Preparedness and Response*:* Veterinarians play a crucial role in disaster response, ensuring livestock and wildlife health during emergencies. Indian veterinarians can collaborate with international organisations, such as the International Federation of Red Cross and Red Crescent Societies (IFRC), for coordinated disaster response efforts, particularly in providing care for affected animals and safeguarding food security. By learning from global best practices, veterinarians can help India develop resilient systems for protecting livestock and wildlife during floods, droughts, or disease outbreaks, thus protecting livelihoods and contributing to food security.

Developing a Circular Economy*:* Maximising resource efficiency is key to sustainability in a growing population. The livestock sector is integral in achieving a circular economy, where agro by-products and food wastes can be efficiently upgraded into animal proteins. Science advocacy and fostering collaborations can empower professionals in the livestock sector to optimise bio-resource utilisation, driving sustainability.

Promoting Animal Welfare and Ethical Practices*:* Animal welfare is an increasingly important topic in international discussions, particularly with the rise of ethical consumerism. India's veterinary professionals can take the lead in promoting ethical animal welfare standards that align with international norms. Science diplomacy allows Indian veterinarians to engage with global organisations like World Animal Protection and the International Fund for Animal Welfare (IFAW), advocating for higher welfare standards in farming, transport, and wildlife management.

Livelihood and Entrepreneurship Opportunities: Information-driven science diplomacy can unlock opportunities in the livestock value chain, empowering marginalised communities and fostering rural economic growth through innovation and entrepreneurship.

India's Initiatives Supporting the Veterinary Sector

The Indian government has introduced key initiatives to enhance the veterinary sector through improved disease control, digital transformation, and international collaboration (Press Information Bureau, 2024).

- Livestock Health & Disease Control Program*:* Fully funded vaccination programs for critical livestock diseases such as Foot-and-Mouth Disease and Peste des Petits Ruminants (PPR).
- National Digital Livestock Mission*:* A transformative digital platform for identifying and registering livestock, tracking vaccination, breeding, and treatment.
- National One Health Mission: Strengthening disease surveillance and operational readiness through coordinated response strategies. Recently, a USD 25 million Pandemic Fund Project on "Animal Health Security Strengthening in India for Pandemic Preparedness and Response" was launched to strengthen laboratory capacities, improve disease surveillance, and enhance the veterinary workforce. These efforts aim to bolster resilience in animal health systems while integrating human and environmental health components.
- Poultry Disease Action Plan: Proactive measures such as biosecurity and enhanced surveillance to combat avian influenza outbreaks.

WOAH recently recognised ICAR-NIVEDI, Bangalore, as a reference laboratory for PPR and Leptospirosis. Other institutes, such as ICAR-NIHSAD, Bhopal (Avian Influenza), and KVFSU, Bangalore (Rabies), have also achieved similar distinctions. These accolades underscore India's commitment to excelling in veterinary science and contributing to global animal health standards.

Conclusions

India's journey towards becoming a *Viksit Bharat* by 2047 is deeply intertwined with its ability to tackle global challenges like zoonotic diseases, food security, climate change, and sustainable development. Veterinary science diplomacy will be the driving force behind impactful advancements in national policies and global partnerships. By embracing science diplomacy, Indian veterinary professionals will not only strengthen domestic resilience in areas like animal health, public health, and food safety but also position India as a global leader in addressing some of the most pressing issues of the 21st century. In this process of collaboration, research, and policy advocacy, veterinary professionals will play a transformative role in shaping India's development trajectory and its leadership on the global stage, contributing significantly to the realisation of "*Viksit Bharat*" by 2047.

NEWS

India and Slovenia Announce Five-Year Collaboration Plan

India and Slovenia are set to strengthen their scientific collaboration with the finalisation of a five-year Programme of Cooperation (PoC) for 2024–2029. Union Minister Dr Jitendra Singh met Slovenian Minister Dr Igor Papič on 5 December 2024 to discuss the initiative, which aims to expand joint research in transformative areas such as hydrogen technologies and sustainable innovation. The PoC will also foster networks among scientists and open new avenues for research collaboration. Dr Singh highlighted the success of over 20 joint projects in fields like health, artificial intelligence, renewable energy, and smart cities, emphasising that the new PoC will further enhance cooperation in emerging domains. Slovenian Minister Dr Papič, accompanied by Ambassador Mateja Vodeb Ghosh and Economic Counsellor Tea Pirih, welcomed the focus on hydrogen technologies, a critical area for global energy sustainability. A Joint Committee meeting planned in Slovenia early next year will support the implementation of a new joint call for research projects, deepening academic and industrial connections. This renewed collaboration underscores a shared commitment to driving innovation and contributing to global progress.

India Launches Ambitious 'One Nation One Subscription' Scheme to Democratise Scholarly Knowledge

In a pioneering move, the Government of India approved a nationwide "One Nation One Subscription" scheme. This initiative aims to provide seamless access to scholarly research articles and journal publications to millions of students, faculty members, and researchers across more than 6,300 institutions, including government-managed higher education institutions and R&D laboratories. With a budget allocation of ₹6,000 crore for 2025–2027, the scheme reflects India's commitment to fostering research, innovation, and equitable access to knowledge. Coordinated by INFLIBNET, an autonomous inter-university centre of the University Grants Commission, the initiative aligns with India's vision for sustainable development and its long-term goals under Viksit Bharat@2047 and the National Education Policy 2020. By targeting underserved regions and expanding opportunities for interdisciplinary research, this initiative positions India as a global leader in democratising knowledge access. It also complements the Anusandhan National Research Foundation's efforts to promote research excellence and innovation. This ambitious step is expected to strengthen India's research ecosystem, inspire similar initiatives globally, and promote international collaboration in academia and science.

Announcements

AAAS-TWAS Course on Science Diplomacy

Submission deadline: 23 January 2025

Further information at:
https://twas.org/opportunity/aaas-twas-course-science-diplomacy

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AIAS Science Diplomacy Fellowships

Submission deadline: 05 February 2025

Further information at:
https://aias.au.dk/opportunities-at-aias/aias-science-diplomacy-fellowships

MoUs Signed

India Signs MoU with International Energy Agency on Cooperation in the Area of Critical Minerals

On 13 November 2024, the Ministry of Mines signed an MoU with the International Energy Agency (IEA) to enhance cooperation in the critical minerals sector. This partnership grants India access to the IEA's comprehensive data, analysis, and policy recommendations, bolstering strategic decision-making and resource management. Through this collaboration, India aims to align its policies, regulations, and investment strategies with global standards and best practices. Drawing on the experiences of IEA member states and associates, the initiative will support India's transition towards more sustainable and resilient energy systems. The MoU also prioritises capacity building and knowledge exchange, facilitating collaboration on data collection, modelling, and analysis. These efforts will enhance India's technical expertise and institutional frameworks within the critical minerals sector. Furthermore, the agreement includes joint research projects, workshops, and training programmes designed to foster innovation in areas such as technology development, extraction techniques, and recycling methods.

SECI signs MoU to promote Green Hydrogen Initiatives

On 19 November 2024, the Solar Energy Corporation of India Ltd (SECI), under the Ministry of New and Renewable Energy, signed an MoU with H2Global Stiftung to promote green hydrogen initiatives. This partnership establishes a framework for knowledge exchange on market-based mechanisms and strengthens cooperation between India and importing countries, contributing to the global advancement of the green hydrogen economy. The collaboration allows India to develop joint tender concepts, focusing on structured tenders that support its ambition to become an export hub for green hydrogen and its derivatives. Insights gained through this partnership, including understanding global hydrogen market dynamics, trade logistics, and stakeholder engagement, will be instrumental in shaping India's strategies in the sector. By aligning with H2Global Stiftung, India aims to accelerate its progress in green hydrogen development, enhance its technical expertise, and leverage market-based solutions to achieve its renewable energy goals.

New Publications

Abrantes M, Vaz-Pinto R (2024) **Science diplomacy in the European Union: mapping the Portuguese case (1986–2021).** *Humanities and Social Sciences Communications*, 11(1): 1610. https://doi.org/10.1057/s41599-024-04102-1

Aso M (2024) **Performing national independence through medical diplomacy: Tuberculosis control and socialist internationalism in Cold War Vietnam.** *British Journal for the History of Science*, 1–16. https://doi.org/10.1017/S0007087424000487

Anghileri D, Pastori M, Marcos-Garcia P, Umlauf G, Crestaz E, Seliger R, Iervolino A, Cordano E, Cattaneo L, Carmona-Moreno C (2024) **Global Water Challenges in Sub-Saharan Africa and how to strengthen science-policy dialogues on transboundary governance and cooperation.** *Journal of Environmental Management*, 365: 121417. https://doi.org/10.1016/j.jenvman.2024.121417

Chen P-Y (2024) **Taiwan's scientific collaboration under the New Southbound Policy: Trends, effects, mechanisms, and implications.** *ALISE Proceeding Jean Tague-Sutcliffe Doctoral Poster Competition*. https://doi.org/10.21900/j.alise.2024.1730

Cumba Garcia LM, Carabajal MI, Pantović B (2024) **Bridging Science Diplomacy and Science Communication: Recommendations for the Latin American and the Caribbean (LAC) Region.** *Science Diplomacy*, 8(1): 27–31.

Dabbagh NT (2024) **Neocolonialism and Science Diplomacy: Personal reflections from the Middle East on mental health policy and practice.** *Frontiers in Public Health*, 12: 1409341. https://doi.org/10.3389/fpubh.2024.1409341

Dajani R, Bayoumi R, Flowe H, Rockowitz S, Stevens L (2024) **Neocolonialism and Science Diplomacy: Lessons Learned from the Field and the Way Forward.** *Frontiers in Public Health*, 12: 1472421. https://doi.org/10.3389/fpubh.2024.1472421

Dyck C (2024) ***Arctic Governance in the Face of Climate Change: A Case for "Inclusive Regionalism."*** *Canadian Yearbook of International Law*. 1–26. https://doi.org/10.1017/cyl.2024.6

Gulliver S, Demeshko A, Harle J, Drake T (2024) **How science diplomacy can reshape global research publishing: A Theory of Change.** *Center for Global Development Policy Paper 344***.** https://www.cgdev.org/publication/how-science-diplomacy-can-reshape-global-researchpublishing-theory-change

Jafarova L (2024) **The WHO Pandemic Treaty: Ethical Imperatives and Political Realities in Global Health Governance.** *Politikon: The IAPSS Journal of Political Science*, 58: 6–25. https://doi.org/10.22151/politikon.58.1

Li R, Ren F, Wang Q (2024) **China–US scientific collaboration on sustainable development amidst geopolitical tensions.** *Humanities and Social Sciences Communication*s, 11: 1448. https://doi.org/10.1057/s41599-024-03948-9

Lima-Toivanen M, Kulju M, Sanchez-Nieminen G, Martins JT, Dos Santos AM (2024) **Science diplomacy in the European and Latin American and Caribbean research infrastructure collaboration.** *Science and Public Policy*, e054. https://doi.org/10.1093/scipol/scae054

Muchie M, Baskaran A, Tang M (2024) **China-Africa Science, Technology and Innovation Collaboration.** *Springer Nature Singapore Pte Ltd*. ISBN. 9789819745760. https://doi.org/10.1007/978-981-97-4576-0

Namdeo SK, Zhang JY (2024) **Rethinking science diplomacy and global biosecurity: Challenges, emerging practices and the way forward.** *International Affairs*, e187. https://doi.org/10.1093/ia/iiae187

Nielsen AH, Rentetzi M (2024) **The Search for Radiation Standards and Science Diplomacy in the Interwar Period.** *Physics in Perspective*. https://doi.org/10.1007/s00016-024-00319-4

Quaggio G (2024) **A Global Campus Beyond the Cold War. Peace and Disarmament among Spanish Academics during the Debate on Joining and Remaining in NATO (1981-1986).** *Culture & History Digital Journal*, 13 (1): 293. https://doi.org/10.3989/chdj.2024.293

Raman R, Lathabai HH, Nedungadi P, Nair VK (2024) **Sustainable Development through Research and Innovation: Insights from East Asia and ASEAN's Engagement with SDGs.** *Journal of Scientometric Research*, 13(3): 1.

Rugmini DM, Mammen JT (2024) **India-ASEAN Science Diplomacy in Renewable Energy Cooperation**. In: Singh S, Varghese P, Balaiah S, Sebastian S (Eds.) India and Southeast Asia in a Changing World: Exploring Relationship Prospects for a Sustainable Future. Routledge India. https://doi.org/10.4324/9781003570745

Schultheiss C (2024) **Ocean Governance and Conflict in the East and South China Sea: Negotiating Natural Resources, Institutions and Power.** *Amsterdam University Press*. ISBN: 9789048557974. http://digital.casalini.it/9789048557974

Science & Diplomacy (2024) **Special Issue: Science Diplomacy — 15 Years On.** This special issue has 21 contributions. https://www.sciencediplomacy.org/tag/science-diplomacy-15-years

Shapiro T, Yanovska V (2024) **International academic cooperation: selected models and mechanisms.** Centre for Ukrainian Studies at the Warsaw School of Economics, Analytical Study No. wp2024/02ENG. http://szapiro.net/wp-content/uploads/2024/10/CSUkr_WP-2024_02Eng.pdf

Shine C (2024) **Climate Change and International History: Negotiating Science, Global Change, and Environmental Justice.** *International Affairs*, 100(6): 2669–2670. https://doi.org/10.1093/ia/iiae240

Shridharan R, Laufman L, Rozin S, Weinberg A (2024) **The Houston-Semipalatinsk Healthcare Partnership: A Lesson in Science Diplomacy.** *Dialogues Across Health Science Humanities and Archives*, Vol. 1. https://hdl.handle.net/1911/117345

Šime Z (2024) **European Science Diplomacy in the Southern Neighbourhood: Insights from Morocco and Tunisia.** *Politologija*, 116: 8–58. https://doi.org/10.15388/Polit.2024.116.1

Suarez SV (2025) **Ocean Science Collaborations: Towards a Complex Interdependence in the South China Sea.** In: Nguyen LAT, Vu HD (Eds.) Viability of UNCLOS amid Emerging Global Maritime Challenges. Springer, Singapore. https://doi.org/10.1007/978-981-97-5838-8_9

Tunc TE (2024) **Science as Diplomacy: Franklin Delano Roosevelt and the Third Presidential Cruise of 1938.** Isis, 115(4): 738–756. https://doi.org/10.1086/733158

Turekian V, Gluckman P (2024) **Science Diplomacy and the Rise of Technopoles.** *Issues in Science and Technology*, 41(1): 51–55. https://doi.org/10.58875/PSYH6414

Vasilyeva IN, Bogatova RS, Rebrova TP (2024) **Development of Science Diplomacy in the MENA Region: Priorities and Prospects for Cooperation with Russia on the Example of Saudi Arabia, Egypt and the United Arab Emirates.** *Russian Journal of Regional Studies*, 32(3): 402–425. https://doi.org/10.15507/2413-1407.128.032.202403.402-425

Vasilyeva IN, Bogatova RS, Korneeva ND (2024) **Enhancement of Science and Technology Cooperation Between Russia and MENA Countries Using Compatriot Scientists Potential and Publication Activity Data.** *Scientific and Technical Information Processing*, 51: 194–205. https://doi.org/10.3103/S0147688224700138

Voth-Gaeddert LE (2024) **Maximizing STEM resources for diplomats: A framework for speed, depth, and accuracy.** *Global Policy*. https://doi.org/10.1111/1758-5899.13468

Call for Proposals

NIG Internship 2025

Last Date: January 09, 2025

Further information at: https://scholarshiproar.com/nig-internship-japan/

DST DFG Joint Call on International Research Training Groups

Last Date: February 01, 2025

Further information at: https://onlinedst.gov.in/Projectproposalformat.aspx?Id=2232

DBT-EU Joint Call on HORIZON-CL5-2024-D3-02-03

Last Date: February 04, 2025

Further information at: https://dbtindia.gov.in/sites/default/files/Revised%20DBT-EU%20joint%20call%20WEBNOTICEWP%202023-24.pdf

DMREF: DST-NSF Joint Call for Research Proposals

Last Date: February 04, 2025

Further information at: https://dst.gov.in/sites/default/files/DMREF%20pre%20call%20launch%20announcement_0.pdf

Forthcoming Events

27th International Congress of History of Science and Technology

Date: June 29-July 5, 2025

Further information at: https://www.ichst2025.org/