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Inside:

- Perspectives
- MoUs
- Announcements
- Publications
- Call for Proposals
- Forthcoming Events

Perspective

Challenges in Technology Commercialisation & Possible Solutions through Techplomacy: An Indian Perspective

Radhika Trikha
Senior Policy Fellow, DST-Centre for Policy Research, Panjab University, Chandigarh, India
E-mail: radhikat@iisc.ac.in

Introduction

The national progress of any country is primarily driven by technological growth rested on research and innovation. Research and innovation act as a breeding ground for technology development. It is of paramount importance that a supportive and conducive framework for commercialising technologies specially developed in academic and research institutes should be created.

In the global context, international relations are primarily defined by interactions around technology needs and evolution. Diplomatic channels, in return, are also having a strong influence on the development of technologies and their deployment. It has led to the emergence of the '*Technology Diplomacy*' concept that helps determine interactions and knowledge sharing mechanisms of international organisations, the private sector and the national governments/ public sector.

Technology commercialisation is the process of transferring a technology-based innovation from the developer to the organisation, utilising and applying the technology for marketable products.[1] There are three groups representing technology developers and commercialising organisations. These include universities and research institutes, startups (technology-oriented) that are founded for the sole purpose of developing (and in some cases also commercialising) technologies and established companies.[1] The universities and national research laboratories are the vital technology developers that can commercialise their technology by licensing or selling it or creating spin-offs.

Technology transfer in India has transitioned towards a large-scale, globally interactive market and is bound to have a tremendous impact on the economy through risk management, research income sponsored by the industry and exclusive licenses.[2] Though the Government of India (GoI) invested particular thoughts and efforts for improved commercialisation of technology, it failed to achieve the required momentum for sustainable and inclusive growth.[2,3] In India, the research and development (R&D) system is deficient in the following:

- Minimal or selective private sector involvement in R&D support programmes.
- Conservative and safe approach that discourages high-risk ventures.
- Scarcity of cooperative or professional education in academic institutions or universities.

- Lack of monitoring, accountability and utilisation of fiscal incentives by the industry and private sector.
- Lack of vision: for instance, research agenda in organisations with a primary focus on fundamental or essential research often gets diluted due to unreasonable expectations of commercialisation and *vice versa*.
- Lack of policy and decision-making ability of public institutions.
- Stringent bureaucratic resource allocation procedures.

India's upcoming 5th National Science, Technology and Innovation Policy (STIP) draft has strongly emphasised building technology competency. Therefore, proper measures, frameworks and models for promoting and commercialising the technologies should be laid out. STIP draft has addressed the changing STI landscape globally and the emerging challenges related to technology development and its governance, especially standards, ethics, ownership, transfer, market access, and dual-use. It calls for direct & dynamic, proactive international S&T engagements through technology diplomacy initiatives. Technology diplomacy will aid in bringing India's proactive role in agenda-setting and global STI governance.

The current article envisages the lack of technology commercialisation and successful translation of academic knowledge to marketable products in India.

Challenges in Technology Commercialisation

Technology commercialisation is an integral part of the innovation process,[4] which means that technologies and products cannot successfully enter the market without going through the commercialisation process. The success in technology/ product commercialisation depends on integrating research and innovative capabilities, including accessing financial resources, understanding market needs, employing highly-skilled forces and forming effective interactions with the other actors in the market.[5] The challenges in technology commercialisation can be categorised into four levels: individual-level, technology-level, organisation-level and national and policy-level.

Individual-level challenges	Technology-level challenges	Organisation-level challenges	National and Policy-level challenges
Scientists/ researchers face barriers during technology commercialisation.	The product generated is not ready for technology commercialisation.	The organisational culture hampers technology commercialisation.	The national policy on Science and Technology (S&T), lack of technical support, lack of Intellectual Property Rights (IPR) valuation, certification, and approvals are barriers to technology commercialisation.

Recommendations* for Enhancing Technology Commercialisation

1. The academic and research institutes engaged in active basic and translational research should have a vibrant Business Management Cell (BMC), which acts as a moderator between academia and industry. BMCs (or equivalents) are considered a vital component of promoting innovations and already exist in the

* Major recommendations are pulled out from the talk given by Prof. R.K. Sinha at an event organised by DST-CPR at Panjab University, Chandigarh.

Indian premier academic institutes, such as the Indian Institute of Science (IISc). Many Indian Institutes of Technology (IITs) and foreign universities are also known for generating R&D-led innovations. BMC primarily consists of personnel adept in business management, marketing, innovation and industry-ecosystem. These BMCs can serve as facilitative channels for technology diplomacy and strategic international engagements in line with a particular technological domain.

2. Although there are many funding programmes available for generating new technologies/ innovative products, there are limited schemes for updating the technologies created in the universities/ research labs. In the present era, technologies become obsolete within a couple of years after hitting the market. These days Internet of Things (IoT) enabled technologies are preferred over analogue-based technologies. Hence, it is imperative to introduce schemes for updating the existing technologies. This will also aid in modernising the current technologies and future-ready ones. Furthermore, diplomatic institutionalised mechanisms can be explored for the necessary support for technology development and its commercialisation. The prime examples are three international centres: Indo-French Centre for Promotion of Advanced Research (IFCPAR/ CEFIPRA); Indo-US Science & Technology Forum (IUSSTF) and Indo-German Science & Technology Centre (IGSTC) established by the Department of Science and Technology (DST) with their foreign counterparts, France, USA and Germany, respectively to aid in joint research, innovation and technology development.
3. An adequately certified technology [high Technology Readiness Levels (TRLs)] stands a high chance of success to be taken up by the industry. The companies trust and rely on certified technologies. Unfortunately, most scientists are unaware of TRLs and there are not enough testing/ certification centres to evaluate technologies created in the R&D labs. The automobile and aviation sectors have suitable testing/ certification centres, but the situation is not encouraging in other domains. The policymakers should look into this matter and set up sector-specific testing/ certification centres in R&D labs.
4. Many innovative technologies are lying on the shelves of R&D labs. Not much emphasis is laid on marketing the technologies by research labs and universities. Besides, the stakeholders (industries and entrepreneurs) are unaware of these technologies. Each lab should create an interactive web platform where the technologies designed and available for licensing should be marketed. The Council for Scientific and Industrial Research (CSIR) under the Ministry of Science and Technology, GoI has come up with a Fast Track Commercialisation (FTC) funding scheme that has started paying dividends. Such an initiative can contribute to the self-sustenance of at least 25% of the R&D budget of each lab. Other funding agencies may set up similar schemes for the speedy commercialisation of technologies lying unsold.
5. It has been noted that having experienced industry R&D personnel in the academic sector positively influences the scientific environment. The universities may consider setting up a position of 'Chair-Professor' for retired R&D personnel from the industry. This initiative will equip academic scientists with an industrial R&D mindset. The model is working well in the Indian state of Orissa.
6. For stimulating technology commercialisation, engaging Masters of Business Administration (MBA) interns for the market study will act as a progressive approach. The R&D labs and research-oriented universities should engage MBA students in technology marketing through internships or short-term training programmes that will create MBAs with knowledge of both domains and would provide better job opportunities.
7. Scientific leadership is also one of the critical parameters for success in translational research. Scientists oriented towards technology development must be nurtured for leadership qualities by the Management Gurus. Business cells created in universities and research labs should be led by experienced scientific leaders accompanied by a team with science and management backgrounds.
8. Developing technology is far more challenging than publishing a research paper. Nonetheless, promotion-evaluators give more emphasis to articles published than to patents granted. In case of failure, the hard

work and time invested in technology development are not considered and do not find favours with evaluators. As a result, the current mindset of Indian scientists is more towards research projects (for publications) than technology-oriented projects. Therefore, more avenues need to be created for scientists engaged in translational research and should be incentivised, which can be in the form of promotion, awards, R&D grants, etc.

9. In the majority of the universities, there is no provision of relaxation in the teaching load of a professor/ scientist excelling in R&D. It takes a heavy toll on the scientist. The Ministry of Education (MoE), GoI may look into this aspect. Also, it is suggested that MoE introduces positions of Research-Professor, Assoc. Professor and Asst. Professor at the universities to promote good quality research in the academic environment.
10. Many scientists in universities and research labs have ideas that can be translated into innovative products/ technologies. The GoI has put in place a Faculty-Entrepreneurship Policy, but scientists are unaware of it. In other cases, universities are reluctant to grant leave to scientists to become entrepreneurs because of the limited teaching staff. This situation requires the immediate attention of MoE.
11. Inter-University Accelerator Centre (IUAC) should come up with the idea to bridge the gaps in the university-level research programmes aiming towards the same product. Moreover, an interface needs to be created wherein academia and industry people meet and join hands to address societal issues requiring R&D interventions and work on industry problems needing the intellect of academia.
12. After the retirement of scientists, the process of technology commercialisation of their developed technologies gets stopped. A special assistance scheme should be introduced for taking up such halted technologies and introducing R&D grants for retired scientists. Hand-over of technologies should be made mandatory and technology development should not cease when a scientist leaves the organisation.
13. It has been observed that institutes that hire experienced and superannuated scientists display better R&D outcomes and tend to secure more funds from the agencies. It is suggested that universities be encouraged to employ such scientists as Adjunct Faculty.
14. One of the industry's concerns has been that a scientist of the academic sector is not sensitive to the timelines of the industry. If the scientists desire to work on an industry-academia research project, they need to deliver the product on time as per the agreement.
15. A scientist can prepare/ create/ design a lab-scale prototype. But the industries are inclined to commercial prototypes, which require further research and inputs from the industry. Sadly, there are not ample schemes catering to this aspect of 'Translational Research'. The Department of Biotechnology (DBT) under the Ministry of Science and Technology, GoI, has constituted a Section 8 Company, Biotechnology Industry Research Assistance Council (BIRAC). BIRAC supports technology development through idea generation to prototype development and commercialisation hence, catering to each stage of technology development. In addition, BIRAC has set up various STI based diplomatic channels to facilitate research and innovations. Some of the key diplomatic channels formed in the field of biotechnology are: Indo-Australian Biotechnology Fund; Bill & Melinda Gates Foundation signed a Memorandum of Understanding with BIRAC to attract global funders for serving grand challenges of India; RAPID USAID-TB Diagnostic programme; BIRAC-UK Trade and Investment programme, etc. It is propounded that govt. funding agencies introduce dedicated funding schemes for lab-scale prototypes to commercial prototypes.
16. BIRAC is highly successful in promoting public-private R&D partnerships. It also assists in the TRL evaluation of medical/ pharma technologies. The R&D investment share of public and private sectors in the BIRAC sponsored projects is nearly 50-50. Many patents/ technologies/ startups have been generated in a short span. It is advocated that each funding agency should look into the BIRAC model and re-orient their funding schemes accordingly.
17. Generally, funding agencies introduce schemes in a mission mode approach; in other words, funds are

allocated for a limited/ fixed time. This approach has not delivered the desired results as commercialised technologies generally have a long gestation period. They also need to be updated occasionally to survive the market competition. Hence, long-term funding schemes (spanning 10-15 years) catering to different sectors are imperative.

18. Industries should also transform their mindset of funding short-term (one to three years) research projects to long-term investments by establishing Centres of Excellence (CoE), cooperative labs, etc. Such CoEs should also have highly skilled technical staff.
19. Although Corporate Social Responsibility (CSR) funds of industries can be used to carry out R&D work in the universities/ research labs, industries are not free to utilise these funds. The Centre influences decisions regarding CSR money expenditure. This issue needs the redressal of the policymakers.
20. Many technologies rely on the availability of components from the market. Hence, an institute/ R&D lab must have a strong network with the vendors. This aspect is essential for technology commercialisation. It is recommended that each institution may enlist its alumni who have set up industrial units. Such units naturally bond with their alma mater and render their services happily, even at a lower price.
21. Sometimes, an industry buys the technology but does not use it as imported items fetch more value. Policy intervention is needed in this matter. Moreover, the academic/ research institutes that sell the technology to the industry should be closely associated with the drive for technology use and maintenance. The government should provide a support system to nurture this.
22. Too much time is taken up to grant a patent in India. This process needs to be speeded up. In addition, the protection of utility patents for small inventions can be introduced in India.
23. The market-to-mind approach is far better than the mind-to-market approach, particularly in translational research. Hence, scientists should engage with industries and work on industry-generated R&D problems. This approach has more chance of success and reduces the time to generate industry-ready prototypes.
24. In developed nations, the industry provides necessary funds for R&D projects in universities and R&D labs. The Centre incentivises industries by providing loans, grants and tax benefits for their R&D investments in the academic sector. In developing countries, it is the Government that contributes towards R&D funds. The Centre may look into this aspect seriously. It can reduce its share of R&D expenditure by granting more incentives (tangible and intangible) to the industries.
25. Some Indian funding agencies like DST, DBT, Ministry of Electronics and Information Technology (MeitY), etc., have set up several Technology Business Incubators (TBIs) across India for converting innovative ideas into prototypes. But, the next phase (i.e. accelerated phase) of taking the prototype to the market is very critical. Most of the entrepreneurs fail here. This phase, also called the 'Valley of Death' phase, needs a strong hand holding by the government. The GoI has responded by setting a few domain-specific accelerators. But, the need of the hour is to establish many more accelerators, especially in the domain of 'Clinical Testings' for Phase two and Phase three studies.
26. In the present innovation era, only those industries will survive that have their R&D set-up tied up with academia (universities and R&D labs). In India, many industries situated in the State of Orissa, India, are collaborating with academic institutes and the results are encouraging. It is suggested that all industries tie up with universities and R&D labs, preferably the ones closely located. The Industrial Policy-2019 highlights this very point.
27. 'Robust Technology Commercialisation Policy' should be put in place at the national, state and institutional levels.
28. National Research Organisations, for example, CSIR, are meant for assisting industries and not for financial benefits. Hence, the technologies should be priced moderately to encourage the industries to buy them.

29. A national policy needs to be in place to purchase homegrown technologies/ products. CSIO, in collaboration with three agencies, developed 6MeV Medical Linear Accelerator (LINAC) in the 1990s. All were working efficiently at hospitals and prices of foreign accelerators came down heavily in India. But the Government stopped funding for making more accelerators.
30. Auditing the universities, R&D labs, and funding agencies should be a serious business. It should be done annually by competent teams who are fully aware of the ins and outs of the organisations.

Exploring Technology Diplomacy

International diplomacy plays a significant role in addressing the emerging issues and challenges globally, and S&T is playing a central role in this. The science diplomats are actively mobilising technical expertise and scientific knowledge for new, emerging and sustainable technologies. The emerging field of technology diplomacy is also catering to policy decisions related to the entire value chain associated with technology development and commercialisation. It has led to the emergence of innovative and collaborative ways to address the whole life cycle of technology development from the idea to the market. As highlighted in India's upcoming STIP draft, the GoI is substantially working towards strengthening its international engagements through STI diplomacy. The policy has a dedicated section on 'International Engagement for Technology Development and Adaptation'. This section brings out the focus of the Central Government in gaining access to the knowledge base (technical know-how) associated with the importing technologies. It has also actively promoted India's participation in Mega-science projects and developed scientific and technological capabilities for indigenous technology development and commercialisation. The outcomes generated through mega-science projects can be further adapted and commercialised in India in line with national priorities and needs, focusing on domestic demands. This can be one of the approaches to achieve the bigger goal of Atmanirbhar Bharat by aspiring for technological self-reliant India. The initiatives taken in this direction are listed below:

- The Ministry of External Affairs (MEA), GoI, has set up a division New, Emerging and Strategic Technologies (NEST). The division has undertaken efforts to reinvigorate Indian organisation capacities by promoting interplay of trade, technology, security and geopolitics in a larger context. The division focuses on dealing with foreign policy and other international legal aspects along with the standard-setting in the technological fields. The diplomatic channels will focus on exchanging knowledge and views with foreign governments, domestic ministries and various associated departments. The diplomatic channels are working towards strengthening India's positioning in the digital landscape, especially in the era of the next generation of network technology. Technology diplomacy has to cater to the global context of technology export and import. The new and emerging technologies are essential for the country's innovation-backed socio-economic development.
- The GoI has initiated Pravasi Bharatiya Academic and Scientific Sampark - Integrating Indian Diaspora with the Motherland (PRABHASS) as a flagship initiative. The virtual portal has been established to develop a database and a platform to bring the global Indian S&T Community to address the Indian societal challenges. This has led to collaborative arrangements for technology development and technology import from abroad as suited for the Indian landscape.
- Presently, India has bilateral S&T cooperation agreements with 83 countries with active cooperation with 44 countries. During recent years the cooperation has strengthened significantly with Australia, Canada, EU, Israel, Japan, Russia, UK and USA. Cooperation with African countries has also been strengthened through the India-Africa S&T initiative. The soft prowess of S&T has been leveraged to engage with several countries under India's Act East policy and with some neighbouring countries. Three bi-national S&T Centres, IFCPAR/ CEFIPRA, IUSSTF and IGSTC have been established under inter-governmental bilateral agreements.
- The International Cooperation division of DST provides thematic cooperation for generating theme-based technologies. Some of the leading programmes where India is taking the lead are:

- International AIDS Vaccine Initiative (IAVI)
- International Solar Alliance (ISA)
- Mission Innovation (MI)
- Laser Interferometer Gravitational-Wave Observatory (LIGO)

- India is also part of various regional, bilateral and multilateral engagements [regional engagements with ASEAN; EU; BRICS; SAARC; multilateral organisations such as OECD, UNESCO, etc.; Ministerial multilateral platforms (Science and Technology for Society Forum)] to promote and strengthen its STI ecosystem. These initiatives and engagement dialogues have established a technology diplomacy channel in India. This division has also created dedicated funds [India-Israel Innovation & Industrial R&D Fund (I4F); Australia -India Strategic Research Fund (AISRF); Indo-Hungarian Joint Research Fund (IHJRF); India-Portuguese Joint Research Fund (IPJRF); ASEAN-India S&T Development Fund (AISTDF)] to support technology development and its deployment with global support.
- DST has also created Global Innovation and Technology Alliance (GITA), a "not-for-profit" Public-Private Partnership (PPP) between the Technology Development Board (TDB), DST and Confederation of Indian Industry (CII), India's apex industry association. It focuses on: a) Professionally managing Government's industrial innovation funds, b) Providing flexibility to industry for R&D, including with global partners, and c) Delivering commercialised products and services to Indian and global markets. It offers funding, capacity building, deployment and strengthening of the innovation ecosystem. It is one of the diplomatic channels for promoting collaborative technology development and deployment in association with global partners.

Conclusions

In the current COVID-19 pandemic, it has become necessary for countries worldwide to become technologically self-reliant. Governments must push indigenous technology development and deployment by strengthening national policies and action plans and exploring the technological prowess of countries routing diplomatic technology channels. The technical deployment in reaching society and contributing to social-economic development requires a conducive environment for supporting technology commercialisation. The economic value and its reach to the masses are only possible with dedicated steps that cater to the endorsement of technology development and its commercialisation. The Indian STI trajectory faces current challenges in commercialising the technologies at the national level, institute level and individual level. Therefore, necessary mitigative steps need to be undertaken by the GoI to promote and create accessible and reliable institutional mechanisms and policy instruments to support the commercialisation of the technologies developed in academic and research institutes. It also calls for introducing policy-level interventions and programme-level interventions to explore technology diplomacy to gain maximum from imported technologies, global resources, and mega-science projects.

In the author's opinion, the GoI can take critical steps to remove barriers to technology commercialisation. It should introduce policies to develop institutional mechanisms, funding mechanisms, incentivisation mechanisms, and legislative and administrative mechanisms for imbibing the culture of technology commercialisation at all levels. The creation of national policy guidelines and protocols and a rulebook for technology commercialisation should be laid at the institutional level. Necessary support mechanisms in terms of setting up Centres of Excellence, Business management cells, thematic incubators, accelerators, etc., should be widely promoted. The funding models for addressing the up-gradation of technology commercialisation should be put in place. The author opines that if the Government undertakes such initiatives, a culture of technology marketing and its commercialisation can be inculcated as a trait amongst the technology developers, technology facilitators, technology deployment vehicles and technology consumers. Furthermore, India should proactively participate in agenda-setting and standard-setting in various technological domains and utilise global knowledge in developing technologies addressing global and national problems.

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Achieving Economic Growth through Science Diplomacy in the Indian Subcontinent

Mamta Bhardwaj
Sr. Scientist-C, DST-Centre for Policy Research, Panjab University, Chandigarh, India
Email: mamtab@pu.ac.in

Sustainable development is one of the prominent agendas of all nations and has become a global mission to be accomplished. The United Nations (UN) General Assembly set up Sustainable Development Goals (SDGs), also known as 'Global Goals' in 2015. The 17 SDGs have well-defined targets and indicators to achieve a better and more sustainable future by the year 2030. In the current article, the author has discussed the facts, challenges, strengths, weaknesses and recommendations pertaining to SDG-8, which is 'Decent Work and Economic Growth' through science diplomacy. In addition, the article also highlights some examples of previous and existing science diplomacy programmes in the countries of the Indian subcontinent.

SDG-8: Decent Work and Economic Growth

The SDG-8 aims to "*foster sustained, inclusive and sustainable economic growth, full and productive employment, and decent work for all*". Historically, decent work and economic growth have been perceived as functions that are antagonistic to each other. It has been reinforced with historical examples of employing cheap labour, slavery, child labour and the lack of laws to protect job security and employees' well-being. The SDG-8 does not merely aim to increase higher employment levels but also calls the system to create inclusive and respectable working environments that would lead to economic productivity. To resolve the prominent vulnerabilities related to decent work, such as low and uncertain incomes, child/ forced labour, unhygienic working conditions and increasing unemployment in the South Asian nations, the respective governments must strengthen ties through science diplomacy and achieve national goals and economic development.

Shoko Noda, UNDP resident representative in India, in her recent article[1] has drawn attention to the absence of government relief measures for *Safai Saathis* during the pandemic despite them being at bottom of the socio-economic chain and having higher health risks. India has >4 million *Safai Saathis* that form the backbone of traditional waste management for 65 million tonnes of waste generated each year. Noda has also suggested policy agendas for safe, sustainable and dignified livelihoods.

Statistical Glimpses on Labour Force and Employment

World Bank data (2020) represents that the share of the youth not in education, employment or training for the Indian subcontinent is only 29% of the total youth population.[2] As far as the Indian scenario is concerned, it is the second-most populous country on earth, contributing to 17.7% of the world population, with >50% and >65% of its population below the age of 25 and 35, respectively. Hence, a large proportion of the Indian population is in the younger age group. Table 1 depicts the data extracted for the labour force and employment rate for the Indian subcontinent. Among these nations, India is the most populated country but has the minimum employment to population ratio (43%) after Pakistan (47.91%). All the selected countries except for Bangladesh reveal negative Gross Domestic Product (GDP) per capita growth (annual %).

Table 1: Statistical details about employment in the Indian Subcontinent

Country	Population in 2020[2]	Total labour force (LF)[2]	Un-employment (% of total LF)[3]	Employment rate[3]	GDP per capita (USD)[2]	GDP per capita growth (annual %)[2]
Bangladesh	164,689.38	68,412.68	4.37%	52.77%	1,961.6	2.5%
India	1,380,004.39	457,779.81	4.68%	43%	1,927.7	-8.2%
Sri Lanka	21,919.00	8,105.65	4.79%	48.65%	3,680.7	-4.1%
Nepal	29,136.81	16,045.63	11.36%	73.8%	1,155.1	-3.9%
Pakistan	220,892.33	71,809.32	4.08%	47.91%	1,188.9	-2.9%
Bhutan	771,612	344,741	2.45%	62.85%	3,000.8	-11.1%

Sources: [2]data.worldbank.org; [3]tradingeconomics.com

The issue of unemployment in the Indian subcontinent is common and needs to be addressed through science diplomacy and policy deliberations at the bilateral and multilateral levels. In the forthcoming sections, suitable measures and steps have been enlisted to strengthen the collaborations and achieve the national goals.

COVID-19 Pandemic Impact on Employment

Not only the global recessions of the past, but the COVID-19 pandemic has also provoked institutions across the world to redesign the existing economic models and rethink ways to ensure that such events do not lead to employment loss in future. This pandemic has had an extreme impact on the labour market, raising the unemployment rate from 3.5% in February 2020 to over 10% in July 2020 (Bureau of Labour Statistics, American Community Survey, O*NET).[4] The International Labour Organization (ILO) also reported that 1.6 billion workers in the informal economy risk losing their livelihood during the pandemic. Unemployment is a major issue in the present scenario. This pandemic has affected the entire world badly, and the economic revival of every stratum is the biggest issue now.

The major weakness here is the lack of SDGs integration into the national planning process. According to the 2021 report, presented at the UN General Assembly by the Secretary-General,[5] "*Even before the current crisis, the global economy was growing at a slower rate than in previous years notwithstanding improvements in labour productivity and unemployment. The pandemic has abruptly and profoundly disrupted it, pushing the world into a recession. The unprecedented shock to the world's labour markets is expected to result in a decrease of around 10.5% in aggregate working hours in the second quarter of 2020, equivalent to 305 million full-time workers. Small and medium enterprises, workers in informal employment, the self-employed, daily wage earners* *and workers in sectors at the highest risk of disruption have been hit the hardest."* The unemployment crisis due to the pandemic has hit the lower-income countries the most. Nations need to adopt inclusive and collaborative approaches to overcome such issues.

In the next section, existing measures and a future roadmap have been discussed to ensure decent work for the masses in the South Asian region.

Existing Regional Science Diplomacy Measures within Indian Subcontinent

The neighbouring nations should come forward to exploit research and collaboration opportunities through science diplomacy. They can improve the relations and bridge the gap between the S&T agencies to resolve common issues. Some of the prominent and successful programmes and initiatives by the Government of India with neighbouring countries are as follows:

ASEAN India S&T Development Fund (AISTDF): India has been the dialogue partner of ASEAN (Association of South-East Asian Nations) since 1992. ASEAN-India S&T Collaboration started formally in 1996 with the establishment of the ASEAN, India S&T working Group (AIWGST). Initially, the collaborative ASEAN-India S&T activities were supported through ASEAN India Fund (AIF). AISTDF was created in 2008 jointly by the Ministry of External Affairs (MEA), India and the Department of Science and Technology (DST), India, to support R&D projects in member states.

Bay of Bengal Initiative for Multi-Sectoral Technical and Economic Cooperation (BIMSTEC): BIMSTEC is a regional organisation comprising seven Member States, five from South Asia, including Bangladesh, Bhutan, India, Nepal, Sri Lanka, and two from Southeast Asia, including Myanmar and Thailand. BIMSTEC has also established a platform for intra-regional cooperation between SAARC and ASEAN members.

South Asian Association for Regional Cooperation (SAARC): The SAARC was established in 1985 to improve the quality of life of the people of South Asia by creating ties with international and regional organisations in economic, social, cultural, technical and scientific fields. SAARC is an economic and political organisation of eight Member States: Afghanistan, Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan and Sri Lanka. Regional cooperation acts as a complement to the bilateral and multilateral relations of Member States.

India Science and Research Fellowship (ISRF): This programme was initiated by DST, India in 2015. It provides opportunities to researchers and scientists from neighbouring countries to get access to the state of the art facilities available in the Indian higher education institutions. The recent fellowship call for the year 2021-22 was announced on 18 February 2022, for the nations: Afghanistan, Bangladesh, Bhutan, Maldives, Myanmar, Nepal, Sri Lanka and Thailand.

Roadmap and Recommendations

The aforementioned initiatives are examples of successful programmes promoting collaborative research, improving the quality of life of people, employment, domain-specific activities among the nations, capacity building and organising developmental activities in the Indian subcontinent. The youths' (15-24 years) inactivity rate[6] for India and Sri Lanka is 55%, followed by Pakistan at 52%, Nepal at 44% and Bangladesh at 39%. The issues of unemployment, inactivity among youths and economic growth can be effectively resolved by developing science diplomacy systems and structures. To ensure sustainable economic growth and decent work, the nations of the South Asian region can collaborate on the following aspects:

Knowledge sharing: Knowledge sharing between the science agencies can be a crucial mechanism to establish scientific ties between South Asian nations through science diplomacy. Countries can collaborate on the attributes like scientific content sharing, exchange programmes, collaborative R&D and partnerships between institutions, industries and research organisations of the neighbouring countries.

Natural resource sharing: Every country possesses diverse natural resources like oil, gas, minerals, water and land, etc. By sharing these resources as catalysts, nations can ensure employment and economic development.

For example, hydropower can act as a catalyst for regional cooperation in South Asia; the International Centre for Integrated Mountain Development, Asia-Pacific Research and Training Network on Trade, etc., for building the capacities of national and regional actors. Agreements, Memorandum of Understanding (MoUs) and contracts can be signed to share the benefits of natural resources. Trade fairs can be organised for exhibiting Traditional Knowledge and Geographical Indications produced in the member countries.

Diversity: Every nation has different cultures, languages, governing systems, working ethics and religions. South Asian countries can organise events and programmes like skill development, employees exchange activities, collaborative education, scientific research, etc., to explore and study the diversity of the neighbouring nation. These initiatives will ensure skill development, investments, connectivity, talent pooling, and employability of the youths of collaborating countries.

Collaborative approach: Some nations sharing borders and boundaries have resentful relations and indulge in unpleasant activities harming their esteem and prosperity. Nations should ignore political issues. The research & scientific institutions should work on collaborative objectives, missions and projects to resolve the real challenges. The neighbouring countries can study and explore the successful social and scientific models and adopt the relevant ones in their respective nations.

Corporate tie-ups: Business tie-ups can play a crucial role in economic development and employment. Some of the initiatives taken by the countries are like PHD Chamber in India and Pakistan bilateral trade in various domains. Similarly, in the field of science & technology, start-ups, education, research, and innovation, can be promoted by signing pacts, MoUs, agreements, etc. Such activities will encourage optimum use of markets, technologies, potential skills, manpower and appetite of neighbouring nations.

Institutional mechanisms sharing: No nation can possess the whole ingredients to address the complexities of scientific research, required funding and resolve global challenges. Each country has a distinct infrastructure and institutional mechanisms to address social, educational and political issues. The international collaborations through signing bilateral agreements, initiating dedicated programmes and collaborative institutional setup with member countries in different S&T areas need to be strengthened. This practice will ultimately boost inter and intra-country research and innovation partnerships.

Conclusions

The need of the hour is to address issues like employment for youths, skill development, and reforms in national/ international labour laws & policies, more programmes to enhance employability through skill development, hands-on training, self-awareness, etc., and fostering social and bilateral dialogues between the nations. India can be a driving force in implementing policies for regional economic development as it is the only key partner of OECD (Organisation for Economic Co-operation and Development) from the Indian subcontinent. Furthermore, countries must devise effective education and training institutions to anticipate labour market needs and adapt to new jobs and rapid technological change. Although science diplomacy as an operational concept cannot resolve all the challenges, a collaborative approach at the national, regional and international levels can be bolstered to address the common issues. More programmes may be initiated for sharing knowledge, technologies, recourses, institutional mechanisms, monetary support, corporate tie-ups, scientific research collaborations, etc., by ignoring political and border difficulties and leveraging diversity positively and constructively.

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"Do or Die"- Learning Science Diplomacy from the Father of our Nation

Jenice Jean Goveas
DST-STI Postdoctoral Policy Fellow, DST-Centre for Policy Research, IISc, Bangalore
Hosted at the Office of the Principal Scientific Adviser to the Government of India
Email: jenicegoveas@iisc.ac.in

On 8th August 1942, on the eve of the launch of the Quit India movement, Mahatma Gandhi made a historic statement, "Here is a Mantra, a short one, that I give you. You may imprint it on your hearts and let every breath of yours give expression to it. The mantra is: 'Do or Die'". By this, he voiced the need for commitment to the cause at hand- to win freedom from colonial rule. Even today, this Gandhian philosophy is still the guiding light in our fight against various enemies. Currently, our nation is confronted with pandemic-induced health crises, agrarian catastrophes, water scarcity and many more challenges. While we struggle against these, we need to hear the frail lingering voice still saying "**Do or Die**". Yes! We have to take action, or we shall all die. We have reached a time when holistic, international collaborative efforts are the only means to stop the damage caused to our planet. It is just one of the many examples where the dire need for science diplomats comes to the fore. Gandhian philosophy is apt to foster genuine partnerships between policymakers, diplomats and scientists.

By cautioning, "An eye for an eye only ends up making the whole world blind", he stressed the need for establishing concrete diplomatic ties to foster friendship and prevent war among nations, along with his concept of **Sarvodaya and Trusteeship**. Let's look at how this man, not directly associated with science, whose name never appeared in any of India's science policies, is still capable of being the patron of Indian Science Diplomacy. Although there is a difference in opinion about Gandhiji's views on science, he is that scientist who performed 'Experiments with Truth'. These experiments have given India and the world breakthrough results that can guide science diplomats and policymakers in a multitude of dimensions. His philosophy embodies many elements of successful diplomacy, which includes building trust among all sections of society through a Cosmo-centric approach to humans.

In 1925, Gandhi wrote in '*Young India*'- "It is impossible for one to be an internationalist without being a nationalist. Internationalism is possible only when nationalism becomes a fact, i.e., when people belonging to different countries have organised themselves and are able to act as one man. It is not nationalism that is evil, it is the narrowness, selfishness, exclusiveness which is the bane of modern nations which is evil." - an apt message for Indian Science diplomats who can uphold the true spirit of science for mankind as they forge new ties. His ability to portray India's economic growth and self-reliance by internationalising an object as trivial as the *charkha* (a cotton gin or spinning wheel) is a powerful lesson in diplomacy. Gandhiji's slogan, "Khadi is the sun of the village solar system" is apt today when nations are grappling to handle microplastics entering water resources from synthetic clothing and threatening aquatic life. The IPCC special reports have warned that environment-related issues can threaten international relations. Recently, Sri Lanka correlated their air quality deterioration in Colombo to the pollution episode in India. While India struggles amidst its embarrassing air pollution levels, we remember Gandhiji's words- "We suffer much because we do not realise the value of pure air". Gandhiji gave the practical meaning of sustainability when he said, "The earth, the air, the land, and the water are not an inheritance from our forefathers but on loan from our children. So we have to hand over to them at least as it was handed over to us".

While we celebrated 150 years of Gandhiji's birth, Prime Minister Modi gave a call to spread Gandhian ideas through innovation. It was apt that India donated a 50 kilowatt 'Gandhi Solar Park' to the Headquarters of the United Nations - A gesture of achieving diplomacy through science going beyond mere talk on climate change. The Swachh Bharat campaign and India's Solar mission have been used rightly as powerful tools in Indian diplomacy. Our engineering and innovation policies have a word of caution from Gandhiji who expressed in '*Young India*' that "Machinery has its place; it has come to stay. But it must not be allowed to displace necessary human labour".[2] Valiant women played an essential role during the Satyagraha and it reminds Indian leaders of the need for gender parity. This effort should be taken seriously by science diplomats, especially when India is struggling to better its disappointing rank of 140 in the World Economic Forum's gender gap index.

Indian Science diplomacy undeniably has in many ways been in sync with the vows of Gandhiji. The true essence of Science can be equated to Gandhiji's hymn **'Vaishnava Jana To',** which means that a true human being can feel the pain of another. Real science diplomacy has to work in this direction. India's efforts towards collaboration in developing climate-resilient crops, supply of generic medicines to African and other needy nations are guided by this principle. Hence, diplomacy's main goal is '**Ahimsa**', which is easier to be achieved through a true scientific spirit. One that searches for '**Satya**' or the truth. Gandhiji guides our environmental policy by '**Asteya**' or non-stealing, warning us that "We are not always aware of our real needs, and most of us improperly multiply our wants, and thus unconsciously make thieves of ourselves". His broad idea of '**Brahmacharya**' or self-discipline is apt for every world leader. '**Aparigraha**' or non-possession can guide science diplomats' work against unnecessary 'hoarding' of essential commodities. Above all, Indian foreign policy is slowly leaving behind its fears of disapprobation by taking significant stands on world issues. Gandhiji termed it '**Sarvatra Bhayavarjana'** (Fearlessness). We are now strongly projecting '**Swadeshi**' goods and resources as our soft power by promoting traditional medicines, Himalayan herbs, Ayurveda, and Yoga to the world.

PM Modi rightly said, "World is eager to know Mahatma Gandhi and hence, it becomes India's responsibility to keep reminding (the) world of the abiding relevance of Mahatma and his vision". Let Science diplomacy be used to establish Sarva Dharma Samantva (Equality of the religions) as science knows no religion. This way science-backed diplomacy can work towards the eradication of '**Sparshbhavna'** (untouchability) among nations making Science, Technology and Innovation available for all.

Even today Gandhiji continues to be the epitome of India's soft power. Currently, when India is vying to get onto the bandwagon of becoming a powerful force 'in Science and through Science', he tells us, "*The difference between what we do and what we are capable of doing would suffice to solve most of the world's problems*". His admiration by the scientific community is testified by Albert Einstein's most famous quote: "Generations to come will scarce believe that such a one as this ever in flesh and blood walked upon this earth". That is why, I believe we still have a lot to gain and learn from Gandhiji, who adds that 'pinch of salt' to Indian Science diplomacy.

Enacting Science as Soft Power by Indian Scientists during Pre-Independence Era

Jayanti Dutta
Faculty, Human Resource Development Centre, Panjab University, Chandigarh, India
E-mail: jayantiduttaroy@yahoo.co.in

Imagine for a moment that we live in an enslaved nation run by foreign rulers. Imagine the absence of a democratic government, an independent judiciary, free press, constitutional rights, and right to information. These rulers own everything-market, education, institutes, industries, police, army, courts, laboratories, scientific journals, conferences, fellowships, funding, etc. In such a scenario, what chance do you have as a scientist? What research can you do? Let alone a scientist, what contribution can you make as a civil society member?

That was the state of the period from 1880 to 1947 in which our pre-independence scientists lived and worked. To appreciate their contributions, we need to understand the milieu of those times and the meaning of being a scientist in those oppressive settings.

Indian scientists or personnel working in the domain of sciences in that period faced discrimination at the hands of the imperialist administration because of the plain reason of being the 'ruled'. The biased opinion about Indians being an irrational and uncivilised community immersed in the pool of weird superstitions, unable to think logically and pursue science was prevalent. It was a general notion that the Indian mind would always turn away from the empirical study of nature to metaphysical speculations. There is ample evidence of such prejudices that formed the foundation of the imperialist scientific structure and were displayed through discriminatory acts. That made it immensely difficult for the Indian scientists to practice good science or even survive in the system. Such discrimination was manifested in different ways.

Indians were mainly assigned and designated for lower-level tasks at subordinate and peripheral positions which lacked an intellectual essence. As a result, their efforts were not recognised at equal footing as researchers, and they never got credit for their significant contributions. Names of Radhanath Sikdar (who computed the height of the peak XV later named Mount Everest), Azizul Haque and Hem Chandra Bose[1] (Police officers who quantified fingerprinting using analytical pattern method) and Kishori Mohan Bandopadhyay[2] (who partnered with Ronald Ross to hypothesize that mosquitoes cause malaria) come to the fore as examples of such discrimination.

Often genuine, lawful claims for salary, promotions, dues, benefits, rightful cadre, leave, etc., were denied irrationally, making their services not only insulting but also unsustainable for the scientists. The case of Sir Jagadish Chandra Bose wherein he was refused the rightful salary for three years is well known.[3] PN Bose preferred to resign from his post when he was superseded for the directorship of the Geological Survey of India by a British officer, ten years his junior. PC Ray was not allowed to move into the imperial service, higher in the administrative hierarchy.[4] Such instances illustrate the stifling of the scientists' careers through administrative authority.

In any scientific endeavour, resources and funding are prerequisites, which were systematically denied to the Indian scientists. JC Bose was refused any research facility, and his work was considered purely private until recognition from the Royal Society.[3] There was no facilitation for doing research, and scientists were often not given any respite from teaching and other duties for pursuing their research interests.

All branches of sciences were not allowed to develop equitably. Projects with economically profitable returns were in Zoology, Botany, Geology, and Meteorology and were supported to exploit natural resources, while other branches of science and related industries were sidelined. Whenever requests were made for starting new institutes in the areas which were not commercially significant, the government pleaded insufficient funds. This lopsided system in research harmed India's robust and all-round growth in science.

However, instead of getting restrained or suppressed by such discriminatory practices by the British, Indian research displayed a sudden surge of activities, establishing itself at an international level and creating an unprecedented scientific movement at the national level. It was made possible by several contributions by the Indian scientists of that era, especially manifested in the first three decades of the 20th century.

It is indeed inspiring to note that these contributions did not have grand projects or huge funds, but through simple, creative, and innovative ways, the scientists used all the resources available: resources of the mind, heart and hand. They used the faculties of thinking, writing, speaking, teaching, and researching- all the repertoire of a scientist, using the practice of science as a tool to push the agenda of nationalism. Some of them did go beyond this gamut and ventured into building institutions, publishing journals, establishing industries, indulging in community service, and supporting the freedom movement openly, perpetually guided by the undercurrent of national self-expression.

As the western empiricism protocols propounded by Francis Bacon started getting practised in Indian institutions, Indian scientific wisdom in Mathematics, Astrophysics, Medicine, Chemistry, and other areas were declared defunct and obsolete. The Indian scientists took it upon themselves to set the account right. There was a need to define 'Indian science' in the modern context. They raised pertinent thoughts such as, how can Indian scientists be true to their tradition and also seek recognition in the modern science; what is it that India can contribute to the universal science from its unique, but subjugated position, and how can India, lagging in the practice of science stand on an equal footing with the West which has marched ahead? Not banking on any kind of revivalism, JC Bose had clearly stated the Indian stand by declaring, "*They would be our worst enemy who would wish us to live only on the glories of the past and die off from the face of the earth in sheer passivity. By continuous achievement alone, we can justify our great ancestry. We do not honour our ancestors by the false claim that they are omniscient and had nothing more to learn*".[5] This clear and objective narrative created a progressive milieu for Indian practitioners of science, scientists, students, and community members; and helped them to excel in modern science while keeping their national pride intact.

JC Bose's call asking Indian scientists to not simply decry the lack of resources, but instead to produce work to the best of their abilities and circumstances as a source of national pride: *"Rise from your depression! Cast off your weakness, in whatever condition we are placed, that is the true starting-point for us*"[6] is an indicator of the thirst for the scientific knowledge and progress the scientists possessed. They engaged themselves in such high-quality and exceptional research that their names were being taken among the best scientists in the world: the optics scattering effect known as the Raman effect named after CV Raman; Boson, one of the elementary particles named after SN Bose; Saha equation for photo-ionisation after MN Saha; and PC Ray earned the sobriquet of 'King of Nitrites' for his research in crystallisation of Nitrites. JC Bose was the pioneer in wireless transmissions of electromagnetic signals and radiations in the 5mm–1cm wavelength. These scientific contributions were path-breaking and pioneering and made the world take notice of the Indian scientific intellect.

A curious and counter-intuitive trend visible in the publications of these scientists is their preference to publish in Indian scientific journals. These journals were initiated and published by Indian scientists who wanted to establish alternative publications which did not discriminate against Indians and provided them with their due academic space. Calcutta Journal of Medicine (M Sircar, 1868), Bulletin of Indian Association for the Cultivation of Science (Edited by CV Raman, 1909), Journal of Indian Chemical Society (PC Ray, 1924), Science and Culture (MN Saha, 1935) were some such journals.[7] In fact, 34% of papers published from 1807 to 1947 in India appeared in Proceedings of the Indian Academy of Sciences- Section A and B.[8] Thus, we find that JC Bose published his work on the polarisation of electromagnetic waves in the Journal of the Asiatic Society of Bengal in 1884, which was communicated to the Royal Society of London by Lord Rayleigh a year later. CV Raman announced his discovery of Raman scattering at the 1928 meeting of the South Asian Science Association in Bangalore.[7] These actions were not naïve happenings but well-thought strategies which resonated with the confidence in their work and their underlying nationalist pride.

In addition to scientific publishing, many scientists initiated documentation of the history of Indian scientific tradition, as the significance of preserving Indian perspectives became obvious. PC Ray's '*A History of Hindu Chemistry: From the Earliest Times to the Middle of the Sixteenth Century A.D.; With Sanskrit Texts, Variants, Translation and Illustrations*' is a successful example of this effort.[9] This book was well-received internationally and reviewed by the renowned science historian Pierre Eugene Marcellin Berthelot in France.[10] A science-fiction entitled, '*Palatak Toofan*' by JC Bose, where he lampoons the imperialists and shows the superiority of Indian wisdom; 'Essays on India' by PC Ray are a few examples where the scientists ventured into literary routes also. They wrote textbooks and popular science books for students and the general public and thus, contributed to creating an ecosystem of scientific thinking in society.

Most of the scientists were also engaged in teaching in colleges and universities. Though teaching took a substantial part of their time, energy, and efforts and kept them away from focussing on research, they used teaching as a weapon to fight the imperialist forces by inculcating logical and rational thinking to their students. They brought up an army of students who were illustrious, industrious and also seeped in the nationalist spirit akin to their teachers. These students further spread out in the country and replicated the model of enriching India with the scientific fervour of a patriotic brand.

By the end of the nineteenth century, there was no space, opportunity, or facility for Indian scientists in the British institutions unless they followed the rigid dictates of the imperialists in administration, academics, and sciences. To chart an original, creative and independent path in science, Indian institutions which were 'solely native and purely national' as envisaged by Dr M Sircar were required. This realisation led to the establishment of several institutions facilitating Indian scientists: Indian Association for the Cultivation of Science (1876, M Sircar), Indian Industrial Association (1891, PN Bose), Basu Vigyan Mandir (1917, JC Bose),[3] Indian Chemical Society (1924, PC Ray), Indian Science News Association (1935, PC Ray and MN Saha), Indian Academy of Sciences (1934, CV Raman).[7] History has shown that these institutes proved to be fertile ground for the independent accomplishments of Indian scientists.

Based on his intellectual capital PC Ray went ahead and tried his hands in establishing *Swadeshi* industries such as Bengal Chemical and Pharmaceutical Works, Bengal Pottery works, Calcutta Soap Works, Bengal Enamel works, Bengal Caning and Condiment works. These industries manufactured chemicals, drugs, pharmaceuticals, home products, fire extinguishers, surgical instruments, and cosmetics employing indigenous technology, skill and raw materials.[10] JC Bose too fabricated his own devices for use in his experiments using the skills of local artisans. Later, many universities from America and England showed interest in placing orders and purchasing these fine instruments for their laboratories, thus boosting confidence in *Swadeshi* products.

The actions of pre-independence Indian scientists cannot be termed as Science diplomacy in the true sense; however, it is clear that these steps, in addition to scientific achievements, were actions to situate India and its heritage at a prominent seat globally. These were, no doubt, reactions to the political milieu, the social upheavals, and the intellectual churns of that specific period in History when Indians everywhere were breaking the shackles of slavery in their own ways. Though these activities were not well-planned and strategically executed, they were well-thought-out rebuttals to the imperialist oppression. Collectively the myriad contributions of the scientists did help India to come out of the morass of self-pity and a medieval, retrogressive mindset and encouraged the countrymen to participate in modern science with objectivity, rigour and confidence.

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MoUs Signed

Cabinet approves Memorandum of Understanding between India and Turkmenistan on Cooperation in the field of Disaster Management

The Union Cabinet approved the signing of the Memorandum of Understanding (MoU) between India and Turkmenistan on Cooperation in the field of Disaster Management on 6 January 2022. The MoU seeks to put in place a system, whereby both India and Turkmenistan will be benefited from the Disaster Management mechanisms of each other and it will help in strengthening the areas of preparedness, response and capacity building in the field of Disaster Management. At present, India has signed the bilateral/ multilateral Agreement/MoU/Joint Declaration of Intent/ Memorandum of Cooperation for cooperation in the field of Disaster Management with Switzerland, Russia, SAARC, Germany, Japan, Tajikistan, Mongolia, Bangladesh and Italy.

CSIR and Institute Pasteur signed an MoU towards advancement in Human Health

In an important milestone in S&T Cooperation between India and France, an MoU was signed on 26 January 2022 between CSIR and Institute Pasteur with scope for cooperation in health research. CSIR and Institute Pasteur would be jointly researching and focusing on emerging, reemerging infectious diseases, inherited disorders, enabling the delivery of effective and affordable healthcare solutions not only for the people of India and France but for the global good. The MoU provides for developing potential scientific and technological cooperation and networking in advanced and emerging areas of Human Health between scientists and institutes/ laboratories of CSIR and Institute Pasteur and its international network.

World Economic Forum and NIUA sign an MoU to collaborate on a jointly designed 'Sustainable Cities India program'

On 24 February 2022, the World Economic Forum and the National Institute of Urban Affairs (NIUA) signed an MoU to collaborate on a jointly designed 'Sustainable Cities India program' which will aim to create an enabling environment for cities to generate decarbonisation solutions across the energy, transport, and the built environment sectors. The 'Sustainable Cities India program' intends to enable cities to decarbonize systematically and sustainably that will reduce emissions and deliver resilient and equitable urban ecosystems. The Forum and NIUA will adapt the Forum's City Sprint process and Toolbox of Solutions for decarbonisation in the context of five to seven Indian cities across two years. The City Sprint process is a series of multi-sectoral, multi-stakeholder workshops involving business, government, and civil society leaders to enable decarbonisation, especially through clean electrification and circularity.

India & Singapore ink an MoU to jointly develop products related to economic & societal challenges

An MoU on cooperation in the fields of Science, Technology and Innovation was signed on 8 March 2022 between the Department of Science & Technology, Government of India, and Ministry of Trade & Industry, Government of Singapore. The MoU will follow a demand-driven approach in developing cooperation, facilitating companies and institutions that wish to optimise the benefit arising from the cooperation, for encouraging companies and institutions to cooperate and utilise programmes, which promote the mobility of scientists and high-level experts. The cooperative activities will include sharing experiences on the national research, development, and innovation policies and programmes of each country, exchanging and sharing of scientific and technological information, organising partnership development activities, workshops, scientific seminars, and conferences. Recognising the importance of international cooperation in the fields of science, technology, and innovation for the two countries' economic and social development, the MoU would strengthen India-Singapore Science, Technology, and Innovation Collaboration.

Announcements

Call for Applications: "AAAS-TWAS Course on Science Diplomacy"

Submission deadline: 15 April 2022

Further information at:

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

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Call for Applications: "India Science and Research Fellowship (ISRF) 2021-2022"

Submission deadline: April 15, 2022

Further information at:

https://dst.gov.in/sites/default/files/ISRF%20Brochure%2C%20FY%202021-22.pdf

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Call for Applications: "2022 cohort of the SciDEAL Program"

Submission deadline: April 15, 2022

Further information at:

https://scipolnetwork.org/page/science-diplomacy-exchange-and-learning-scideal

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Call for Applications: "Science Diplomacy online course"

Submission deadline: 5 September 2022

Further information at:

https://www.diplomacy.edu/course/science-diplomacy/#howtoapply

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De Grijs R (2022) **When governments don't get along, scientists are key.**
https://www.authoraid.info/en/news/details/1517/

European Commission, Directorate-General for Research and Innovation (2022) **Tackling R&I foreign interference: staff working document.**
https://data.europa.eu/doi/10.2777/513746

Fägersten B (2022) **Leveraging Science Diplomacy in an Era of Geo-Economic Rivalry: Towards a European strategy.** UI Report No. 1, March 2022.
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https://doi.org/10.1080/07036337.2022.2049260

Call for Proposals

India-Taiwan Programme of Cooperation in Science & Technology 2022
Last Date: April 8, 2022
Further information at:
https://www.gita.org.in/OnlineRfp/ProgramInfo.aspx?GITA=kZdo4yRVS4gRExygXA1Gyli3Y0vQ5oB/lz0Fz5I5y4w=

2022 Digital Energy Challenge
Last Date: April 30, 2022
Further information at: https://www.afd.fr/en/digital-energy-challenge-utilities-annual-call-projects

EPFLeaders4impact: MSCA Postdoctoral Fellowships in Sustainable Innovation
Last Date: May 2, 2022
Further information at: https://www.epfl.ch/research/services/fund-research/funding-opportunities/fellowship-mobility/epfleaders4impact/

United States-India Educational Foundation (USIEF) 2023-2024 Fulbright Fellowships for Indian Citizens
Last Date: May 16, 2022
Further information at: https://www.usief.org.in/uploadip/ip2023-24/Fellowships_for_Indian_Citizens_2023-2024_brochure.pdf

Indo-Danish research and innovation cooperation in the area of "Green fuels including green hydrogen"
Last Date: June 2, 2022
Further information at: https://dst.gov.in/sites/default/files/Indo-Danish%20joint%20call%20in%20Green%20fuels-converted.pdf

India – Israel Industrial R&D and Technological Innovation Fund
Last Date: June 16, 2022
Further information at: https://www.gita.org.in/OnlineRfp/ProgramInfo.aspx?GITA=kZdo4yRVS4gRExygXA1Gyq9SZnneO25N65fp3J3SeI8=

DST DFG joint call on International Research Training Groups (IRTG) 2022
Last Date: August 1, 2022
Further information at: https://dst.gov.in/sites/default/files/DST-DFG-IRTG-Announcement-2022%20%281%29-converted.pdf

Forthcoming Events

Seminar on Space Diplomacy
Date: May 5–6, 2022

Further information at:
https://www.science-diplomacy.eu/events/seminar-on-space-diplomacy/

GYA International Conference of Young Scientists: "Harmonizing Reason with Sensibility: Regenerating science for an inclusive and sustainable future"
Date: June 14–17, 2022

Further information at:
https://globalyoungacademy.net/events/2022-international-conference-of-young-scientists-and-gya-annual-general-meeting/

InsSciDE Concluding Conference Paris
Date: June 23–24, 2022

Further information at:
https://www.science-diplomacy.eu/events/insscide-concluding-conference-paris/

Conference of the European Association for the Study of Science and Technology (EASST 2022) – Politics of Technoscientific Futures
Date: July 6–9, 2022

Further information at:
https://www.science-diplomacy.eu/events/conference-of-the-european-association-for-the-study-of-science-and-technology-easst-2022-politics-of-technoscientific-futures/

CFP:10th ESHS Conference: "Science Policy and the Politics of Science"
Date: September 7–10, 2022

Further information at:
https://eshsbrussels2022.com/

World Science Forum 2022
Date: December 8–9, 2022

Further information at:
https://globalyoungacademy.net/events/world-science-forum-2022/

This Science Digest is open to new ideas, valid criticism and constructive feedback. If there is any science diplomacy/ policy related event which requires wider outreach, please share it with us. We welcome your articles/ feedback/ suggestions at scidip@niscpr.res.in

Director: Dr Ranjana Aggarwal
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CSIR - National Institute of Science Communication & Policy Research (NIScPR)
Council of Scientific & Industrial Research (CSIR)
Vigyan Sanchar Bhawan, Dr. K.S. Krishnan Marg, New Delhi-110012, India.
Fax: +91- 11-25847062

+91-11-26967789
scidip@niscpr.res.in
niscpr.res.in
@csir_niscair