Prospects of India-Taiwan Science & Technology Cooperation

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Introduction

India-Taiwan cooperation in the field of science and technology has gained traction in recent years, and there is ample scope for building on this for deepening the bilateral relationship. Owing to rising tensions between China and countries such as India, the United States, Australia, and Japan, the need for engaging Taiwan has assumed greater importance. Recent events have fueled the perception that China is posing a threat to the rules-based international order in the Indo-Pacific. This has led countries in the region to curtail their economic dependence on China. Quad leaders, during the first in-person summit on September 24, 2021 in Washington D.C., agreed on several important initiatives on science and technology cooperation. While these are some obvious push factors, there are several pull factors as well which incentivise building long-term science, technology and innovation (STI) cooperation between India and Taiwan.

Taiwan's Science and Technological Progress

Taiwan's gross expenditure on research and development (GERD) has risen to 3.49 percent of its total gross domestic product in 2018 from 1.91 percent in 2000, making it the third highest in the world, exceeded only by the Republic of Korea and Israel.[1] In comparison, India's GERD dropped to 0.7 percent in 2019 from 0.8 percent in 2005.[2] The world average has risen from 1.51 percent in 2000 to 1.72 percent in 2017. Another important indicator is the human resources for R&D. The number of researchers per million population was 8,180 in Taiwan in 2017 and 255 in India in 2020. These indicators show that Taiwan has made significant strides in the field of science and technology. Taiwan has scored impressive results in innovation, being ranked as having the fifth-greatest potential for economic innovation in the world, according to a new index released by Bloomberg Economics.

Taiwan's high-tech sector development has been fueled by its government's generous funding of applied scientific development. Institutions such as the Industrial Technology Research Institute (ITRI), National Applied Research Laboratories and Institute for Information Industry (III), which conduct research, and aid Taiwan's private enterprises with R&D and exploring new technologies, are at the helm of these advancements. Several prominent companies have grown in this ecosystem, including Taiwan Semiconductor Manufacturing Company (TSMC) and United Microelectronics Corp., which are among the world's top producers of integrated circuit chips. Eight national research centers cover four major areas of science - earth and environment, information and communication technology, biomedical technology and technology policies. III leads in digital transformation, advancing ICT development, policy making and promoting talent cultivation. The Taiwan Tech Arena is a hub for innovation and startups attracting young entrepreneurs from around the world. Taiwan's network of science parks is a home to clusters of companies pursuing breakthroughs in fields such as biotechnology, personal computing and peripherals, integrated circuits, nanotechnology, optoelectronics, precision machinery and telecommunications.

Charting Out India-Taiwan Science and Technology Cooperation

India ranks third among the most attractive investment destinations for technology transactions in the world. It is one of the top five nations in the field for space exploration. India has developed its capacity for R&D in all aspects of the nuclear fuel cycle and reactor technology and has a major programme for expansion of nuclear energy and applied nuclear technology. In the energy sector, India has embarked on a major programme to shift to renewable energy, especially solar energy. Along with France, India has set up the International Solar Alliance (ISA), a global collaborative platform for solar energy. Other important areas are in earth and ocean sciences including polar region science, nanomaterials, biotechnology, AI and quantum computing, cybersecurity, and aerospace. These are all areas for fruitful cooperation between India and Taiwan.

The Government of India is extensively promoting research parks and technology business incubators (TBIs), which would promote innovative ideas till they become commercial ventures. The Council of Scientific and Industrial Research runs 37 national laboratories and 39 outreach centers. Advances are taking place in sectors such as agriculture, healthcare, space research, and nuclear power. India has a major and growing capacity in the field of production of drugs, vaccines and medical devices. It has not only pioneered ICT applications in diverse fields such as financial services, healthcare, education, and governance, and citizen services, but also applied them on a massive scale. The COVID-19 pandemic has brought into sharp focus the need for stronger international collaboration to deal with current and future pandemics. This is another fertile field for India and Taiwan to cooperate.

India has been engaged in pursuing the Sustainable Development Goals (SDGs) through the application of Science Technology and Innovation (STI) in various sectors such as food and agriculture, water and sanitation, health, energy, environment, ICT for development, etc. The resulting technologies and frugal innovation could be of value across the developing world. In this effort, Taiwan could offer some important contributions based on its own experience in progressing towards the SDGs.

India's New Education Policy 2021, and the draft Science Technology and Innovation Policy (STIP) 2020 envisage a major qualitative and quantitative jump in R&D activity. This includes increases in R&D funding, stepping up human STEM resources, STEM diaspora integration, strengthening the Indian STI ecosystem, building stronger international cooperation with partners, participation in mega and big science projects, and tackling global challenges through STI. These developments will open up more possibilities of building cooperation.

There is an India-Taiwan Joint Committee on Cooperation in the field of Science and Technology held at the senior officials' level. Under this Joint Committee, there is an Indo-Taiwan S&T cooperation Programme which extends financial support through joint calls for proposals to researchers in India and Taiwan to carry out research and scientific projects.

Several priority areas have been listed like renewable energy, clean energy, IoT, big data, cybersecurity, micro/nano-electronics, embedded systems & sensors, biotechnology, health care including functional genomics, drug development and biomedical devices, etc under the programme. Under the Digital India initiative, the two sides can accelerate work on the "South Asian Silicon Valley" development project.

In July 2019, Taiwan's National Chung Cheng University (CCU), with the support of the Ministry of Science and Technology (MoST) established a research center at IIT-Ropar to work in the field of AI and related industries. Under Taiwan's New Southbound Policy, Taipei seeks to boost STI exchanges among Indian and Taiwanese academic and research institutions. According to recent pronouncements, Taiwan is keen to further advance talent exchanges through short term fellowships and work in Taiwan's science parks. The two sides also held a virtual exhibition on India-Taiwan exchanges under the New Southbound Policy in December 2020. There is huge scope for widening and deepening such exchanges.

Several Track II interactions have been held between Indian and Taiwanese sides on cooperation in science, technology and innovation. In February 2021, the Research and Information Systems (India) and the Prospect Foundation (Taiwan) had organized a webinar focused on Sectoral cooperation in ICT and Semiconductors, Smart Manufacturing and Industry 4.0, and Cooperation with Science Parks in Taiwan. The webinar brought together stakeholders on both sides to discuss cooperation possibilities. It was suggested that India must provide an enabling ecosystem to foster market dynamics and supply chain needs to facilitate Taiwanese companies to set up their units in India. India's strength in IC design can initiate collaborative endeavors between the two countries and also offer India immense potential to develop and strengthen its ICT industries and increase its footprint in the global supply chain. Investments and infrastructural support by the Government of India for the development of ICT industries will be critical. The present crisis in China's financial system offers opportunities to attract greater investment flows into India if some necessary reforms are carried out.

In the semiconductor industry, Taiwan occupies a leading role. TSMC is a global giant in semiconductor manufacturing and technology that has an equity base of US$ 53 billion with over 56,000 employees and substantial in-house R&D capabilities. TSMC plans to start production of three nanometre chips in 2022. India is at present at the 180-nanometre level, which was developed in 1999. The technology has advanced rapidly from 90 nm in 2003 to 5 nm in 2020. Semiconductor fabrication facilities require very large investments typically of the order of US$ 20-50 billion. Such large investments in India will require major government support, but can be of strategic value. Can both sides work together and become a reliable global supplier of semiconductor chips? This is indeed a challenge.

The Way Forward

Cooperation in Agricultural research could be explored between the Indian Agricultural Research Institute and the Taiwan Agricultural Research Institute on basic and applied research for agronomic and horticultural crops, biotechnology, soils fertility and plant nutrition, diseases and pest managements, farm machineries, meteorology, agricultural economics, and extension. Taiwan is a leader in high quality rice production and produces a wide variety of fruits and vegetables of interest to Indian consumers.

In the field of space research, the Indian Space Research Organization (ISRO) and Taiwan's National Space Organization (NSPO) could work together in areas such as launch vehicle development, satellite payloads, remote sensing and space applications, and tracking of space objects. Taiwan has recently passed legislation in 2021, opening up the space sector to private participation, similar to what India has also done.

In the field of atomic energy, Taiwan has a special status as a non-party to the NPT, but is covered under a trilateral agreement with the United States and the International Atomic Energy Agency (IAEA) to safeguard its nuclear facilities. 10 percent of Taiwan's electricity is generated by nuclear power with three nuclear plants operating at present, with several others shut down or cancelled in view of the Fukushima Daiichi Nuclear Power Plant accident of 2011. The official policy is to phase it out by 2025. Interestingly, in December 2021, a referendum proposing to restart work on Taiwan's fourth nuclear power plant failed to pass.

Taiwan's main agencies dealing with nuclear energy, the Atomic Energy Council (AEC) and the Institute of Nuclear Energy Research (INER), could cooperate with their Indian counterpart. Cooperation with some Indian research institutions such as the Indian Institute of Science and Tata Institute of Fundamental Research could be mutually beneficial. There is some potential for cooperation with India in areas such as nuclear safety and monitoring, applications of radioisotopes in medicine, agriculture and food preservation, etc. The National Center for Theoretical Sciences (NCTS) in Taiwan carries out frontier research in physics, including areas such as particles and fields theory; condensed matter physics; atomic molecular and optical physics, and Soft Matters, Bio-Physics and Complex Systems.

Cooperation in the fields of biotechnology and nanomaterials between institutions on both sides could also be explored. Both sides are heavily dependent on imported fossil fuels and have ambitious targets for cutting greenhouse gas emissions. This includes ramping up renewable energy and the associated energy storage systems. It also naturally includes going in for hydrogen-based energy systems, involving massive production of hydrogen from renewable energy excess generation, storing and reconverting hydrogen into energy when needed. This is a complex effort requiring dovetailing of various sectors of the economy. India has launched a National Hydrogen Mission in August 2021, while Taiwan has also launched a Hydrogen Energy Promotion Alliance with similar objectives. These initiatives can lead to increased cooperation in the Hydrogen energy sector.

In the field of biotechnology, some notable institutions in Taiwan are Agricultural Biotechnology Research Center (ABRC) of Academia Sinica, Taiwan which does basic research in agricultural biotechnology; National Biotechnology Research Park (NBRP) which provides an ecosystem platform for biomedical research; Institute of Biotechnology, National Taiwan University. These institutes specialize in bioinformatics, nano-biomedical research, tissue engineering and regenerative medicine, genomics and proteomics. These are all areas of interest to R&D institutions in India's biotechnology sector, and cooperation could be pursued.

In medical research, Taiwan's National Health Research Institutes (NHRI), a non-profit foundation established by the government conducts mission-oriented medical research in basic biomedical sciences, as well as specific diseases. These range from the common problems such as ageing, cancer, infectious diseases, mental disorders, occupational diseases, to health policy. This organization could be a useful partner for the Indian Council for Medical Research (ICMR)

In nanomaterials science, some important institutions in Taiwan are - (1) Taiwan Nanotechnology Research Center (of the University system of Taiwan) (2) Taiwan Nanotechnology Industry Development Association (TANIDA) (3) Center of Applied Nanomedicine (National Cheng Kung University), and several other research laboratories working in a wide range of areas. This offers a rich scope for collaboration with Indian institutions.

In conclusion, there is a vast scope for building cooperation between India and Taiwan in the field of science and technology, for mutual benefit and for tackling global challenges. ■

Notes:

[1] "Gross Domestic Spending on R&D, 2021", OECD, https://data.oecd.org/rd/gross-domestic-spending-on-r-d.htm.

[2] Research and Development Statistics 2019-20, Department of Science and Technology (DST), Ministry of Science and Technology, Republic of India, 2020, https://dst.gov.in/sites/default/files/Research%20and%20Deveopment%20Statistics%202019-20_0.pdf