A Paradigm Change for India: Science Technology and Emerging World Order by Viksit Bharat 2047*

Archana Sharma
Senior Adviser International Relations
Head Engagement Office, CMS Experiment
Principal Scientist Physics Department
CERN CH 1211 Geneva 23 Switzerland
E-mail: Archana.Sharma@cern.ch

In an era where boundaries are not just geographical but extend into the realms of innovation and knowledge, the role of science and technology (S&T) in diplomacy has become increasingly crucial. As a nation with a rich history and a promising future, India must harness S&T to not only propel its development but also to foster international collaboration and goodwill. This shift in global priorities underscores modern exports extending beyond physical goods to include information, technology, and expertise, enabling countries like India to contribute significantly to global progress. While Saudi Arabia remains the largest oil exporter, the Brazilian economy thrives on coffee beans export, and Switzerland exported over USD 100 billion worth of gold in 2022 alone; the era when precious goods were the only meaningful exports is over. Today, data, technology, and expertise are as important as physical resources and can be used not just for the betterment of India but humankind as a whole.

India has always been a cradle of ancient wisdom, and in today's context, this wisdom has manifested itself in the form of cutting-edge scientific and technological advancements. From space exploration to information technology, India has made significant strides. It is now time to leverage these achievements for humanity's greater good. S&T diplomacy for India should not be viewed merely as a means to enhance economic growth or gain a competitive edge but as a tool to address global challenges collaboratively. Climate change, healthcare, poverty, food and water security, and sustainable development are challenges that transcend national boundaries. By fostering international cooperation in S&T, India can contribute to finding innovative solutions.

India has a vast pool of talented scientists, engineers and researchers. Our globally renowned institutions of higher learning and research should open doors wider for collaborations and exchanging ideas. Joint research, technology transfer and collaborative initiatives can be the cornerstone of our diplomacy efforts. CERN serves as a relevant and effective example of governance and international cooperation. Scientists and engineers from across the world come together to explore the universe's biggest questions– something that would be impossible for one nation acting alone. But when more than 50 nations pool their resources and intelligence, world-changing discoveries can be made. CERN's 'One-Earth' approach is a shining example of global togetherness. As CERN Director General Fabiola Gianotti once said: "Places like CERN contribute

* Based on the author's contribution to Raisina Dialogue 2024

to the kind of knowledge that not only enriches humanity but provides the wellspring of ideas that become the technologies of the future." From a human and diplomatic standpoint, India must continue representing itself globally in such collaborative efforts.

In the fields of artificial intelligence, biotechnology, and renewable energy, India has a significant role to play. By aligning our scientific pursuits with the United Nations Sustainable Development Goals, we can showcase our commitment to a better world and inspire collaboration on a global scale. Digital diplomacy is also essential in today's interconnected world. Through open-source collaboration, joint data sharing, and digital innovation, India is and can further amplify its influence and shape global norms in the digital space.

In recent years, India has emerged as a global leader in scientific research, technological advancements and innovation. The Indian Space Research Organisation (ISRO) has consistently demonstrated India's capabilities globally. Missions like the Mars Orbiter and Chandrayaan have not only showcased our technological prowess but have also underscored India's commitment to peaceful exploration and collaboration in space. In information technology, Indian professionals have played a pivotal role in driving global innovation. Indian tech companies and start-ups are at the forefront of creating cutting-edge solutions, be it artificial intelligence, cybersecurity, or blockchain technology. The 32 million-strong Indian diaspora has significantly contributed to the success of Silicon Valley and tech hubs worldwide. Advancements in information and technology come with responsibility. Leading the world safely and securely requires balancing scientific progress with responsible practices. International collaboration is essential to develop adequate safeguards and rules for a new era of civilisation, particularly with recent advances in artificial intelligence. Inclusivity is vital in global engagement. S&T should not be exclusive to developed countries. With its commitment to inclusive growth, India must actively support capacity building in developing nations, facilitating knowledge and technology transfer to uplift societies globally.

For the sake of diplomatic sustainability, helping countries down the economic ladder can pay off long term as they develop and evolve. Diplomacy is not about making the best deals with the prominent countries alone but positioning India as a powerhouse for generations. Better diplomatic relations can maximise the benefits of India's vast resources. Our commitment to sustainable and inclusive development is evident in initiatives like the International Solar Alliance (ISA). By bringing together nations to harness solar energy, India is leading the charge in addressing climate change and promoting sustainable practices globally. The next



Figure 1. R&D expenditure as % of GDP for selected countries (2020)
(Source: DST R&D statistics at a glance, 2022-23)

generation of geopolitics is set to be driven by scientific developments, and India's voice in these historic moments is crucial. S&T diplomacy for India is not just an option but a necessity. It is a pathway to a future where nations collaborate, innovate, and grow together. Harnessing the power of S&T will help India emerge not only as a global leader but also as a force for positive change. There are certain imperatives that we must embark upon.

India's R&D investment, understandably, given the challenges of our country, has been relatively low, declining from 0.8% of Gross Domestic Product (GDP) in 2009–10 to 0.64% in 2020–21. In comparison, other developing BRICS countries spent more on R&D in 2020-21: Brazil allocated 1.3%, the Russian Federation 1.1%, China 2.4%, and South Africa 0.6%. Most developed countries invest over 2% of their GDP in R&D, while India lags, as shown in Figure 2.

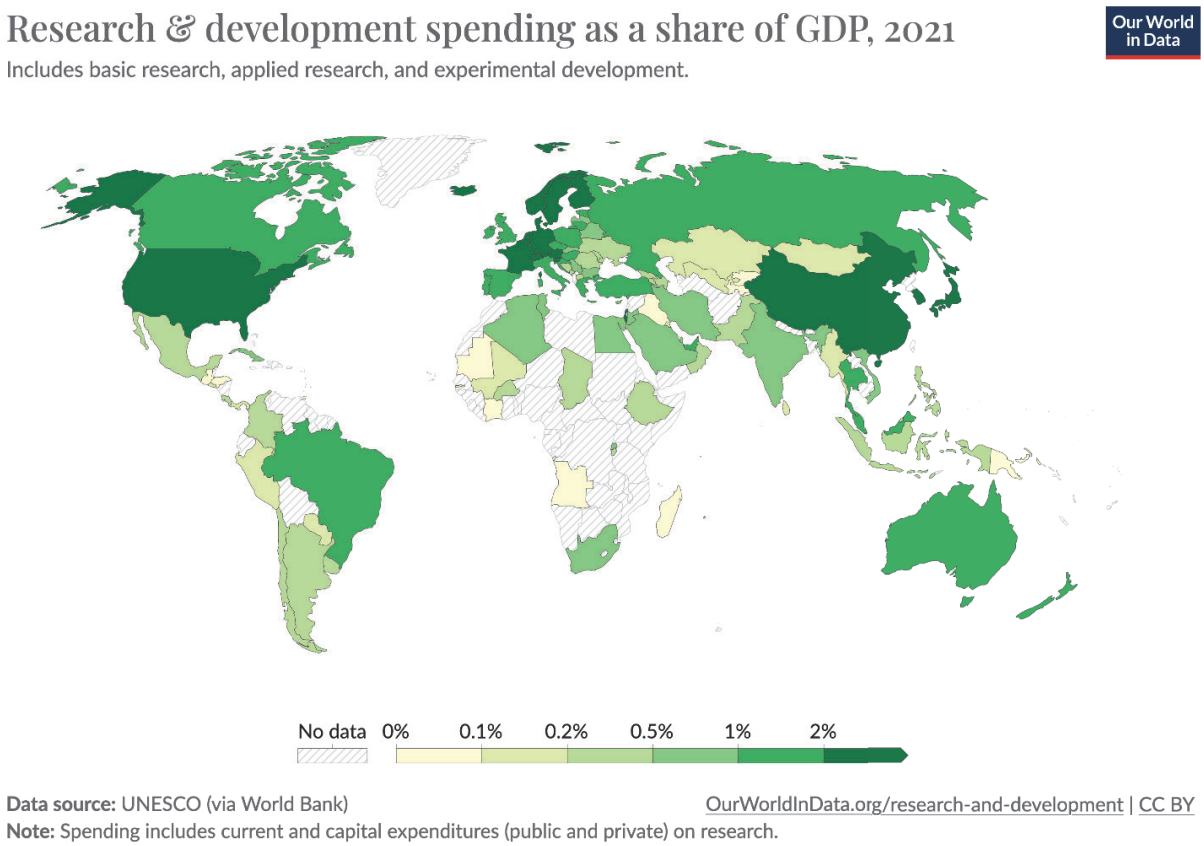


Figure 2. R&D spending as a share of GDP (2021)

Increasing the Gross Expenditure on Research and Development (GERD) as a percentage of GDP is crucial for India's economic growth, innovation, and global competitiveness. Here are some suggestions to strengthen S&T in India:

The Indian government should allocate more funds for R&D in S&T sectors to encourage innovation. The budget allocation should be increased so that the percentage of GDP allocated to R&D matches global standards. Investing in state-of-the-art research facilities and infrastructure is essential for conducting high-quality research. We must upgrade existing research facilities and establish new ones in emerging fields of S&T. Developing and maintaining technological platforms and databases to support R&D activities is necessary.

Provide grants, subsidies, and tax incentives to institutions, universities, and industries involved in R&D with Public-Private Partnerships. Collaboration between the government and the private sector can accelerate

R&D activities by pooling resources and expertise in PPP models. Encourage industries to invest in R&D by offering tax benefits and other incentives. Joint ventures between public and private sectors to share the risks and rewards of R&D projects should be promoted. Establish and fund incubators and accelerators focused on S&T. Tax breaks should be provided along with financial incentives to venture capitalists investing in S&T start-ups.

Increasing funding for universities and institutions to support high-quality research with competitive research grants can be introduced to support innovative projects and encourage interdisciplinary research. Partnerships with international research institutions and organisations to jointly fund and undertake R&D projects and facilitate exchange programs for researchers and scientists must be encouraged. Specialised training programs and workshops should be implemented to enhance researchers' skills and knowledge. In addition, scholarships and fellowships should be offered to attract and retain talented individuals, including the Indian scientific diaspora.

Increasing public awareness and engagement in S&T can foster a culture of innovation and scientific curiosity. Science communication and public engagement programs to raise awareness about the importance of R&D need to be amplified and consolidated. It can be further supported by encouraging citizen science initiatives where the public can participate in scientific research projects. Implementing these suggestions can help India become a global leader in S&T. India's leadership in S&T is about impact and addressing societal challenges. Looking ahead, this leadership must be guided by collaboration, forging international partnerships, sharing knowledge and contributing to global initiatives. This approach will elevate our capabilities and foster a collective global effort to solve pressing challenges.

By continuing this journey with determination and collaboration, we can harness the power of S&T to build a more sustainable, equitable, and prosperous world for all.