Journal of Scientific Temper
Vol 10 (1&2), Jan-June 2022, pp. 79-96

ARTICLE

Indian Science and Technology during the Freedom Struggle: A 'Science Diplomacy' Perspective

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ABSTRACT

Science Diplomacy (SD) has emerged as a key component of foreign policy in the first decade of the 21st century. It provides an outlookto explore science and technology and diplomatic efforts in three distinctive perspectives namely 'science for diplomacy', 'diplomacy for science' and 'science in diplomacy'. However, one must note that this is not a new phenomenon and has been in practice in different forms for centuries and Indian S&T is not an exception. However, literature dominates the European perspective and is not much available from the non-western contexts. Therefore, the paper aims to explore S&T in the Indian context from the SD perspective in the first half of the 20th century, which also marked the period of freedom struggle at its peak.

The paper uses the historiography of science method and purposively selected three cases, two from the 'colonised' and one from the 'colonisers' perspective. The first is The Association for the Advancement of Scientific and Industrial Education of Indians (AASIEI) and the second set of cases reflects the efforts of four Indian scientists, namely Saha, Bhatnagar, Raman, and Bhabha. The third case is of a diplomatic effort to gather Indian support for the war by the British when they sent Hill to India. The events and anecdotes suggest that SD was very much part of the freedom struggle movement and after independence, they shaped the Indian S&T in a major way. In the end, the paper suggests a few learning for Indian S&T from the SD perspective.

KEYWORDS: Freedom struggle, India, Science diplomacy, S&T

Introduction

Knowledge, whether science, technology and or in any other form, plays a crucial role in the development of a nation. Realising its significance, nation-states have been using knowledge power in setting their agenda at international levels too. In this context, 'Science Diplomacy (SD)' emerged as one of the key concepts in the field of International Relations (IR) at the beginning of the 21st century. Though SD may be a new term, such a phenomenon was already there in various forms. However, scanty literature is available, especially from the developing countries perspective.

Further, the postcolonial study of science and technology scholars have explored the British rule in India from various dimensions and its impact on Indian society. Anderson (2002) argues that the postcolonial study of science and technology is the reinterpretation of history by breaking the hegemonic practices and claims of colonisers. He quotes Stacy Leigh Pigg "we now need to find out more about how science and technology travel, not whether they belong to one culture or another (Anderson, 2002; p.644)." Thus, it helps us in understanding the linkages between 'local' and 'global' S&T events, which is different from an anti-colonial perspective (Krishnan, 2009). Adas (1997) argues that the historiography of colonialism was Eurocentric and biased towards European superiority in terms of science and technology to satisfy the colonial administration.

Kumar (2006) explored the development of science during the British period and how it advanced over the pre-colonial science in India. Though, it did not discuss much about indigenous science and technology during the period. Tripathi (1996) argues that without doubt, British colonialism was exploitative, though, one needs to look beyond this perspective to have a nuanced understanding of colonial rule. In other words, he suggests exploring the technology choices made by different actors during British rule and what role they played in the process of development in India.

This paper was first presented in the International conference on the "Role of Indian Science in Freedom Movement (RISFreM 2022)", organised by JNU in collaboration with Vijnana Bharati, CSIR-NIScPR, and Vigyan Prasar on 28 February 2022 and 1 March 2022.

Therefore, the paper explores the idea of SD during the freedom struggle movement during the first half of the 20th century i.e. 1900-1947. This period is significant from India's perspective, as many efforts during the 19th century, especially in the field of science and technology education, started showing their effects during this period. For instance, Congress was critical of the Indian Medical Service and passed a resolution asking the government "to raise a scientific medical profession in India by throwing open fields for medical and scientific work to the best talent available and indigenous talent in particular." Thus, Congress looked into the problems of education, agriculture, mining and other science and technology areas and that has paid in some or other ways. So, the paper does not discount the efforts made in earlier phases but aims to situate the debate in a more dynamic period.

The paper is divided into four sections and the next section discusses the literature on SD and its current understanding. The section on methodology gives a detailed account of the data collection and the cases used for the analysis. Further, the cases discussed in detail to understand the nature of SD practices in Indian S&T. The last section put forth the discussion and conclusion.

Understanding Science Diplomacy: A literature review

Knowledge, whether in the form of S&T, has played an important role in diplomacy at international levels. Strange (1994; pp 30-31) has made it more clear and argues that"knowledge is power and whoever is able to develop or acquire and to deny the access of others to a kind of knowledge respected and sought by other; and whoever can control the channels by which it is communicated to those given access to it, will exercise a very special kind of structural power (in Wojciuk (2018)."

Similarly, Mathur (1987) argues that the powerful, often in minority, use technology in all possible ways to rule the majority. This is what we have experienced throughout history, especially after scientific and industrial revolutions. To understand such power dynamics of scientific and technological knowledge, SD has emerged as a key concept in the last two

decades. However, Turekian *et al.* (2015) suggest that SD is an old phenomenon and one may find its roots in the post of Foreign Secretary of the Royal Society, London, the UK established in 1723 for 'Science' and 'International Cooperation'. Ruffini (2017) and Wojciuk (2018) also point out that the Enlightenment period in European history can be marked as the starting point for SD practices when many great voyages and explorations, primarily by France, England and Russia, were started, which culminated into the colonisation of many countries.

Ruffini (2017) further argues that the primary agenda was political advancement to the unknown world with the help of science. Though, Flink (2020) argues that the importance of SD was realised only after the 1950s when Science, Technology and Innovation (STI) and Higher Education (HE) were considered relevant for foreign policymaking. Truekian *et al.* (2015: p.4) have defined SD as "the process by which states represent themselves and their interests in the international arena when it comes to areas of knowledge — their acquisition, utilisation and communication — acquired by the scientific method." Additionally, Ruffini (2017: p. 11) has broadened the understanding of SD and defines it as "an intentional effort to engage with other countries where the relationship is not good otherwise. The science allows you to deal with non-sensitive issues that both sides can work on together for the good for all." Moreover, he quotes Fedor off (2009) "science diplomacy is the use of scientific collaborations among nations to address the common problems facing twenty-first century humanity and to build constructive international partnerships". Thus, SD has a more strategic approach and, for it to be successful it needs to be driven by the institutional arrangements of a country (Turekian, 2018).

The American Association for the Advancement of Science (AAAS) and the UK Royal Society brought out a report *New Frontiers in Science Diplomacy* (The Royal Society, 2010) which suggests a more comprehensive outlook of the term and proposes three distinguishing dimensions to look at SD in a wider context namely 'Science in Diplomacy', 'Diplomacy for Science' and 'Science for Diplomacy'. Thus, it is important to

understand these dimensions to explore varied contexts of SD. For instance, 'science in diplomacy' reflects the areas of foreign policy where the science and scientific research community or experts help diplomats in putting forth their agenda. Such as issues of climate change (Intergovernmental Panel on Climate Change (IPCC)), health pandemics-especially COVID-19 and Ebola-like situations, and the United Nations Environment Programme (UNEP).

The second dimension i.e. 'diplomacy for science' can be found in the fields of international science and engineering collaborations where many countries come together using diplomatic tools. This may happen in terms of collaborations to facilitate research networks and infrastructure with other countries. The possible examples could be CERN and various research infrastructures, like the Large Hadron Collider (LHC), established by it. Diplomacy for science is further useful in a situation where funding arrangements are not possible by a single nation-state. Not only this, but in the context of globalisations, many individual scientific collaborations fall under this category. Lastly, 'science for diplomacy' reflects the use of science and technology cooperation to improve relations among nation-states. Nye's (2004) conceptualisation of 'soft power' perhaps reflects the most suitable understanding of 'science for diplomacy', where science plays an important role in such a situation. Peramunugamage *et al.* (2021) have explored the cases of science for diplomacy in the south Asian region by looking at the cases of water and sanitation.

Thus, these definitions capture a broad understanding of SD which is not only for the sake of knowledge but in improving international relations and tackling global challenges in today's context. Flink (2020), however, criticises such a conception of SD and points out problems with its three categories. He argues that such an understanding reflects the western notion of SD and perhaps does not reflect upon or confuses the intersection of the field of "science" and "diplomacy". Such discourse and critical reflections are necessary for a more nuanced understanding and advancement of any field of knowledge.

Further, more evidence is required from diverse contexts to develop a broader understanding of SD that could capture the

scale and intensity of interconnections in the contemporary globalised world. Historically, one may also find SD practices in non-European contexts too. For instance, Sharma (1987) mentioned that Sawai Jai Singh sent his scholars to Portugal in 1728 to learn some techniques of astronomy. Further, he also invited Muslim astronomers of the Persian-Arabic school to his kingdom. Thus, Jai Singh's efforts were not limited only to Europe, but he also approached the Arabic world to learn science and technology. Therefore, it is important to understand and explore the concept of SD from non-western perspectives too.

The field of science and technology in itself is not very value-neutral, and many socio-economic, political and historical dimensions are involved. In this context, Flink (2020) also questions such an attempt to promote SD considering it devoid of all biases. Thus, using historical accounts of S&T from SD perspective would be an interesting venture. Further, looking at SD only from a developed country's perspective would not give a clear understanding of the role played by it. One has to also look at the country at the receiving end would help in critically analysing this concept. Therefore, one may argue that the idea of SD is not new and has broader applications to exploring international relations from this framework, especially in the past.

Methodology

The paper explores the period between 1900-1947 to understand the SD perspectives in the development of science and technology in India. Since this period is marked as a freedom struggle, it is important to look into the efforts of the Indians (the colonised) and the British (the colonisers). Therefore, purposively three different sets of cases were identified. The first two sets reflect the efforts by the Indians, which can be further categorised as institutional efforts and individual efforts in the field of S&T. The case of institutional efforts is of The Association for the Advancement of Scientific and Industrial Education of Indians (AASIEI).

For the individual scientific efforts four scientists namely Meghnad Saha, Shanti Swaroop Bhatnagar, C.V. Raman and Homi Bhabha are identified. The third case is the A.V. Hill visit

to India, which was the British diplomatic effort to gain Indian support for the war. The historiography of AASIEI annual meeting reports, from 1904-1912, has been used as a primary source of data. These reports are well written in English and have all the information ranging from objectives, members, number of scholarships, financial information, and presidential address of the annual meetings. The reports are available online at *South Asia Archives.*

To analyse the individual cases, the book *Nucleus and Nation: Scientists, International Networks and Power in India* by Robert S. Anderson (2010) is used as a secondary source of data. The book explores in detail the life events of the key scientists mentioned in the case list. It also discusses in detail A.V. Hill's visit to India and its ramifications on Indian S&T. Therefore, these sources have sufficient information to explore the SD during the freedom struggle and at the time of independence.

SD and building Science and Technology in India: The Cases

Advancement of Scientific and Industrial Education of Indians: Institutional mechanisms of SD

On 22 March 1904, The Association for the Advancement of Scientific and Industrial Education of Indians (AASIEI) was formed with an idea for the development of scientific, industrial, agricultural, and commercial education for Indians. The objective was to send qualified young students to Europe (the UK, France and Germany), America, Japan and other industrialised countries for study and training in science-based industries. District committees were formed in Bengal, Bebar, Orissa and Assam to collect funds at the local level.

In the first year of its establishment, 38 district committees were formed. Many eminent personalities, both Indian and British, were part of the association. Some of the notable names are Hon'ble Mr D.M. Hamilton, The Hon'ble Mr Justice Stephen, Mr Marriott, Commissioner of Patna Division, Mr Mande, Commissioner of Chotanagpore, the Hon'ble Mr Allen, Chairman of the Corporation of Calcutta, Mr Radice, Magistrate of Krishnagar, Mr Forster, Deputy-commissioner of Hazaribagh, Mr Chapman, District Judge of Mozuffurpore, Mr Panton,

District Judge of Shahabad, Mr Monahan, Secretary to the Chief Commissioner of Assam, Mr Hart, Deputy-commissioner of Sylhet, Mr Ahmed, Magistrate of Khulana, The Maharaja of Cassim bazar, the Maharaja of Dinajpore, Raja Peary Mohun Mukerjee Bahadoor, and the Raja of Digbapatia. Association annual membership fee was 4 annas and in the first year of its establishment, 107 people from various parts of the country donated to the cause. In the first year of its establishment six men, a Bengali Mahomedan, one Behari Mahomedan, one Indian Christian, one Behari Hindoo, and two Hindoos of Bengal, Orissa or Assam were given Rs 1550/- scholarship to get training in different countries.

Table 1: Distribution of Scholarship by AASIEI

Country	Subject	Scholarship amount
England	Agriculture and Leather	Life insurance (Rs 2000/-), passage money, Rs 120/- and Rs 200/- (For Sciences)
Germany	Manufacturing Chemistry (including dyeing and paints)	Rs 100/- Rs 150/- (for Sciences)
Japan	Weaving and Lacquer work	Rs 50/-
Any country in Europe or America	Oil industry (with Agriculture as a subsidiary subject)	Rs 25-100/-

Source: Annual Report of AASIEI, 1904

In the year 1905, the number of District Committees increased to 48. These committees collected Rs 2100/- in 1905 and increased to Rs 8946/- in 1908. In a drive to bring all the similar associations under one platform, The Society of Improvement of Arts and Manufacturers and the Indian Gardening Association were amalgamated into AASIEI. Further, steps were initiated to bring the Indian Industrial Association under the rubric of the association. The association convinced The British India Steam Navigation Company headed by Mr D.M. Hamilton to waive 50 per cent of fare for Indian students to travel abroad. With the encouraging results from the previous year, in 1905 the

association planned to send 15 students to learn agriculture, weaving, tanning, manufacturing chemists, mining, pharmacy, preparation of printing ink, soap, matches, enamel, silk, and other industries. Thus, the number of streams also increased keeping in mind the requirements of the country. The Association sent two to America, five to Great Britain and eleven to Japan for industrial training in the year 1906.

Over a period, other important fields of knowledge and industry category were identified such as electrical and mechanical engineering, spinning, matches, agriculture, sericulture, leather, pharmacy, practical chemistry, weaving, handlooms, soaps, buttons, enamel, glass and mining. The association realised that students are facing language problems in the host country, so established language teaching in French, German and Japanese at Calcutta. Proposal to start a technical college, agriculture college and a bank were also on the agenda of the meeting in 1906. The association also encouraged students who have not received any scholarship by providing mentorship from the members of the association.

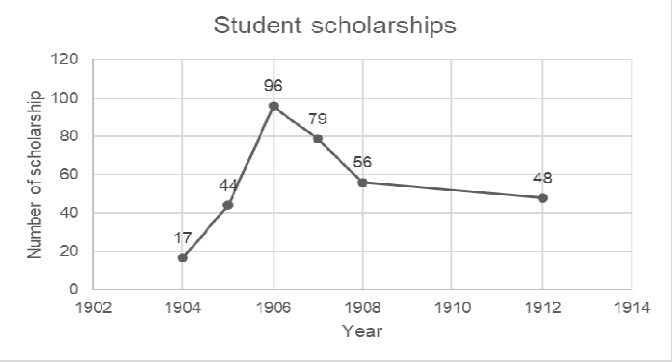

Figure 1: Distribution of Scholarship by AASIEI: 1904-1912
(*Source: AASIEI Annual Meeting Reports*)

In its 1908 annual meeting, the Association thanked Mr D. Campbell of London, Mr N Hibbard of Tokio Y.M.C.A., Mr Hawki Yamawaki, Director of the Imperial Commercial Museum, Japan, Professor Tezima, Director of the Higher Technological Institution, Tokio, Count Okuma, President of the Indo-Japanese Association, The British Consul in Japan, the

Secretaries of Y.M.C.A. in England and America, Prof. Sylvain Levi of France for supporting the scholars from India. In the presidential address, it has been highlighted that seeing the efforts of this association, other places such as Madras, United Province, Poona and Punjab have also started similar efforts. The United Province initiative was in Benares under the leadership of Mrs Annie Besant and was named "The Association for the Promotion of Education of Indians Abroad". It had a branch in London with the name "The Indian Student's Aid Association". Though, they were not as successful as AASIEI in achieving its goals. The President further stressed that such association is getting support from European communities because "it is a movement like this that brings about "a common feeling of nationality (Bishop Copplestone)".

Further, he states that "Our Movement runs on unsectarian, unaggressive lines. Sympathy and cooperation are its chief elements. Anyone no matter what his creed, nationality or politics may be is welcome within the portals of our association if he is only interested in the industrial progress of the country." The idea of the 'Swadeshi' movement was also discussed and the association claimed that it is serving the cause. He further stressed that now there is a need to create a swadeshi market to substitute the foreign articles. The kind of activities the association was doing, it had the confidence of providing men and material required to create a swadeshi market. The president acknowledges the role of the Anglo-Indian community, both official and non-official, in helping the association in achieving the goals of the swadeshi movement.

The presidential address of 1912 mentioned that with the efforts of the association Small Industries Development Company, the Boot and Equipment Factory Company, the Rungpore Tobacco Company, the Deoghar Agricultural Settlement Scheme and other enterprises were started. He stressed that the Government and European friends have helped the association in achieving the idea of ‘swadeshism’. President thanked European friends for their support in furthering the cause of the association. By that time a few efforts were made to establish science education in India such as the Indian Institute of Research (later known as the Indian Institute of Science) in

Bangalore was established in 1909 on the lines of Johns Hopkins University in Baltimore[i].

Many foreign collaborators, such as Sir William Ramsay (a British Chemist), Colonel John Cibborn, Principal of Thomason College of Civil Engineering (now known as Indian Institute of Technology Roorkee), and David Orme Masson (a professor from Melbourne University) supported the establishment of IISc. However, this institution was primarily meant for research in basic sciences, which was different from the aims of AASIEI. Another major objective was to engage AASIEI scholars in various industries returning to India after the training. The annual reports mention the names of various fellowship holders and their contributions to Indian industries. Further, these returnees were supposed to give some part of their income to the association so that others can be benefitted from this scholarship. Thus, AASIEI was an effort to resolve the Indian crisis of employment by promoting S&T education and training with the support of industrialised countries.

Indian scientists' effort in SD

At the beginning of the 20th century, many young scientists from different parts of India went abroad for higher education in sciences. The paper discusses four distinguished scientists namely Meghnad Saha, Shanti Swaroop Bhatnagar, C.V. Raman and Homi Bhabha. Each of them was contemporary and interconnected in some or other ways, however, Raman was the only among those who were not educated abroad. These scientists belonged to different socio-economic and cultural backgrounds, though motivated by one thought of the development of S&T in India after independence, especially Saha and Bhatnagar. In this section, the paper discusses these scientists and episodes of their life which are relevant for understanding the SD perspective.

Meghnad Saha: Saha, coming from a lower caste, came to Calcutta to complete his education. Saha's contemporaries were Satyen Bose, Jnan Ghosh, N.R. Sen, J.N. Mukherji (classmates), Nil Ratan Dhar and PC Mahalanobis (seniors) and taught by Prafulla Chandra Ray and Jagdish Chandra Bose (Teachers) in academics. He closely observed politically motivated freedom

fighters like Rajendra Prasad and Subhas Chandra Bose at Presidency College, Calcutta. He also has close contacts with revolutionary leaders like 'Bagha' Jatin Mukherjee (Jugantar Party) and Pulin Das (Anusilan Samity). These networks were enough to bring out the revolutionary instincts in Saha. However, Jatin Mukherjee advised him not to engage in these things right now and maybe his academic acumen will be required once India gets independence. Thus, Saha concentrated on academics more and along with Satyen Bose translated Einstein's classical papers on special and general relativity and published as a book *Principles of Relativity* in 1919 by the University of Calcutta Press. This was the first book publication of Einstein's work in English.

Similarly, Saha conducted a few science experiments, published papers in reputed journals and earned his DSc from the University of Calcutta. His dissertation was evaluated by a Nobel laureate in physics O.W. Richardson. These events brought international recognition to Saha and he received two scholarships for two-year postdoctoral research in England and Germany. He was also elected as a Fellow of the Royal Society in 1927. Most of his international networks were developed during his stay there. He developed a good rapport with the famous scientists of the time like Nernst, Einstein, Planck, Sommerfeld, and other European physicists and maintained a good relationship with them throughout his life. Saha stayed in Copenhagen and worked with Neils Bohr's group, where he met for the first time with Bhabha.

Saha laid the foundation of the Institute of Nuclear Physics in Calcutta in 1948 with the help of Shyama Prasad Mookerjee and inaugurated by Frederic Joliot-Curie, head of the French Atomic Energy Commission and a member of the Communist Party of France. The institute's experiment on the cyclotron, designed by Donald Cooksey and Ernest Lawrence in 1938, was troublesome and his student B.D. Nagchaudhuri went again to Berkeley to learn its operation. Ernest Lawrence, who helped Nagchaudhuri to do his PhD with Emilio Segré's cyclotron group at Berkeley, helped them in getting a new vacuum system. Saha started *Science and Culture* journal in 1935 on the line of British (*Nature*) and American (*Science*) journals, to spread science in nontechnical language.

Shanti Swaroop Bhatnagar: Bhatnagar received initial support from teachers like B.M. Jones and due to his academic achievement received Dayal Singh Five-year travelling scholarship to study in America. Though he was not able to go to America and reached London in 1920 and met Saha there. They developed a good friendship, which lasted till the end. Bhatnagar also visited Germany and met famous scientists like Fritz Haber, H.M.F. Freundlich, and others. These helped Bhatnagar to grasp the field of colloidal chemistry and this led to his selection as a Fellow of the Royal Society in 1943.

In 1942 Viceroy Wavell started paying attention, after Cripps mission, towards science and industry, which was not the case in earlier regimes. The government of India enhanced the funding and powers of the new Council of Scientific and Industrial Research (CSIR). However, initially, no scientists were part of it and at Bhatnagar's request, four unofficial scientists were later appointed to the council. Bhatnagar was the first Indian elected as vice president of the Society of Chemical Industries in London in 1943. This helped him to use his contacts in India and abroad, especially A.V. Hill and planned the establishment of the CSIR, one of the world's largest networks of science laboratories.

Chandrasekhara Venkata Raman: Raman joined the Indian Association for Cultivation of Science Calcutta in 1907 while working in the Finance Department. He worked there for ten years and moved to Calcutta University as full-time faculty in 1917. Raman gained his knighthood in 1929 and won the Nobel Prize in 1930. Sommerfeld visited India and attended Raman's lecture in 1928 to learn more about the 'Raman Effect' for which he received the Nobel Prize. Due to the Saha-Raman conflict, Raman moved to IISc Bangalore in 1932 as director and was recommended to the post by Sir Ernest Rutherford, director of the Cavendish Laboratory. The Indian Science Congress (ISC) was founded in 1911 by P.S. MacMahon, Lucknow, and J.L. Simonsen, Madras. In its annual meeting in Bangalore in 1930 Sir Richard Gregory, editor of *Nature*, with the help of Raman founded the *Current Science* magazine for Indian researchers. Raman, during his stay as director IISc, brought many refugee

scientists from Europe like Max Born, Germany, Rudolph Ortvay, Budapest, and tried for Ernest Schroedinger, Germany, George von Hevesy and V.M. Goldschmidt, Hungary, Pieter Zeeman, the Netherlands.

Homi Bhabha: Bhabha was born in an affluent Parsi family in 1909. His uncle Sir Dorab Tata had helped in establishing the Department of Engineering at Cambridge University. Thus, Bhabha was not unknown at Cambridge and his teachers like Paul Dirac taught him mathematics, who later advised him to start a department of mathematics in his institute in Bombay. Bhabha was contemporary to physicists like Cockcroft, Walton, Blackett, Occhialini, and Chadwick working on the structure of the nucleus in the Cavendish Laboratory. Bhabha completed his PhD with R.H. Fowler, after getting the Isaac Newton studentship. This helped him to stay longer in Europe and meet key physicists like the groups of Pauli in Zurich, Kramers in Utrecht, and Fermi in Rome. He also visited Copenhagen in 1936 where he met Saha and Niels Bohr, James Franck, Wolfgang Pauli, Werner Heisenberg, Max Born, Marcus Oliphant and Lise Meitner. Bhabha worked closely with Werner Heitler, which later proved to be instrumental in his ventures in S&T in India.

The British efforts in SD

Archibald Vivian Hill: Hill was the president of the Royal Society when he visited India as part of the post-war reconstruction plan. Earlier he served as scientific attaché at the British embassy in Washington in 1940, chair of the Executive Committee of the National Physical Laboratory, and member of the war cabinet scientific advisory committee. Before reaching India in 1944, he thoroughly studied the Indian situation and consulted experts like Sir Stanely Read and cleared his agenda for the promotion of science with the help of Indian scientists. In this context, he came up with a report identifying the research problems in S&T in India. Thus, the arrival of Hill and the report opened various opportunities for the local scientists in managing scientific affairs by increasing their role in policy formulation.

Not only Hill, but Indian scientific bodies also realised his visit as important for India and its S&T development. To this

effect, the Indian Association for Cultivation of Science (IACS) had appointed three honorary fellows who were already FRS, Sir Henry Dale, Sir Robert Robinson, and J.L. Simonsen; awarded medals to astronomers Sir E.J. Russell and F.W. Aston, who were of British origin and awarded medals or fellowships to people who were not British — namely, Niels Bohr, Arnold Sommerfeld, and Robert Millikan (in 1939). In the past these tall figures in science have played crucial roles like appointments in scientific institutions in India, writing recommendation letters and inviting Indian students abroad, and voting in the election of fellows at various scientific bodies abroad. Thus, it was a diplomatic move on the part of IACS.

Further, Hill was instrumental in establishing a commonwealth scientific office that would bring Indian, Canadian, and Australian scientific attachés together, in London. On the recommendation of Hill, an official team of physical chemists and team leader Sir S.S. Bhatnagar, physicist M.N. Saha, physical chemist Sir J.C. Ghosh, radio researcher S.K. Mitra, agricultural development specialist J.N. Mukherjee, medical education authority S.L. Bhatia, and agrotechnologist Nazir Ahmed visited various scientific facilities in England, America and Canada in 1944. The mission visited a mixture of secret and open facilities — the Malvern radar laboratory, the National Physical Laboratory at Teddington, radio research at Slough, chemical industries at Huddersfield and Billingham, and major universities like Cambridge, Oxford, and London. In North America, they went to McGill University in Montreal, where part of the Manhattan Project already had British, French, and Canadian participation, the University of Toronto, and the National Research Council at Ottawa, where another part of the Manhattan Project was located. Thus, Hill's visit to India proved to be instrumental in bringing a new era of collaboration in S&T for Indian scientists with other influential countries.

Discussion and Conclusion

One may analyse the above-mentioned cases from the colonisers (British) and the colonised (Indian) point of view. At the beginning of the 20th century, the efforts for independence increased and led to political unrest in the country. The British

also realised it and they started responding to them in different ways and S&T was one of them. On the part of Indians, they realised that S&T are important for the eradication of many problems in the country and will be instrumental once India gets freedom.

The above-mentioned cases show that efforts were made in the field of science and technology towards the goal of independence, both at institutional and individual levels. If we look at these cases from the SD perspective, more specifically the nuanced understanding of "science in diplomacy", "science for diplomacy" and "diplomacy for science", efforts made during that period helped S&T in many ways in India. The case of AASIEI can be categorised as "science for diplomacy" where efforts were made to train Indian youth in foreign countries and after their return, they will contribute to fulfilling the dream of 'Swadeshi'.

Various interventions made by the British and American scientists and diplomats in collaborating with Indian scientists like Saha, Bhatnagar, Raman and Bhabha fall under the category of "diplomacy for science". The visit of Hill to India and inviting a group of Indian scientists to England, America and Canada and other interventions to resolve the scientific conflicts at IISc and IACS highlight the core of "science in diplomacy". These SD efforts led to the development of various scientific institutions (IISc, CSIR and IIT-Roorkee), journals (*Current Science* and *Science and Culture*), scientific bodies (Indian Science Congress), policy-making and management of S&T, and new areas of scientific research (Atomic Energy, Biophysics, etc.), which were instrumental in shaping the trajectory of S&T in post-independent India. Having said this, it is also important to mention that many aspects of SD were problematic. For instance, women and various caste-based discriminations were evident in these efforts. We have not seen any women names featuring in the AISSIE scholarship. Further, most elites were taking advantage of such mechanisms and that too from limited parts of the country.

This research also suggests that historiography would be an important method to explore SD from the past. This research further opens up new areas of research in the field of STS studies

from an SD perspective and suggests that it is not a new phenomenon and has been in practice for a long in various forms. This will also help to explore the non-European perspective of SD and tells us how a resource-constrained nation may use these methods to develop its S&T. In the end, one should be cautious of too much reliance on SD, as it may emphasise the involvement of scientists and technocrats in the policymaking, which STS studies have already warned.

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[i]Indian Institute of Science (IISc Bangalore) was established with the efforts of Jamsetji Nusserwanji Tata and Dewan of Mysore. Tata was already a successful businessman and once on a trip to North America from Japan he met Swami Vivekanand and discussed the idea of establishing a research university. To materialise this dream, Tata gave some fund and land and gave responsibility to Burjorji Padshah in 1898, who suggested a university that was tentatively called the Imperial University of India. In 1889 a delegation met Viceroy of India Lord Curzon, who principally agreed for it and named it the Indian University of Research. The Dewan of Mysore State SeshadriIyer offered land and additional money for the cause. However, after the sudden death of Tata in 1904, this idea got delayed. such an institute. Then Government appointed William Ramsay to head a committee to implement the project in 1901 and he named it Indian Institute of Research. Finally, it came into existence on May 27, 1909 and Morris Travers (a British Chemist) was appointed as its first director (Indian Institute of Science: Origin).