

Vietnam - India Comprehensive Strategic Partnership: Science and Technology Cooperation Perspective

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Abstract: Science and technology (S&T) cooperation between Vietnam and India is one of the most important areas of bilateral cooperation since the two countries established diplomatic relations in the 1970s. Since 2016, it has become a key pillar of the comprehensive strategic partnership. This paper analyses the strengths of India and Vietnam in the S&T field and the current status of S&T cooperation between the two countries, thereby providing some suggestions to promote bilateral cooperation in this field. Firstly, Vietnam should create a strong research group (a kind of eminent persons' group), including people with both professional and linguistic capabilities, and who are ready to overcome difficulties in working with Indian partners; and secondly, Vietnam and India should open more affiliated universities in Vietnam and pay attention to improving the quality and efficiency of the existing institutions. There is still great potential for both countries to further accelerate in this important field.

Keywords: India, Vietnam, science and technology, cooperation.

Subject classification: Politics

1. Introduction

Recently (from around 2020), a new term has been introduced which is gradually becoming familiar in academic circles, that is science diplomacy¹. In the context of the COVID-19 pandemic, in addition to cultural, economic, and vaccine diplomacy, “science diplomacy” has come under the spotlight. Since 2020, the Vietnamese Embassy in India has had a full-time officer in charge of promoting S&T cooperation between the two countries. The 13th National Congress of the Communist Party of Vietnam for the first time

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¹ Science diplomacy can be understood as the use of scientific collaborations among nations to address common problems and to build constructive international partnerships. Science diplomacy is a form of new diplomacy and has become an umbrella term to describe a number of formal or informal technical, research-based, academic or engineering exchanges, within the general field of international relations and the emerging field of global policy making.

identified “science, technology, and innovation” as one of the strategic breakthroughs for building and developing the nation. It can be said that a key feature of this Resolution is the emphasis on S&T. Currently, S&T cooperation is considered one of the five pillars of the Vietnam-India partnership, the others being: politics, economics, security and defence, S&T, and culture. In the past, S&T was often included in the aspects of cultural, educational, and science-technology cooperation, but today the latter has become a separate pillar in the Vietnam - India partnership. For these reasons, it is important to study the current state of S&T cooperation between Vietnam and India, helping to provide implications for its promotion by the two countries.

2. Strengths of India’s science and technology

India is not only a land of religion, spirituality, and philosophy, but it is also a land of science and technology. Here, even religion becomes a kind of science, which is why Mahatma Gandhi, the Father of the Nation, considered “Truth/Religion” a kind of experiment which has to go through rigorous sequential steps similar to when a scientific experiment is conducted, in order to achieve our desired goals. The physicist Albert Einstein once said: “We owe a lot to the ancient Indians, teaching us how to count, without which most modern scientific discoveries would have been impossible” (Sanchari Pal, 2016).

Therefore, it can be said that S&T is India’s strength. Through historical records, we have learnt that India had early scientific thinking. Ancient India was a land of sages and seers as well as of scholars and scientists. Research has shown that from making the best steel in the world to teaching mankind to count, India was actively contributing to the field of S&T long before modern laboratories were established. Many theories and techniques discovered by the ancient Indians have created and strengthened the fundamentals of modern S&T for example: the idea of zero, the decimal system, numeral notations, atomic theory, plastic surgery, cataract surgery, Ayurveda, iron-cased rockets, and so on.

Acharya Sushruta was an ancient Indian surgeon, author of “*Sushruta Samhita*” (*Book of Medicine and Surgery*, an important extant treatise on this subject from ancient times). Sushruta is known as the “father of surgery” (Riya Hirani, 2020). He is said to be the first surgeon in the world to perform complex surgeries about 2,600 years ago (such as eye surgery, limbs surgery, rhinoplasty nose restoration, broken bones, kidney, and plastic surgery).

It is interesting that the first iron-cased rockets were developed in the 1780s by Tipu Sultan of Mysore who successfully used these rockets against the larger forces of the British East India Company during the Anglo-Mysore Wars. With a range of about 2km, these rockets were the best in the world at the time and instilled as much fear and confusion as damage. Due to them, the British suffered one of their worst ever defeats in India at the hands of Tipu (The Space Techie, 2021).

While some of India’s groundbreaking contributions in S&T have been acknowledged, others are still unknown to most people. In the last two decades, India has taken giant steps

in terms of S&T, where it has become a world power in some aspects. As a result of the right policy and orientation in S&T since Indian independence (1947), major changes in people's lives have been brought about and India has witnessed rapid economic development (Government of India, Ministry of Culture, 2022). From an economy facing serious problems in terms of food security at the time of independence, India has become the world's second largest rice producer, and the fourth largest wheat and milk producer (Đức Phường, 2007). The country's breakthroughs in space technology and its widespread use of communications, television, weather forecasting, and disaster management and so on, have become the envy of the world. The country's information technology (IT) and software industry has emerged as one of the fastest growing sectors of the economy, making India "the office of the world". Progress in nuclear technology is also a significant achievement for India. Recently, the country has had remarkable success in biotechnology, mobile phones, steelmaking, and other manufacturing sectors.

India's annual S&T research budget has increased in recent years. From 2018 to 2019, the budget for research and development (R&D) in S&T rose by 16% compared to the previous year (2017); and in 2020, India increased its R&D budget by 8% compared to the 2018-2019 period (Ministry of Science and Technology, 2018). India ranks fifth in the world in terms of R&D investment (after the US, China, Japan, and Germany). The Indian government is giving priority to investing in strategic fields such as IT, biotechnology, space research, and nuclear energy for socio-economic development.

India's S&T strengths are shown in IT, biotechnology, medical biotechnology, space exploration, and nuclear technology.

It is said that, India's future belongs to IT. Bangalore (Bengaluru) is known as the "Second Silicon Valley" home to more than 200 multi-national companies. This technology hub contributes about 40% of India's software industry output. More than 100 countries in the world import software from India (Đức Phường, 2007).

Biotechnology is a strategic area where India has invested in development with the policy of "biotechnology helping to alleviate poverty and increase integration". Indian agricultural biotechnology is leading the way (Business Standard News, 2016). In addition, its medical biotechnology has grown exceptionally fast in recent years. Indian scientists, through R&D, have developed new therapies that reduce treatment and medication costs for people. India has become the world's second-largest producer of child vaccines, which it exports to more than 100 countries (Đức Phường, 2007). Its biotechnology in pharmacy is also very advanced. With around 17,000 kinds of precious herbs, Indian pharmaceutical companies sell their products to 125 countries. Its pharmaceutical industry is worth about USD 6 billion as part of the total USD 550 billion of the global pharmaceutical industry (Phuong Son, 2015). India plans to build a half-billion dollar "Pharmaceutical Park" in Vietnam, which will also mean the Vietnamese people will have easy access to quality Indian pharmaceutical products (Phuong Son, 2015).

India is also advancing in terms of space exploration. The country continues to develop new marine vessels and launch more satellites into space to meet the country's key

objectives. In 1994 India became the sixth country of a select group (after the Soviet Union in 1957, the US in 1958, France in 1965, and Japan and China in 1970) when the Polar Satellite Launch Vessel (PSLV) fulfilled its mission by placing the 800kg IRS-P2 satellite into orbit. A number of other vessels capable of carrying larger satellites into space have also been developed, such as the Geostationary Satellite Launch Vessel (GSLV) capable of placing a 2,000kg satellite into space (Rajan, Y.S., 1992).

With its remarkable investment in space technology, India is the third largest country in the world to develop its own long-range sensor satellite (Kasturiranagn, K., 2021). Today, the devices of Indian space technology have been widely applied in scientific research, communications, education, health, environment, defence, resource management, weather forecasting, and so on, becoming the key tool for India's development and integration.

Being the first Asian country possessing nuclear power and becoming the sixth member of the world nuclear club, *India is recognized as one of the most advanced countries in nuclear technology*. The key objective of India's nuclear energy programme is to develop and use nuclear energy for peaceful purposes. Currently, 15 nuclear power plants are in operation nationwide and another eight are under construction which will increase the nuclear power supply in the coming years, and gradually reduce energy imports. It is estimated that, nuclear power is expected to account for about 35% of India's total electricity consumption by 2050 (Đức Phường, 2007).

3. Vietnam's new developments in S&T

Although not comparable to India, Vietnam has made new and important developments in S&T. In 2019, it celebrated 60 years of S&T establishment and development. Vietnam's S&T potential has grown at a fast pace over the years. In the 1960s, there were only eight research institutes in North Vietnam and six universities in the whole country. In 2019, there were more than 4,000 S&T organisations across the country, three national high-tech parks, 13 hi-tech agricultural zones, eight concentrated information technology parks, and nearly 67,000 scientists (Ministry of Science and Technology, 2019).

The level of S&T development in Vietnam has improved markedly over the years. Social sciences and humanities have provided profound consultancy services for the policy makers of the Party and State; natural sciences and technology have contributed positively to improving domestic research capacity, enhancing productivity, the quality and growth of the economy, and contributing to creating a new position for Vietnam in the region and on the world stage.

Vietnam's innovation capacity has been constantly rising. In 2019, it was ranked 42 out of 129 countries and it is leading the group of low-middle income countries. The number of international publications of Vietnamese scientists increases by an average of 26% per year and Vietnam is always at the top of ASEAN countries in the fields of mathematics and physics (Ministry of Science and Technology, 2019).

In January 2019, an event took place which was considered an important milestone in the development of Vietnam's space technology industry. It was the first time that a satellite designed by Vietnamese engineers was launched into space. The satellite, named Micro Dragon, carried the Vietnamese scientists' dream of reaching into space. This event helped to put Vietnam's name on the world space science map.

Also in 2019, the Ramanujan Prize - a prestigious prize in mathematics - was first awarded to a Vietnamese scientist, Professor Phạm Hoàng Hiệp, Institute of Mathematics - Vietnam Academy of Science and Technology (Vietnam Academy of Science and Technology, 2019). Interestingly, the prize is named after a brilliant Indian mathematician Srinivasan Ramanujan (1887-1920). Born in the late 19th century, he was self-taught and made very important discoveries at a young age. The Ramanujan Prize is sponsored by the Indian Ministry of Science and Technology and funded by the Niels Henrik Abel Memorial Fund of the Norwegian Academy of Sciences and Humanities in collaboration with the International Mathematical Union (IMU).

In 2019, ST25 rice from Vietnam was voted "the world's best rice" in a contest organised by The Rice Trader in Manila, Philippines held from 10 to 13 November 2019 (Thạch Hồng, 2019). Thanks to the application of scientific and technological achievements, Vietnam is able to produce ST25 rice, specialty rice from Sóc Trăng province. This shows that the quality of Vietnam's rice is on a par with that of other countries, and it has even with more advantages such as higher productivity, tolerance to harsh climate...

In 2021, Vietnam's S&T had a number of notable achievements, including: Viettel's smart city model which is recognised as the most effective and innovative in the world; the scientific project "development and application of a biosensor system to quickly determine biochemical oxygen demand (BOD) and toxicity in water" won the special prize at the Asia Innovation Awards; Vietnam's "mobile isolation hat" was honoured by the World Intellectual Property Organisation (WIPO), to name but a few initiatives. It can be said that being a developing country with limited resources, Vietnam has made encouraging progress, gradually reducing the gap in scientific and innovation capacity with its regional neighbours and the world. This creates opportunities for the Vietnam - India S&T cooperation.

Currently, the Vietnamese government is strengthening the country's international cooperation and integration, promoting joint research with advanced countries. Vietnam is trying to improve its capacity and level of S&T so that it can be part of equally and mutually beneficial partnerships in the long term. This is reflected in Resolution No.20-NQ/TW of the 11th National Congress of the Communist Party of Vietnam; the 2013 Law on Science and Technology; and Vietnam's Strategy for Science and Technology Development through 2020. Vietnam strongly supports scientific exchange activities at regional and global levels by improving the efficiency of its S&T representative networks in foreign countries; the Vietnam embassy's S&T office in India (referred to the introduction) is a good case in point.

4. Current status of Vietnam - India cooperation

Looking at India's strengths in S&T, Vietnam's rapid development in this field, and its importance in Vietnam's policy in recent years, it can be seen that the Vietnam - India cooperation in S&T has the potential to make new breakthroughs.

Both India and Vietnam recognised the importance of international scientific collaboration in S&T quite early on and they have signed a number of S&T agreements. The first milestone in Vietnam - India S&T cooperation was in 1978 with the signing of the first bilateral agreement (renewed in 1996). Under this agreement, a Joint Committee on S&T was constituted in 1997 to oversee the implementation and process of the collaboration (Lê Thị Hằng Nga, 2022). Vietnam and India cooperated in many areas during the 1990s and 2000s, including: nuclear energy, agriculture, fisheries, animal husbandry, computer hardware and software, pharmaceuticals, remote sensing, water resources, biotechnology, and IT. India has helped build technology centres and hi-tech parks in Vietnam and supported Vietnam in establishing the Cửu Long Delta Rice Research Institute. India agreed, in 2013, to set up a high-tech cyber forensic laboratory (the Indira Gandhi Hi-tech Crime Lab), and in addition India supported the opening of a Vietnam - India IT Training and English Centre at the National Defence Academy of Vietnam.

Since the 1990s, priority has been given to cooperation in terms of human resource training in S&T which has proved to be one of the most effective collaborations between India and Vietnam.

Cooperation in education and training has been instrumental in strengthening the partnership in S&T between the two countries. Annually, the Indian government grants scholarships for Vietnamese students under various programmes, including: the Indian Technical and Economic Cooperation (ITEC) programme, Cultural Exchange Programme (CEP), General Cultural Scholarship Scheme (GCSS), Educational Exchange Programme (EEP), and the Mekong-Ganga Cooperation Scholarship Scheme (MGCSS). Vietnam has been the largest recipient of training programmes under the ITEC programme (Ngô Xuân Bình & Lê Thị Hằng Nga, 2011). Since 2013, 150 ITEC places have been offered to Vietnam every year along with 16 scholarships under the GCSS, 14 scholarships under the EEP, and ten scholarships under the MGCSS (Ministry of External Affairs, 2017). Also since 2013, the Indian government annually provides Vietnam with four scholarship places for Buddhist and Sanskrit studies. By now, many Vietnamese Buddhist monks and nuns have benefited from this scholarship programme (previously, most of them had to self-finance their studies in India). By 2018, within the ITEC programme framework, nearly 400 students who worked for the government and non-government organisations and institutions in Vietnam have benefited from short-term training programmes at leading institutions of higher education in India. Most of the ITEC beneficiaries have returned to Vietnam holding great affection for India and they can be considered "unofficial ambassadors" of Vietnam to India.

The year 2012 was another turning point in India - Vietnam S&T cooperation. In April that year, Deputy Prime Minister Nguyễn Thiện Nhân led a delegation of Vietnamese officials and businessmen on a visit to India. Delegates from Hà Nội and Hồ Chí Minh City national universities also joined this trip. After this visit, Vietnam - India cooperation in S&T moved from individual cooperation among scientific institutions to a national approach with focus on key areas of each country. Previously, some research institutes within the Vietnam National University in Hồ Chí Minh City and the Vietnam Academy of Science and Technology had bilateral cooperation with some Indian partners. However, since 2012, Vietnam's Ministry of Science and Technology has been taking the leading role in promoting and supporting scientific and technological cooperation between the two countries. That is also the reason why in 2016, the signing of a MOU between the Vietnam Academy of Social Sciences (VASS) and the Indian Council of World Affairs (ICWA) was included on the agenda of the official visit to Vietnam by the Indian Prime Minister Narendra Modi (September 2016). Following this, VASS and ICWA have been organising dialogues every two years (in 2017 it was organised at VASS, Hanoi; in 2019 at ICWA, New Delhi; and in 2022 at VASS, Hanoi).

In 2016, besides the academic cooperation agreement between VASS and ICWA, Vietnam and India signed 12 other cooperation agreements, including an agreement on the exploration and use of outer space for peaceful purposes, IT cooperation, cyber security, use of atomic energy for peaceful purposes, agreement on building information infrastructure for high quality information technology training, and so on (The World and Vietnam Report, 2016).

The implementing arrangement between the Indian Space Research Organisation and the Vietnamese Ministry of Natural Resources and Environment for establishing a satellite tracking and telemetry centre in Vietnam under the India - ASEAN cooperation on space, was signed during the visit of Vietnamese Prime Minister Nguyễn Xuân Phúc to New Delhi in January 2018 (Consulate General of India, 2020).

Since the two countries established their strategic partnership in 2007 they have signed various S&T cooperation agreements. As calculated by the author, over the course of 15 years (from 2007 to 2021) approximately 15 S&T cooperation agreements have been signed (Table 1).

So far, major areas of cooperation between the two countries in S&T are:

(i) Research and application of nanotechnology in the production of materials and equipment for defence, healthcare, agriculture, information technology and telecommunications, chemicals.

(ii) Biotechnology includes molecular biology; and biotechnology in agriculture, medicine, and environmental services.

(iii) Oceanography, including the domain of earthquake and tsunami warning, and seismic exploration of oceans.

Among these three aspects, the most urgent for Vietnam is biotechnology in agriculture - one of the key determinants of the country's agricultural restructuring. Vietnam and India have exchanged possibilities of cooperation in the exploitation and development of

indigenous gene sources, genetically modified plants, and salt tolerant rice varieties; studies on post-harvest loss assessment; using geographic information system (GIS) in soil and water resources management, and monitoring climate change.

Table 1: Cooperation Agreements on S&T between Vietnam and India (2007-2020)

Year	Name of Agreements
July 2007	MOU between Vietnam's Ministry of Science and Technology and India's Ministry of Nuclear Energy to continue with nuclear energy cooperation for peaceful purposes
November 2013	MOU for setting up the Indira Gandhi High-tech Crime Lab (IGHCL) in Hanoi
November 2013	Agreement on the Protection of Classified Information
November 2013	Cooperation Agreement between Vietnam National University, Hanoi and Indian Council for Scientific and Industrial Research
October 2014	MOU on establishing the Centre for English Language and Information Technology Training at the Telecommunications University in Nha Trang
October 2014	MOU on exchange of audio-visual programmes
September 2016	Framework Agreement on Cooperation in the Exploration and Uses of Outer Space for Peaceful Purposes
September 2016	MOU on the cooperation in information technology
September 2016	MOU on the cooperation between the Vietnam Academy of Social Sciences (VASS) and the Indian Council of World Affairs (ICWA)
September 2016	MOU on cooperation in cyber security
December 2016	Agreement on cooperation between the two governments regarding the peaceful use of atomic energy
December 2016	MOU between the Vietnam Atomic Energy Institute and India's Global Centre for Nuclear Energy Partnership
December 2020	Agreement on USD 5 million Indian grant assistance for the Army Software Park at the Telecommunications University, Nha Trang
December 2020	MOU between India's Atomic Energy Regulatory Board and the Vietnam Agency for Radiation and Nuclear Safety
December 2020	MOU between the National Solar Federation of India and the Vietnam Clean Energy Association

Source: Author.

Some recent developments in S&T cooperation between Vietnam and India include: the HCL Group announced the establishment of a company in Vietnam in 2020; the FPT Group of Vietnam established an office in India's Hyderabad City; on 11 August 2021, the Indian Ambassador to Vietnam presented a cheque for USD 1 million to the Vietnamese

Deputy Minister of the Ministry of Defence to establish the Military Software Park at Nha Trang University of Telecommunications (this was the first round of funding out of a total USD 5 million package to support the construction of the Military Software Park). The Military Software Park is an important symbol of Vietnam - India high-tech cooperation (Lê Thị Hằng Nga, 2022).

Vietnam - India S&T cooperation at multilateral level

Vietnam - India S&T cooperation is conducted at both bilateral and multilateral levels. The multilateral level is primarily through the India - ASEAN partnership. Within the ASEAN framework India set up the Vietnam - India English Language Training Centre in Đà Nẵng in July 2007; and the Vietnam - India Entrepreneurship Development Centre in Hanoi set up in May 2006 supported the Initiative for ASEAN Integration and provided technical assistance to the Vietnamese government. It has been decided to start a new Vietnam - India English Language Training Centre at the National Defence Academy of Vietnam. Both sides have also planned to establish a Vocational Training Centre in Hồ Chí Minh City. A Centre for Satellite Tracking and Data Reception and an Imaging Facility in Vietnam under the ASEAN - India cooperation mechanism is soon to be established. India will fully fund the centre and the Indian Space Research Organisation (ISRO) will be the implementing agency. It will utilise data provided by Indian remote sensing satellites and harness it for multiple developmental applications.

On the whole, both Vietnam and India identify S&T as one of the directions in their development strategies. Thus, both countries agree that the bilateral strategic partnership must have closer S&T ties. However, the gap in the level of scientific and technological development between the two countries is also a factor hindering effective cooperation. India is one of the leading countries in the world in terms of S&T; in contrast, the level of Vietnam's S&T development is rather low. Therefore, S&T cooperation between the two countries has been largely one-sided. India has played the role of supporting country with Vietnam being the supported one. This is mainly to serve political and strategic relations. This has also led to a number of other limitations such as the small number of joint research projects, limited state budget for scientific research projects, lack of participation and investment in the private sector; lack of interconnection between research and practical market demand; and complicated administrative procedures in implementing research projects. Besides, perhaps the Vietnamese side has not given sufficient importance to Indian S&T, still giving priority to promote this area of cooperation with western countries. Even in the fields of traditional S&T cooperation of agriculture and biotechnology, Vietnam has recently changed direction veering towards high-tech development cooperation with countries such as Japan and Israel.

5. Suggestions and conclusion

To further promote Vietnam - India cooperation in S&T, both sides should make more effort. India has invited Cambodia, Laos, Myanmar and Vietnam to join the International

Solar Alliance based in India. Vietnam is expected to join which would bring new opportunities for cooperation in large-scale solar deployment (Đắk Lắk Union of Friendship Organisations, 2022). Below are some suggestions to promote S&T cooperation between Vietnam and India:

Firstly, human resources are the key factor. Vietnam and India have good policies and agreements, but at the implementation level, they face a lot of obstacles. From the Vietnam side, the major challenge for Vietnamese scientists is not only the level of S&T expertise but also English language competency which is far behind their Indian counterparts. Vietnam should create a group of people with a good command of English, deep understanding of India's strengths, and who can meet the most challenging difficulties when working with Indian partners. In order to realise this, S&T educational cooperation between the two sides should be continuously strengthened and given priority.

Secondly, the two sides should consider opening more joint universities in Vietnam, such as Hoa Sen University, APTECH, NIIT An Giang Province, and Hanoi-Arena. And at the same time, attention should be paid to improving the quality and effectiveness of the existing joint universities. APTECH has helped train more than 100,000 engineers and programmers (high quality human resources) in Vietnam over the past years (Nguyễn Thị Mai Liên, 2017, p.630). Speaking at the conference on IT Human Resources Training Solutions for 4.0 Industrial Revolution in Hanoi on 3 July 2019, the Indian Deputy Chief of Mission to Vietnam, Mr Rajesh Uike commented: "APTECH Vietnam Group has trained more than 100,000 people highly qualified in IT. The great thing is that APTECH has brought India's leading technology to Vietnam, in collaboration with Vietnamese universities, giving Vietnamese students the opportunity to develop in the 4.0 Industrial Revolution" (Nguyễn Thị Mai Liên, 2017, p.630). This achievement should be multiplied.

In summary, Vietnam - India S&T cooperation from the 1990s up to now is considered a priority area and it is one that has undergone major changes. In the 1990s and the first decades of the 21st century, cooperation on agricultural development, biotechnology, and the environment were considered priority areas. However, since the two countries established a strategic partnership in 2007, and especially when the relationship was upgraded to a comprehensive one in 2016, Vietnam and India have on the one hand continued to maintain cooperation in traditional S&T areas, while on the other hand given more focus to the new technological areas. Recent exchange visits by high-level leaders of the two countries, including the visit to India by the Chairman of National Assembly of Vietnam Vương Đình Huệ (December 2021) and the visit to Vietnam by Om Birla, the Speaker of the Indian Lok Sabha (April 2022), have highlighted the importance of bilateral cooperation for both sides, in which S&T is one of the key pillars. It is hoped that with the new emphasis on S&T cooperation, and the dynamism of science diplomacy, there will be new breakthroughs in Vietnam - India cooperation in all fields in general, and in S&T in particular.

Note: Language editor: Stella Ciorra.

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