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

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

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

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

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

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

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

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

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

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

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

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

A curious and counter-intuitive trend visible in the publications of these scientists is their preference to publish in Indian scientific journals. These journals were initiated and published by Indian scientists who wanted to establish alternative publications which did not discriminate against Indians and provided them with their due academic space. Calcutta Journal of Medicine (M Sircar, 1868), Bulletin of Indian Association

for the Cultivation of Science (Edited by CV Raman, 1909), Journal of Indian Chemical Society (PC Ray, 1924), Science and Culture (MN Saha, 1935) were some such journals.[7] In fact, 34% of papers published from 1807 to 1947 in India appeared in Proceedings of the Indian Academy of Sciences- Section A and B.[8] Thus, we find that JC Bose published his work on the polarisation of electromagnetic waves in the Journal of the Asiatic Society of Bengal in 1884, which was communicated to the Royal Society of London by Lord Rayleigh a year later. CV Raman announced his discovery of Raman scattering at the 1928 meeting of the South Asian Science Association in Bangalore.[7] These actions were not naïve happenings but well-thought strategies which resonated with the confidence in their work and their underlying nationalist pride.

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

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

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

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

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

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