

CHAPTER I

Introduction

Science, technology and medicine have served mankind and made life easier, more comfortable, safer and healthier. They have helped to break the limits of climate, seasons and surmount the vagaries of nature. Concomitantly, in the last two centuries of momentous achievements, science and technology have also made wars deadlier and human existence more precarious. On the one hand, they have enhanced the longevity and quality of life, on the other, they have also devalued human dignity and struggle and made human life cheap. Apart from nuclear bombs, submarines, poisonous gases and biological warfare techniques, several nobler and celebratory aspects of science and technology have also been deployed for unethical and sinister purposes beyond recognition. The Internet revolution with its benefits has also aided crude terrorism and sophisticated human perversities like pornography making them available at ones fingertips. The perverse, parochial and the petty have deployed the same boon of science and technology for perpetuating habits and mindsets that debase the human spirit. The momentum of changes is such that sometimes the sheer awareness that such erosion and debasement have happened betrays our cognition and understanding.

The compact and coupling of science with nation states, science with terror groups who act like quasi states, and science with industrial magnates and sharks i.e. science with mega corporates, or vice versa are more than manifest today. We see science and scientists in all such core power groups that are themselves linked to each other. Scientists cross over and sometimes present themselves as purchasables pawns in the hands of these compelling groups, categories or contexts. It is well known that resources are scarce and wars further debase and destroy them, making the world murkier and existence more unjust and precarious. Is it possible for science to augment resources and restore the balance of nature? Wars in the last two centuries induced and aided great developments in science, technology

and medicine but then can such virtues and efficacies of science reduce the burden of war and redeem nature and environment?

In this context, the thesis deals with the entwined journey of science and the Indian nation from 1850s to 1960s. Broadly speaking, it was undertaken in the quest for self-reliance by Indian cultural interlocutors, scientists and nationalists. The journey was both one of hardships but full of hope epitomised in the evocative Nehruvian phrase ‘tryst with destiny’. This tryst with destiny was to be realised with the mediation of science and technology and was also an attempt to negotiate modernity. In actuality this tryst had begun much earlier to the midnight of 15th August 1947 going way back to the mid nineteenth century. The eve of independence was an important moment in this long and arduous journey that still continuous. The reforms that began somewhere in mid nineteenth-century India and the subsequent long-drawn journey emphasised the inculcation of the new knowledge i.e. science. Reformers of all hues and persuasion all along the nineteenth century realised that the strength of the west or Europe was science and science based industrialism. As the ensuing cultural encounter intensified in India during this period, the cultural and industrial importance of science began to be acknowledged and addressed by various reformers and cultural interlocutors.

This narrative of the relationship between science and nationalism in the formation of the nation-state in India and its subsequent impact on society and polity has been told and retold in several distinguished works on the subject that evince its diverse hues and colours.¹ However, it still needs to be seen from various perspectives to comprehend the dilemmas and predicaments embedded in this relationship. This thesis as such is yet another exercise to explore aspects of the salience of this relationship.

From the eighteenth century onwards, India and Europe followed an entwined journey, though characterised by unequal and severely skewed power relations.² Science was

¹ For a global survey of this phenomenon, see the special issue brought out by OSIRIS edited by Carol E. Harrison and Ann Johnson, *National Identity the Role of Science and Technology*, OSIRIS, second series vol. 24, 2009. In the Indian context one can see Deepak Kumar, *Science and the Raj: A Study of British India*, 1995; New Delhi: Oxford University Press, 2006 (2nd edn.).

² Critical commentators on colonial science have detailed and demonstrated this severely skewed power relationship emphasising the causative role of western science in negotiating the colonies and maintaining the imperium. See Anil Kumar, *Medicine and the Raj: British Medical Policy in India, 1835-1911*, New Delhi: Sage Publications, 1998; Roy Macleod and Deepak Kumar (eds.), *Technology and the Raj: Western Technology and Technical Transfers to India 1700-1947*, New Delhi: Sage Publications 1995; Deepak Kumar, *Science and the Raj: A Study of British India*, 1995; New Delhi: Oxford University Press, 2006 (2nd edn.), and monographs of a similar genre.

a handmaiden in European expansion and a living link between the metropole and colony.³ It is almost a truism that in the west modern science first reached its ‘walking and talking’ stage in about 1700, and only around 1800, did it show signs of adolescence. This is the precise temporal phase when the British were trying to gain a foothold in the Indian subcontinent. Thereafter, an intense protracted ‘cultural encounter’ ensued through which science gradually acquired the status of a prominent social referent. Every quest of modernity was to ultimately gain legitimacy at the altar of this universal referent. Coeval to this, there emerged interlocutors from several cultural realms with different ideological persuasions whose ideas converged and underscored the need to usher science and a scientific spirit into Indian society.⁴

In this context, the present work captures the place and significance of science in the phase of ‘cultural encounter’ that unfolded in the nineteenth century Indian colonial milieu and examines its continued significance as part and parcel of the development discourse in the post independent era of the Indian sovereign nation state, within the temporal frame of 1850s to 1960s. This enquiry entails and includes investigation into aspects of the nature and modes of knowledge production, distribution, and communication pertaining to science. In doing so, it brings within the ambit of historical inquiry protagonists who worked both at national and regional levels to inculcate scientific temper and spirit to make the nation ‘modern’ and ‘advanced’. The inherently meant a special focus on the emerging literati otherwise called the ‘Bhadralok’ at Calcutta—one of the most animated sites of this cultural encounter.⁵ It was here that the idea of a national science was mooted and articulated in the 1870s making it an essential ingredient constitutive of nationalism itself.⁶ Similar ideas,

³ For various aspects of this phenomena see Boston Studies in Philosophy of Science (BSPS) series edited by Patrick Petitjean, Catherine Jami and Anne Marie Moulin, *Science and Empires: Historical Studies about Scientific Development and European Expansion*, vol. 136, Springer Science & Business Media, B.V., originally published by Kluwer Academic Publishers, 1992.

⁴ M.G.K. Menon, ‘Science in India: Past and Present: A Sociological Perspective’, in B.V. Subbarayappa (ed.), *Science in India: Past and Present*, Mumbai: Nehru Centre and Popular Prakashan, 2007, pp. 1-48.

⁵ The early location of colonial power and cultural influence in Bengal justifies our primary focus on and entry through this region. For the significance of both science and Calcutta, see Deepak Kumar, ‘Calcutta: The Emergence of a Science City (1784-1856)’, *Indian Journal of History of Science*, vol. 29, no. 1, 1994, pp. 1-7; S.N. Sen, ‘The Pioneering Role of Calcutta in Scientific and Technical Education in India’, *Indian Journal of History of Science*, vol. 29, no. 1, 1994, pp. 41-47; Deepak Kumar, ‘Science in Higher Education: A Study in Victorian India’, *Indian Journal of History of Science*, vol. 19, no. 3, 1984, pp. 253-60; Mel Gorman, ‘Introduction of Western Science into Colonial India: Role of the Calcutta Medical College’, *Proceedings of the American Philosophical Society*, vol. 132, no. 3, 1988, pp. 276-98.

⁶ When one uses the word science with the prefix ‘national’, it does not connote a ‘set of structures’ or a policy statement as is connoted by the term ‘colonial science’. In the last decade of the nineteenth century, it was employed just as an expression of a will, a purpose, a mission to be embarked upon. It merely indicates that science was becoming an important referent in the forging of a national identity and that it had to be imbibed and inculcated if a true national spirit was to be fostered. See two seminal essays by Mahendralal Sarkar: ‘On

concerns and their articulation are discerned for other regions as well. Even if such an exercise does not disapprove anything and the conclusions drawn remain compatible and complementary to the Bengal experience, it does provide us the opportunity to bring within the historical ambit the compulsions, concerns, accomplishments and difficulties of the protagonists and actors of other regions and linguistic groups.⁷

We do not refer to the protagonists and actors who engaged with the question of science as ‘scientists’⁸ as this professional category in the early decades of the nineteenth century was still in the making both in India, and even in England. In the Indian context they must be understood in a much broader sense as cultural interlocutors and their espousal of ‘rationality’ is captured and documented within the engagements and encounters that took place in the context of colonial domination. In this regard, the spirit generated by the national movement that critiqued and challenged the colonial domination and discourse and induced the Indian cultural interlocutors to claim parity has also been juxtaposed to the damaging and limiting context of colonialism. It is well known that eventually both these aspects reordered various realms of existence in India.

This research chalks out aspects of the social history of science and science institutions over a century, not merely as a linear hagiographical narrative of individual scientists but as an account of their efforts to wrest meaning and success from their engagement and encounters with a changing and dynamic social world. The contradictions of their time are not erased or flattened to make them exemplary role models but rather stand

the Desirability of Cultivation of the Sciences by the Natives of India’, *Calcutta Journal of Medicine*, vol. 2, no. 8, Aug. 1869, pp. 286-91. Also reprinted in Arun Kumar Biswas (comp. & ed.), *Collected Works of Mahendralal Sircar, Eugene Lafont and the Science Movement (1860-1910)*, Kolkata: The Asiatic Society, 2003, pp. 40-44; ‘On the Necessity of National Support to an Institution for the Cultivation of the Physical Sciences by the Natives of India’, *Calcutta Journal of Medicine*, Jan & Feb. 1872, pp. 37-. Also reprinted in Arun Kumar Biswas (comp. & ed.), *Collected Works of Mahendralal Sircar, Eugene Lafont and the Science Movement (1860-1910)*, pp. 69-80.

⁷ Some aspects of this probe will be covered in chapter 2.

⁸ ‘The growth of science organised in terms of specialist groups of small communities sharing a set of “cognitive” and “social” values to explore and advance knowledge is a twentieth century phenomenon. Life writing about scientists has tended to intrigue the public particularly since the late twentieth century because science as an institution – rooted in research, requiring academic credentials funded by grants, centred on sharing experimental results – did not fully emerge until the twentieth century; earlier scientists were often dilettantes whose livelihood came from other occupations. Charles Darwin typifies the nineteenth century student of “natural history” – a loose designation now subsumed under biology. After abandoning theology and medicine, Darwin was accepted on the *Beagle* as a “natural” historian.’ [Margaretta Jolly (ed.), *Encyclopedia of Life Writing*, vols. I & II, London, Chicago: Fitzroy Dearborn Publishers, 2001, pp. 791-92.] ‘In fact, the popular credit throughout the nineteenth century went largely to the inventor, not to the scientist. This was true both in England and the United States. Imperial Germany was the only nation where the physical scientist as scientist received something of what was his due.’ [James B. Conant, *Modern Science and Modern Man*, New York: Columbia University, 1952, pp. 7-8.]

highlighted. As the men associated with science did not constitute a very large community, one is methodologically tempted to draw upon the prosopographical technique—the use of collective and contemporaneous biographies with all their connectivities and dissensions—to explore their intellectual and social endeavours. The narrative thus generated accounts for the moral and material concerns, particularly, educational concerns of the community around science and the efforts they initiated to make the social milieu of the literati more receptive to the scientific spirit that resulted in a unique efflorescence of science and scientific institutions at Calcutta.⁹ By moving from individual biographies to the prosopographical approach,¹⁰ this study intends to amplify the ideological debates and social connectivities and contestations which made up that sociological phenomenon sometimes loosely defined as the nineteenth century ‘Bengal Renaissance’.¹¹

The nineteenth century cultural encounter, with science as a cultural referent, occasioned the assessment and reassessment of tradition and its diversities. This paved way for a cultural critique and an array of reforms. Broadly speaking, education was the arena where varieties of reforms were underlined and initiated and this process acquired momentum, both during the swadeshi era and also after the non-cooperation movement, providing the swadeshi spirit a new lease of life and meaning. With the advent of the Indian National Congress in 1885, political reforms began to be debated and demanded. This merged with the ongoing movements for social and cultural reforms and strengthened the different hues of nationalisms. Science, swadeshi and industrialism provided strength to these nationalisms and their quest to modernity.

In the documentation and delineation of the role of science in the phenomenon described as the ‘Bengal Renaissance’,¹² this study has focused on those aspects of the struggle which endeavoured to establish native institutions outside the colonial pedagogic

⁹ This does not preclude the possibilities of drawing analogies from other cultural zones both within and outside the Indian subcontinent.

¹⁰ The tapping and amplifying of the self-expressions of men of science at the level of methodology will entail not only retrieving but collating and contextualising information from their diaries and private papers, autobiographies and memoirs, also from the letters which they exchanged both in official and private capacities, the academic as well as public speeches they delivered.

¹¹ Subrata Dasgupta, *The Bengal Renaissance: Identity and Creativity from Rammohun Roy to Rabindranath Tagore*, Delhi: Permanent Black, 2007.

¹² The term ‘renaissance’ even in the European context has been deemed elusive. It becomes more controversial when used with the prefix Bengal. No doubt, ‘Bengal Renaissance’ is a controversial epithet and has been validly critiqued in retrospect and with hindsight. By establishing the non congruence and farfetched parallelism of this imported term vis-à-vis the social and economic realities of nineteenth century Bengal, historians have rightly pointed to the limitations of the modernising process which emerged in the colonial milieu under the rubric and rhetoric of this term.

structures. This has been demonstrated through a rigorous biography of Mahendralal Sarkar,¹³ and the institution he founded, the Indian Association for the Cultivation of Science (IACS) that still survives and thrives.¹⁴ In the critical assessment of the phenomena of cultivation of science through IACS, it is both tempting and instructive to document the deliberately delayed organisation of science teaching and research within the Calcutta University *per se*. In this context an appreciation of Asutosh Mukherjee's role in organising science at Calcutta University has been included in a chapter within the larger rubric of science and swadeshi.¹⁵

Drawing from a gamut of available literature, the thesis further underlines those common concerns that provided an intellectual and cultural background for Sarkar's engagement with the idea of a national institution for the cultivation of science. The cultivation of science movement initiated by Sarkar and IACS proliferated in the sense that intellectuals like Ramendra Sunder Trivedi and Rabindranath Tagore extended their support to the *Bangiya Sahitya Parishad* and the National Council of Education as other aspects of native efforts in the direction of underscoring science. The narrative attempts to explain such convergences and divergences. In a similar vein, it tries to plausibly explain Sarkar's connections to Akshay Kumar Dutt's ideas and to those of Rajendralal Mitra, and how proximate the rationalist-Sanskritist Vidyasagar was to Akshay Dutt. In the words of a perceptive historian, '[f]or the average educated Bengali today, nineteenth century Calcutta lives on mainly as a galaxy of great names. Religious and social reformers, scholars, journalists, and patriotic orators, *maybe a couple of scientists*, all merge to form an image of "renaissance", *nabajagaran* (awakening) or *nabayuga* (new age), assumed to mark the transition from medieval to modern,'¹⁶ the thesis intends to plausibly redress the dismissive '*maybe*' by exploring the role of those cultural interlocutors who anchored their social vision

¹³ In this thesis for the purpose of uniformity, the current day spelling 'Sarkar' has been used for Mahendralal Sarkar. However, in the sources of the period, his name appears in several forms such as Mahendro Lall Sircar, Mahendra Lal Sircar and so on. Wherever possible, references to his work are given in their original spelling. For biographical details on Mahendralal Sarkar, see Sharat Chandra Ghose, *Life of Dr. Mahendralal Sircar*, Calcutta: Hahnemann, 1935; Pratik Chakrabarti, *Western Science in Modern India: Metropolitan Methods, Colonial Practices*, Delhi, Permanent Black, 2004; John Lourdaswamy, *Science and National Consciousness in Bengal 1870–1930*, New Delhi, Chennai: Orient Longman, 2004.

¹⁴ Arun Kumar Biswas (comp. & ed.), *Collected Works of Mahendralal Sircar, Eugene Lafont and the Science Movement (1860-1910)*, Kolkata: The Asiatic Society, 2003.

¹⁵ Narendra Krishna Sinha, *Asutosh Mookerjee: A Biographical Study*, Asutosh Mookerjee Centenary Committee, 1966. Also see Debduitta Chakraborty, *Asutosh Mookerjee*, Kolkata: Institute of Social and Cultural Studies, 2017; Kankan Bhattacharya, 'Sir Asutosh and the Rise of Modern Science in India', *Indian Journal of History of Science*, vol. 50, no. 3, 2015, pp. 420-28.

¹⁶ Sumit Sarkar, 'The City Imagined: Calcutta of the 19th and early 20th centuries', in *Writing Social History*, New Delhi: Oxford University Press, 1997, p. 160. Emphasis added.

on science. It will draw upon various connections and contestations in the articulation of the men associated with science and its cultivation, both in the disciplinarian sense and also as a cultural and moral force. Science as a moral force, a value and temperament allows us to understand various shades of nationalism in a much more rigorous fashion.

Science Nationalism and Modernity

Science was a cultural referent for reforms and an important ingredient of industrialism. Science and industrialism were constitutive of nationalism itself and nationalism was a factor in modernity. Clearly the Indian quest for modernity became a national quest and the pursuit of science also became a significant factor in modernity. Therefore, the questions of science and the nation or its manifest nationalism are intimate cofactors in the quest of Indian modernity. Science also made a claim for universal knowledge status. In this sense, it reinforced itself as a cardinal or defining element of modernity and the modern world reconfigured on the basis of modern nation states, as distinct from earlier empires¹⁷ or civilisational-monarchical states.¹⁸

In the first half of twentieth-century India, the context of pervasive colonialism and the existence of an overarching colonial state within the larger empire and imperium complicate the above-generalised formulation. The emerging national movement that challenged colonialism also unsettled the above picture, though science remained an important factor nevertheless.¹⁹

After the gestation of the Indian national movement the new sovereign Indian nation state was to be a welfare state, whether of radical revolutionary character or otherwise is besides the point. For this welfare state, science was again a promising handmaiden or midwife. The inculcation of science and scientific temperament was economically and

¹⁷ Even in the Chinese context, despite the presence of a civilisational-monarchical state and the simultaneous intervention of various European countries/states there was a clear engagement with western modernity China had to modernise and that was the central debate. The May Fourth intellectual movement witnessed significant discourses on science in the context of debates on building modern nation-state in China. Such debates were also part of the nation-building discourses in Indian freedom struggle. India did not experience something exactly like the May Fourth but witnessed other kinds of intellectual and political movements with bearings on science, society and nation building. The trajectories for the inculcation and cultivation of science were very different in China and India, but the quest to modernity was central and common to both. See, for China, D.W.Y. Kwok, *Scientism in Chinese Thought, 1900-1950*, New Haven: Yale University Press, 1965.

¹⁸ In the case of Russia, also a civilisational-monarchical state which did not have the same formative experiences of Renaissance and Enlightenment as of Western Europe, the central debate was how Russia has to modernise. Its defeat by Japan in 1905 was also a turning point and an important catalytic factor.

¹⁹ In this context it must be noted that conceptualisation of colonial science draws our attention to its dependent nature. It was understood that colonial science was not allowed to serve the nation and its people as it was put to use as per colonial needs of governance. The aspiration to end colonialism was entwined with the aspiration to inculcate science and ensure to harness its potential for the nation and its people.

socially liberating. Moreover, the pursuit of science did not depend on ascribed status of caste. Science characterised the new open and universal knowledge.²⁰ The distinction between knowledge, which was a prerogative of a few castes or sects, and open knowledge that elicited and invited anyone was important. The urge to inculcate science and the impulse for the establishment of new universities by native intellectuals was a symbol of modernity, a site and symbol of knowledge inculcation, production and dissemination of science.²¹

In short, the attempt is to present the broader phenomena of science becoming a cultural referent and to document the efforts to create scientific institutions for the cultivation of science in late nineteenth-century Bengal as an entry point to other regions as well. It also alludes to the process by which science became constitutive of Indian nationalism and the ways in which the scientists/cultural interlocutors carved out a role for themselves in the developmental discourse that emerged in the 1930s and provided it a particular direction in the post 1947 era.²²

The broad cultural contours of nineteenth-century Calcutta metropolis and its critical appraisal from the standpoint of the emergence and evolution of the discourse of science will serve as a backdrop to the study of the transition of science from dependence to independence. Conceding to the efficacy and validity of earlier studies on science under the rubric of colonial policies where colonial imperatives were demonstrably discerned in the organisation of the initial scientific institutions like various survey departments in the era of the so called 'explorative' or field sciences, and to shift focus to the public realm where debates around science as a cultural attribute gradually gained strength, it is important to account for the connectivities of ideas among cultural interlocutors, so as to provide a glimpse of the process by which science as a cultural force was not only recognised but elevated to the status of a social referent.

All along the nineteenth century, several social and cultural forces were unleashed in the course of the complex civilisational encounter. One of them was the urge to appreciate, imbibe and inculcate science among our own people. But this realisation did not dawn all of a sudden as the digits of civilisational comparisons unfolded gradually. Science and the spirit

²⁰ This is not to discount the economic, political and social context of science.

²¹ Native intellectuals or organic intellectuals were haunted both by the incapacity of their traditions to solve or resolve the contemporary challenges that the cultural encounter threw before them and the optimism generated by modernity and modern knowledge systems to help them to tide over and tackle a gamut of contemporary problems.

²² Deepak Kumar, 'Reconstructing India: Disunity in the Science and Technology for Development Discourse, 1900-1947', *Osiris*, vol. 15, *Nature and Empire: Science and the Colonial Enterprise*, 2000, pp. 241-257.

associated with it were recognised as one of the superior elements of western civilisation. In the process of this recognition, science emerged as an important yardstick to analyse and critique the cultural attributes not only of our own society, but that of the coloniser's as well. The focus is to understand and account for the reflexes and responses of the emerging literati in this era of civilisational encounter. Caught between the crosscurrents of the revivalist pulls and attraction of the rational telos, their apprehensions and confidence found vent in the various *Samaik Patras*²³ (journals) of the age. In this sense, the growth of a science movement in Bengal in the nineteenth century cannot be understood unless placed in the context of the creation of a new Bhadrakok with its notions of social, economic, cultural and spiritual 'revival' and 'regeneration.'

For example, the Brahmo movement hitherto has been studied mainly in terms of religious or spiritual efflorescence that had broad social and cultural impact.²⁴ The earlier Brahmos themselves would have sharply disagreed with such an approach. For them the Brahmo movement epitomised a new 'humanism' that included spiritual as well as intellectual concerns. Thus, the Brahmo's spirituality was intrinsically social and cultural as much as its social and cultural concerns were spiritual. It is no wonder that the first serious journal or *Masik Patra* brought out by the Brahmo pioneers—*Tatwaa Bodhini Patrika*—included articles on history, economics, science and political thought.

The Brahmo movement did not encompass the entire new Bhadrakok. It represented only a certain influential and articulate section among them. But even those formally outside the Brahmo pale and strongly opposed to Brahmo visions of religious reforms shared many of their assumptions. Thus, Rajendralal Mitra,²⁵ who was quite skeptical of Brahmo religious reformism, shared their vision of scientific and philosophical renaissance. Similarly, Akshay Kumar Dutt,²⁶ while being the editor of the Brahmo organ *Tattwa Bodhini Patrika*, was closer to Rajendralal Mitra's vision than the ideals of the journals he edited. In contrast to the Brahmo ideals, Akshay Kumar Dutt in his 'Baconian aplomb' regarded science not merely as an intellectual engagement or an opinion or doctrine to be held but as 'a work to be done',

²³ Three important monthly journals i.e. *Masik Patras* of mid nineteenth century where the discourse of science figured most prominently were *Bibidharth Sangraha* (1851-61), *Rahasya Sandarbha* (1862-71), and *Bijnan Darpan* (1882-1885). See Pradip Kumar Bose (ed.), *Health and Society in Bengal: A Selection from late 19th century Bengali Periodicals*, New Delhi: Sage, 2005, pp. 275-80.

²⁴ See Charles H. Heimsath, *Indian Nationalism and Hindu Social Reform*, Princeton: Princeton University Press, 1964; David Kopf, *The Brahmo Samaj and the Shaping of the Modern Indian Mind*, Princeton: Princeton University Press, 1979.

²⁵ Siddhartha Ghosh, *Rajendralal Mitra*, Makers of Indian Literature, New Delhi: Sahitya Akademi, 2002.

²⁶ Asit Kumar Dutt, *Akshay Kumar Dutt*, Makers of Indian Literature, New Delhi: Sahitya Akademi, 1996.

informed by and predicated upon a passionate inquiry of the human nature for utility and power. However, his ‘Baconian aplomb’ did not prove sublime enough for Debendranath Tagore to tolerate him as the editor of *Tattwa Bodhini Patrika*. Debendranath was searching for the relationship between God and himself but found Dutt more interested in the relationship between external objects and human nature. When Dutt lost his editorship, it was Rajendralal Mitra who provided him intellectual asylum. Despite their differences, Rajendralal and Debendranath had worked for some similar cause as members of the Association for the Promotion of Social Improvements founded in 1854.

If one attempts to retrace the chain of intellectual antecedents, the basis of many converging ideas of different cultural interlocutors—both contemporary and temporally separated from each other—becomes comprehensible. It was Rajendralal Mitra who stood by Mahendralal Sarkar and Father Lafont when they were having a rough time with the rival Indian League while pushing through the proposed project of the IACS in 1876. It was again Mitra who bailed out Sarkar when he was not accepted on the medical faculty of the Calcutta University because of his homoeopathic practice. Mitra stood for the intellectual acquittal of Sarkar.²⁷ These facts are well known, but few know that both Mitra and Sarkar, though separated by a generation, were alumni of the Calcutta Medical College.²⁸ Mitra, who later established himself as an Orientalist-Sanskritist, and an art critic of rare excellence, had dropped out of medical college because of an altercation with Professor F.J. Mouat. As a medical student, Rajendralal remained the favourite pupil of Professor William Brook O’Shaughnessy, a brilliant medical man who taught *material medica* and chemistry, and who is popularly remembered as the father of electric telegraph in India.²⁹ If one links up these facts, it does not appear surprising that Mitra supported Sarkar’s vision of a national science. After all, he himself had been disseminating and inculcating such a spirit through his *Bibidhartha Sangraha* and *Rahasya Sandarbha*—two most outstanding Bangla journals

²⁷ Raj Jogeshur Mitter (ed.), *Speeches by Raja Rajendralala Mitra*, Calcutta: Messrs S.K. Lahiri and Co, 1892. See the speech titled ‘The Hon’ble Dr. Sircar and the Faculty of Medicine’, pp. 90-100. This speech was delivered by Rajendralal Mitra in defence of Dr Mahendralal Sarkar ‘at a meeting of the Senate held on 31st August 1878 to consider the resolution of the Medical Faculty and Dr Mahendra Lal Sircar’s letter in reference thereto regarding his nomination to that body’.

²⁸ The Calcutta Medical College, established in 1835, was then the only institution where training and practice of science actually took place. See Mel Gorman, ‘Introduction of Western Science into Colonial India: Role of the Calcutta Medical College’, *Proceedings of the American Philosophical Society*, vol. 132, no. 3, 1988, pp. 276-98.

²⁹ See Mel Gorman, ‘Introduction of Western Science into Colonial India: Role of the Calcutta Medical College’, *Proceedings of the American Philosophical Society*, vol. 132, no. 3, 1988, pp. 276-98.

covering serious scientific subjects that lampooned logic chopping of the *Nyaya* tradition and metaphysical speculations.

One should also not forget that when the great rationalist-Sanskritist, Vidyasagar³⁰—while discharging his dual role as the Principal of Sanskrit College and Assistant Inspector of Schools of four districts—was reorganising the school system by providing for a normal school to train village headmasters at Sanskrit College, he was able to do so with the help of none other than his Baconian friend, Akshay Kumar Dutt. Vidyasagar not only wrote elegant and innovative primers but also authored informative biographies of leading scientists like Copernicus, Galileo, Newton, Herschell and Linnaeus.³¹ In light of these facts, the rationalist preference of Vidyasagar gets amply clear. He was also close to Rajendra Dutt, the homoeopath, and himself practiced this Hahnemmanian pathy though as an amateur. Vidyasagar, the ocean of learning and compassion, remained the mentor and friend of Sarkar for a long time, and Rajendra Dutt was instrumental in his conversion to homoeopathy.

If these trans-generational linkages are traced then Sarkar's intellectual pedigree becomes clear. It was not incidental or a chance happening that he floated the idea of a national science. There was already a fermenting intellectual and cultural background to it. In the wake of his conversion to homoeopathy, the orthodoxy of the medical fraternity may have pushed him towards the broader vision of inculcating the spirit of science. Sarkar's effort should not merely be seen in terms of the heroic endeavour of an individual but must be located within the wider matrix of the convergences of ideas and opinions arising from the multiple contexts, pressures, challenges and opportunities occasioned by the intense and protracted cultural encounter. It has discernable linkages to the activities of the many cultural interlocutors both preceding and contemporary to him.

As alluded to earlier, the emerging discourse of science also occasioned experimentation with the Bengali language. Language and literature serve as the terrain where identity is forged, asserted, and it is through this medium that it is disseminated further. It is in this sense that language becomes not only the self-expression of an identity, it becomes the identity itself. The Bhadrlok, in its attempt at forging an identity, did not leave it unaddressed. As a vehicle for the dissemination of the discourse of science, the Bengali language was made amenable for carrying scientific concepts and information. H. Woodrow,

³⁰ Santosh Kumar Adhikari, *Vidyasagar and the Regeneration of Bengal*, Calcutta: Subarnarekha, 1980.

³¹ Gopal Halder, *Vidyasagar: A Reassessment*, Delhi: People's Publishing House, p. 64.

the Inspector of Schools, East Bengal, found Pandits of Sanskrit College under the guidance of Vidyasagar, showing sufficient interest in European science and literature, not as an end in itself but as a means to an end. Vidyasagar and his followers directed their efforts towards making the Bengali language not just amenable but an elegant vehicle for the dissemination of scientific knowledge.³² *Bibidhartha Sangraha* contained several items on science by Vidyasagar. It is not incidental that Bankim Chandra found *Bibidhartha Sangraha* the most useful and outstanding journal of its kind among the available Bengali periodicals of the time. Again, it is not incidental that Bankim translated Sarkar's proposal for a science association which had appeared in the *Hindoo Patriot* in 1870,³³ in the fifth issue of the *Bang Darshan*, exhorting his countrymen to worship science.³⁴ Bankim located European success in the power of their science and the servitude of India in its neglect. Bankim subsequently championed the positivist-empiricist methodology of science as opposed to metaphysical speculation in his popular science articles published between 1872 and 1875 in *Bang Darshan*, that were later on compiled and brought out as *Bijnan Rahasya*.³⁵

Apart from demonstrating how ideas converged as far as the cultivation of science was concerned, the above illustrative instances also reveal a limited amorphosity among the Bhadrak. The caste identification was not that strict as the definable characteristic and an entry point to the Bhadrak realm was modern English education. This was not to say that there were no hierarchies within the Bhadrak world. All Bhadrak were not equal, some were less equal than the others in the Orwellian sense of inversion. In fact, the Bhadrak were able to establish themselves through the skillful deployment of a few basic determinants of nineteenth century middle class life in Bengal like education, profession and print culture. The impact of the print culture in the proliferation of *Samaik Patras* has already been hinted at. 'Scientist' as a professional category had yet to emerge. It is in this sense that the demand for bringing science in the curriculum was just one pragmatic manifestation of this era of intellectual and cultural gestation and ferment.

³² In the next generation, it was Ramendra Sunder Trivedi who perfected it as an art. In the twentieth century, S.N. Bose carried this legacy in a much more flamboyant way. Bose via his *Bangiya Vigyan Parishad* tried to disseminate science in his mother tongue. Though this institution still survives, it is a vulgar caricature of the ideals laid down by Bose in this regard.

³³ *Hindoo Patriot*, Jan. 1870, in Arun Kumar Biswas (comp. & ed.), *Father Eugene Lafont of St. Xavier's College and the Contemporary Science Movement (1860-1910)*, Calcutta: The Asiatic Society, 2003, p. 46.

³⁴ *Bang Darshan*, 1872, in Arun Kumar Biswas (comp. & ed.), *Father Eugene Lafont of St. Xavier's College and the Contemporary Science Movement (1860-1910)*, pp. 84-90.

³⁵ Sisir K. Majumdar, 'Bankim Chandra: First Writer of Popular Science in Bengali', *Indian Journal of History of Science*, vol. 49, no. 3, 2014, pp. 308-10.

Towards the realisation of these demands, the missionaries contributed their own might. Science had found entry into the Serampore Protestant Missionaries' journal *Digdarshan* from 1820s onwards.³⁶ The Jesuit missionaries with their own tradition of scientific research did not remain far behind. Father Eugene Lafont was one of the pillars of the IACS and can legitimately be regarded as one of the co-founders of the association. J.C. Bose was one of his famous pupils. Clearly, the discourse of science brought about a much closer interaction among the literati. Diverse personalities belonging to different generations of the nineteenth century like Ram Mohan, Akshay Kumar Dutt, Rajendralal Mitra, Iswar Chandra Vidyasagar, RajendraDutt, Bankim Chandra, Vivekananda, Ramendra Sunder Trivedi, Father Eugene Lafont and Mahendralal Sarkar all came together and contributed their might to underline the role of science as a transformative force, both culturally and materially. In subsequent decades, it brought people like Ramendra Sunder Trivedi, Rabindranath Tagore, J.C. Bose, Asutosh Mukherjee and P.C. Ray together at various forums both directly and indirectly. Many men from preceding and following generations interacted very closely. It was this close interaction that not only sustained the various science journals and societies but, in due course, imparted stability to the emerging science institutions. This close interaction among the cultural interlocutors from different realms continued even in the mature decades of the national movement when science had emerged as an autonomous profession.

The above cursory appraisal cutting across generations is useful but a focused delineation warrants closer scrutiny for a shorter and focused time span, say a few decades. Conceding to the efficacies of both these modes of narratives, this probe urges the need to conceptualise two different but interrelated historical processes. The first of these processes refers to the trans-generational changes taking place over centuries, for example, the charting of the gradual shift from 'colonial science' characterised by the explorative spirit of the various survey departments established under the aegis of the colonial state for better extraction of natural resources to the era of national science, when inculcation of science became an expression of national urge spearheaded by indigenous cultural interlocutors in the public realm cutting across two-three generations. In this long chain of connectivities contingencies will indeed have a minor effect. The second process deals with generational

³⁶ Sanjoy Mukherjee, *William Carey's Contribution to Science*, Calcutta: Minerva Associates (Publications) Pvt. Ltd., 1999. Also see Sambit Mallick, 'Democratizing Scientific Knowledge through Building Scientific Institutions in nineteenth century India: The Sociology of Science Perspective', *Current Science*, vol. 90, no. 8, 25 Apr. 2006, pp. 1138-45.

history at the level of decades, i.e. it employs the generational perspective where individual intervention—say by Mahendralal Sarkar in the 1870s—might have a decisive impact. In the former trans-generational perspective, the gradual shifts by which science acquired the status of an ultimate referent, followed by its efflorescence at the turn of the century, will be seen ‘working its way into the tissues of time’. Here, in the long chain of interlocutors, Sarkar’s contribution and its significance is subsumed within the larger gestation, in the sense that he is one among the many. Yet, if these long-range processes suffuse generational history, they do not negate it. To contextualise the era of a national science through a focused study of the IACS, the generational perspective which will be the considered context and the dominant mode of probe and narrative in the second chapter, will be invoked.

Aspirations for a National Science: Mahendralal Sarkar and the IACS

Apart from a few cursory sketches, there has been no in-depth analysis of the way science was organised when the aspirations for a national science institution finally began to take shape in and around IACS. The nature and function of the association during the formative years reminds us how science became constitutive of nationalism itself. Its role was fundamental in creating a viable scientific community in India, which becomes readily identified, in the last quarter of the nineteenth century. Many among the first generation of scientists had their initial serious exposure at the IACS. The intellectual assessment of these men and the connectivities that they forged among themselves and with leaders of other realms will reveal their ‘group mentality.’ Thus, the delineation of the institutional history of the IACS will also entail sociological inquiries about the scientific community which constituted it.

The exercise of delineating ‘institutional histories’ is generally considered a lower grade of history writing as ‘it connotes a dry, superficial chronicle of persons and events.’ Despite this lacuna, as IACS became the basis of the formation of a community of scientists, a more focused study of this institution is imperative. Like a child, an institution is born in a milieu replete with expectations and, in the course of engaging with those expectations, it acquires a distinct personality and character of its own. In this regard it is demonstrable that the IACS was not just an institution but also a science movement in itself. Attempts at institutional histories too often lapse into vague, anecdotal, impressionist and cursory surveys, revealing little about individuals and the settings from which they emerge and on which they leave an indelible impact. The biography of IACS along with the connecting

biographical details of the men who constituted and embodied the aspirations of a non-dependent sovereign national science in this first native institution reveal the travails in the journey of science and the nation.

Information from Mahendralal Sarkar's voluminous diaries and their collation with his published articles and lectures is required to remedy the compartmentalised treatment accorded to him in almost all the biographical sketches that we have till date.³⁷ His diaries may lead us to other members with whom he interacted very closely.³⁸ Evidently, interweaving of insights from many biographies running parallel and intermeshing with each other when grounded in the institutional biography of the IACS itself, will allow the transition from the biographical to the prosopographical and the functionality of their connecting and converging ideas will emerge in bold relief along with their triumphs and failures.³⁹ Keeping the cultivation of science as a frame of reference it is important to locate the genesis of the IACS, both as an institution and as a movement, almost akin to a self-respect movement that despite being located in a colonial milieu, initiated, ensured and enabled a sustained process of the generation, transmission and reception of scientific ideas.

The delineation of the entwined biographies of Sarkar and his colleagues within the institutional framework of the IACS limits the efforts towards an intellectual assessment of Sarkar. IACS was only one manifest part of his larger vision. It is ironical that the shadow of an institution precludes the exploration not only of the larger utopia that its founder was chasing but also considerably reduces the intellectual canvas on which Sarkar dwelt. This thesis will demonstrate that it was much larger than is generally assumed. Encased in the IACS frame, Sarkar at best appears as the lynchpin and axis of the institution for whom the stewardship of the IACS was the most important mission. Though imparting science education in a rudimentary disciplinarian sense remained solely the activity of the IACS in its early phase, Sarkar endeavoured to project and propel it as a self-respect movement in

³⁷ See Sharat Chandra Ghose, *Life of Dr. Mahendralal Sircar*, Calcutta: Hahnemann, 1935; Pratik Chakrabarti, *Western Science in Modern India: Metropolitan Methods, Colonial Practices*, Delhi, Permanent Black, 2004; John Lourdaswamy, *Science and National Consciousness in Bengal 1870–1930*, New Delhi, Chennai: Orient Longman, 2004.

³⁸ Biographies of forgotten individuals like Gooroodas Banerjee, Father Eugene Lafont, Asutosh Mukherjee, and Chunilal Bose needs to be collated and juxtaposed to each other and to that of Sarkar.

³⁹ Though many biographical accounts of scientists are available, there is an urgent need to recast them with much more critical analysis, as most of them are quasi-hagiographical or at best they can be deemed as laudatory biographies which are an end in themselves. As a departure, the proposed biographical treatment will be a means to an end. It will be our endeavour to make it an aid for the deeper sociological understanding of the big question: why did science fructify in this particular cultural zone so rapidly at the turn of the nineteenth century? Our task will primarily be to assess the role of these cultural interlocutors in accounting for the plausible explanation for the efflorescence of science.

cultural terms—a self-critical cultural project of the natives and as a civilisational reply to the colonisers. Clearly, science for Sarkar was both a cultural value and a moral force.

In 1867, Sarkar declared his faith in homoeopathy. The following year we see him cornered and reprimanded, vulgarly criticised, castigated and finally thrown out of the Bengal chapter of the British Medical Association.⁴⁰ In these hard times, it was difficult for him to even retain his practice. It is intriguing but nevertheless true that in these very insecure years, he did two grand things: first, he founded a journal called the *Calcutta Journal of Medicine* in 1868; and secondly, in the following year, through the same journal he floated the idea of a national institution for the cultivation of sciences by the natives. One should pause and ask why in the first place, in such insecure times, he not only entertained such grand utopias⁴¹ but plunged head-on to realise these ideals by stepping out of the limits of his professional peer group to establish communication with the literati at large by directly addressing them? What intellectual and cultural concerns, commitment and conviction compelled him to tread such an uncharted path? What cultural conclusions did he reach in these two insecure years (1867-69) that led him to set for himself such ideals that subsequently became his lifelong mission?

It is in light of these questions that we lament the compartmentalisation of Sarkar's life and contribution into two neat categories: one, as a doctor of homoeopathic persuasion, and the other as a cultivator of science with an extraordinary scientific and rational bent of mind. Instead of probing the links between them, the former aspect of his existence is generally underplayed and the latter aspect is overemphasised and inflated. The lively and enduring links between his conversion into a new creed of medicine and his subsequent veering towards the foundation of a national science institution for the espousal of science as a moral force permeating every aspect of cultural existence needs to be emphasised. The chapter on Sarkar will act as a template on which the possibilities of a more nuanced and comprehensive biography of Sarkar can be predicated and realised.

⁴⁰ Mahendra Lal Sircar, *On the Supposed Uncertainty in Medical Science, and on the relation between Diseases and their Remedial Agents; being the Address in Medicine read at the Fourth Annual Meeting of the Bengal Branch of the British Medical Association, held on the 16th February, 1867*, Calcutta: Printed by P. Sircar, Anglo-Sanskrit Press, 1903 [This was a reprint of the 1867 address, with a new Preface and opinions of the press].

⁴¹ It should be remembered that the IACS was visualised in the image of the Royal Institution and the British Association for the Advancement of Science.

Science and Swadeshi: National Education and Universities, Self-Enterprise and Industrialism

The third chapter of this thesis attempts to contextualise the assimilation, naturalisation and domestication of science, technology and medicine within the ambit of science and swadeshi. The idea of National Education and the urge to reform colonial universities and establish new national universities and similar centres of learning became the hallmark of the early decades of the twentieth century. The deployment of debates around science and technology infused the discussion on indigenous industrialism and informed larger debates on National Education. Both science and science-based industrialism in complementarity with the Indian craft tradition characterised the swadeshi spirit. The political context of Swadeshi Movement in Bengal provided deeper cultural contexts to the proliferating science publications and institutions in the Hindi public sphere in the first two decades of the twentieth century.

The stamp of the ideals of swadeshi is clearly evident in various actors from different realms and profession. In fact, political leaders like Madan Mohan Malaviya⁴² and scientists like P.C. Ray underscored the compatible and reinforcing industrial potential of coupling science and swadeshi. P.C. Ray also hinted at the potential of such science-based industrialism to foster employment and entrepreneurship.⁴³ One can see the threads of Mahendralal Sarkar's thoughts and actions being retrieved, refined but being argued in a much more pragmatic and production oriented context of swadeshi and self-reliance.

The Maharaja of Mysore rearticulated Sarkar's vision when he underlined the role and vision of the Banaras Hindu University during the first convocation address as the Chancellor of the university. The aspiration and challenges before this new university and the wish to impart an open character to it from the very beginning was succinctly put before the

⁴² Madan Mohan Malaviya, *The Hindu University of Benaras: Why it is Wanted? And What it Aims At?* Allahabad: Printed by Panch Kory Mittra at the Indian Press, 1909. This pamphlet has three front pages including the title page, apart from the main text of 44 pages. The two pages following the title page are in themselves a testimony to the importance that this visualised university accorded to science and scientific education. It is clearly stated that it aims 'For the promotion of scientific, technical and artistic education combined with religious instruction and classical culture. The need for scientific education is most pressing.' Malaviya and his associates were astute enough to quote His Majesty King-Emperor, George V in order to legitimise and validate the emphasis which he wanted to accord to science and scientific education: 'Without a scientific foundation no permanent superstructure can be raised. Does not experience warn us that **the rule of thumb is dead and that the rule of science has taken its place**; that to-day we cannot be satisfied with the crude methods which were sufficient for our forefathers, and that those great industries which do not keep abreast of the advance of science must surely and rapidly decline.' (Emphasis original) [Extract from a speech by H.M. King-Emperor George V (when Prince of Wales) at the International Congress of Applied Chemistry, London, May 27th, 1909.]

⁴³ P.C. Ray, *Essays and Discourses*, With a Biographical Sketch & A Portrait, Madras: G.A. Natesan & Co., 1918 (1st edn.)

nation by the Maharaja. Presiding over the 1919 convocation, the then Chancellor explained that

in order to preserve and promote our distinctive civilization and culture and to instruct our youth in the sacred precepts of religion, it was necessary to build up an ideal University which would seek to combine the practical efficiency of the modern system of education with the high spiritual ideals of ancient India. Especially should we, Hindus, with our glorious past, beware of the temptation to confuse patriotism with blind adoration of ancient days, coupled with a feeling of repugnance for everything modern and foreign. *No nation is impoverished by commerce with other nations; no civilization can suffer by intercourse with other civilizations, and by an intelligent assimilation of the principles, ideas and practices that have proved to be beneficial to other peoples and countries. I trust therefore that the Benares University will gather the fruit of all ages and countries, will keep abreast of modern progress and will bring up her children to become healthy and strong and well-fitted to remould the destinies of India on sane, yet progressive, lines.*⁴⁴

In continuity with the spirit and activities of the IACS and the National Council of Education created by the Dawn Society group, the new articulated urge to establish residential universities by indigenous efforts where teaching and research could coexist to foster and strengthen industrialism gradually captured the imagination of the leadership.⁴⁵ The impact of swadeshi on enterprise and industrialism has been well documented.⁴⁶ The same spirit of science, swadeshi and industrialism was responsible for the creation of the Indian Institute of Science, Bangalore and the nationalisation of Calcutta University from within. J.N. Tata's vision of science and technology in India,⁴⁷ and Asutosh Mukherjee's role in converting the Calcutta University into an institution akin to a Humboldtian University were impacted by the same spirit of science and swadeshi. It was Mukherjee who brought C.V. Raman as Palit Professor to lead the Science Department at Calcutta University. The

⁴⁴ *BHU Convocation Addresses*, 17th Jan., 1919 by (Maharaja of Mysore) the Chancellor of the university and Sir P. S. Sivaswamy Iyer (the Vice-Chancellor of the University), Varanasi: Banaras Hindu University, 1919, pp. 5-6. Emphasis added.

⁴⁵ For a short and succinct account, see *The National Council of Education, Bengal: A History and Homage*, Diamond Jubilee, 1906-66, Calcutta: NCE Bengal, Jadavpur University, 1968. Also see Amitabha Mukherjee, *Fifty Years of National Education: The Story of An Experiment 1906-1956*, Calcutta: National Council of Education, Bengal, 1992.

⁴⁶ See Amit Bhattacharyya, *Swadeshi Enterprise in Bengal, 1900-1920*, Calcutta: INA Press, 1986; Amit Bhattacharyya, *Swadeshi Enterprise in Bengal, 1921-1947*, Kolkata: Setu Prakashani, 2007.

⁴⁷ J.N. Tata's early engagement with scientific and technical education and research becomes intelligible only if one grasps that he was one of the perceptible minds that understood the basic requirements and tenets for industrialisation in India. He stated three basic ingredients for its early realisation. 'Steel was the mother of heavy industry. Hydro-electric power the cheapest energy to be generated, and technical education coupled with research was essential for industrial advance.' (See R.M. Lala, *The Creation of Wealth*, Bombay: IBH Publishing & Co., 1981, p. 6; see also the first four chapters.) TISCO at Jamshedpur (1907), The Tata Hydro-Electric Power Supply Company at Bombay (1910), and the Indian Institute of Science at Bangalore (1911) bear testimony to his efforts, understanding, and entrepreneurial acumen.

lessons learnt by Mukherjee at IACS allowed and aided him to provide a firm foundation to the Science Department at Calcutta University. He creatively transcended the Curzonian frame to impart science research a dynamism of its own within the university framework. As a teacher and researcher of mathematics at IACS, he remained in personal contact with many young and aspiring students of science and mathematics and, later, as an influential Vice Chancellor and legal luminary, he arranged for their higher studies abroad and persuaded them to join the Science Department at Calcutta University.⁴⁸ Besides C.V. Raman, M.N. Saha and S.N. Bose were the other initial beneficiaries of Mukherjee's reorganisation of science teaching and research at the Calcutta University.⁴⁹ Mukherjee was also instrumental in the formation of the Indian Science Congress Association (ISCA) in 1914. The Science Congress went from strength to strength in the sense that beginning with a membership of 60 scientists in 1914, the ISCA expanded to 300 members in 1916 and 360 members in 1920 increasingly becoming articulate and assertive about the role of scientists as a community—not only in the dissemination, application, administration and control of matters pertaining to science but also in addressing wider national problems.⁵⁰

The idea of self-reliance was as forcefully articulated by the emerging savants of science, as by those who critiqued the Raj's political and economic imperatives. The marriage of science and self-reliance gave more concrete meaning to nationalism.⁵¹ Though swadeshi could not continue as a movement for long, its legacy in different shades remained among the men nurtured in that ethos. It should not be forgotten that many famous luminaries of Indian science who, after the 1930s, spearheaded one institution or the other, had spent the

⁴⁸ Kankan Bhattacharya, 'Sir Asutosh and the Rise of Modern Science in India', *Indian Journal of History of Science*, vol. 50, no. 3, 2015, pp. 420-28.

⁴⁹ Aspects of interconnected histories of Banaras Hindu University, Aligarh Muslim University, Calcutta University and Indian Institute of Science provides further strength and depth to the idea of science, swadeshi and industrialism.

⁵⁰ In the context of the formation of Indian Science Congress Association (ISCA), a perceptive historian (perhaps Roy Macleod) had once remarked that with its foundation, India had attained its independence. Rhetoric apart, this statement does carry some grain of truth in it. The organised scientific community increasingly came to terms with the Nationalist political policy makers. So much so that the first National Planning Committee (1938) had conceded a considerable role of leadership to the nationalist scientists in formulating and charting out a long-term agenda of national growth and regeneration. Meghnad Saha's journal *Science and Culture* recurrently articulated this new spirit and role of the scientific community in unambiguous terms. The journal emerged as a debating platform where the interaction between science, politics, and society took place, but in a very subtle and persuasive manner the tenor of the journal argued for a greater role for scientists in every walk of life. Increasingly, the debates and arguments were presented in such a manner so as to resolve the debate in favour of the scientific community so that the quantum of space it carved for itself in the technological, industrial and economic development of India increased considerably.

⁵¹ *Report of the Industrial Commission (1916)* with *Malviya's dissent note* can be regarded as the certificate of the compact between science and self-reliance alluded to. *Report of the Indian Industrial Commission, 1916-18*, London, 1919.

formative and youthful years of their life in the swadeshi ethos. It is not incidental that M.N. Saha, P.C. Mahalanobis and S.N. Bose who were born in almost the same year started their career in physics and, except for Bose who remained in basic science, one went on to become a science organiser and administrator par excellence, and the other a planner par excellence.

The gestation and genesis of the Indian Institute of Science also underlines the contribution of the house of Tatas towards higher education in India. J.N. Tata's industrialism and his understanding of the contradictions of colonial system of higher education propelled him towards a vision of a full teaching and research university. Science and industrialism were important components of his vision. In the then prevailing colonial context, Tata acquired the insight to create endowments for nurturing talents by providing them scholarships to study abroad for acquiring higher professional competence and standards. This became the starting point for Tata's engagement with higher education in India. Due to colonial constraints and impediments and despite Tata's notion of constructive philanthropy to create a university of excellence what emerged was a much-truncated institution. In line with Asutosh Mukherjee's efforts, Tata's nationalist aspiration and industrial vision desired for a full-fledged teaching and research university, but what came into being through Curzonian colonial intervention was a much-truncated science institute at Bangalore called the Indian Institute of Sciences.⁵²

Apart from the vision and aspiration of such national institutions, various individuals worked at different levels to set up amateur and professional institutions and industries. The idea was to popularise swadeshi and science based industrialism among the common masses of various districts, small towns and among rural villages. As a manifestation of the spirit of swadeshi, publication of scientific magazines, journals, articles and literature in the Hindi public sphere also proliferated by the 1920s and 30s. Publication of textbooks on science and industrialism in Hindi along with swadeshi directories, advertisements and poems that portray the spirit of swadeshi and science became a marked feature of the Hindi public sphere in the first three decades of twentieth century. The institutional efforts made by institutions like the Vigyan Parishad, Prayag acquires significance.⁵³

⁵² See B.V. Subbarayappa, *In Pursuit of Excellence: A History of the Indian Institute of Science*, New Delhi: Tata McGraw Hill Publishing Company, 1992; P. Balram, 'The Indian Institute of Science: Reflections on a Century', *Current Science*, vol. 96, no. 10, 2009, pp. 1404-11.

⁵³ The Dawn Society and its magazine which shaped the idea of National Education Council had a much wider scope and concrete institutional aim of National Education where science and swadeshi figured prominently.

Coeval to the vernacularisation of languages, the innumerable instances of rendering textbooks and popular books on science, technology and medicine in the vernacular (here it is Hindi) also reveal the efforts towards popularisation of science and skill based ‘everyday technologies’.⁵⁴ These tracts and their authors sought to create favourable opinion towards the products made through the deployment of science and skill based low cost everyday technologies. Along with products from Indian craft traditions, a new range of swadeshi products was to emerge from these science-based everyday technologies to act as a comforting factor for Indian consumers for whom imported products were unaffordable. This advocacy of the swadeshi spirit of science and production based upon it opened up alternative ways of replacing similar popular products of European everyday modernity.

This was true not just for the urban context and milieu but science was to inform the basic productive process and the larger activity of agriculture as well. It is not incidental that hitherto unknown individuals like Shri Sukhsampatti Rai Bhandari, Pandit Tejshankar Kochak, Shri Shankar Rao Joshi and Shitala Prasad Tiwari were promoters of science-based, small-scale interventions and initiatives in agriculture. They wrote numerous science-based tracts and books in Hindi propagating novel and scientific ways of negotiating agricultural practices.⁵⁵ The array of such publications presented by the authors of these tracts catalysed and strengthened the modern ‘nation in the making’.

Erudite and appealing teachers like Prof Mahesh Charan Sinha, Prof Phuldeo Sahay Varma, Dr Nilhalkaran Sethi, Dr Gorakh Prasad, Dr Satyaprakash, and Dr Braj Mohan and publicists and popularisers like Shri Lakshmi Chand were engaged in negotiating science and modernity imbued as they were with the spirit of science and swadeshi. These savants of science attempted to author, publish and propagate books on various aspects of science in Hindi to be used by students and teachers. They were trying to forge a sustainable and swadeshi way of negotiating modernity. For instance, Prof Phuldeo Sahay Verma did not just author a textbook in general chemistry but he also deployed his knowledge of chemistry in negotiating agriculture and ceramic crafts in search of new alternatives and sustainable swadeshi. The coupling of science and swadeshi can be seen in negotiation with the impinging European modernity but on their own terms.

⁵⁴ David Arnold, *Everyday Technology: Machines and the Making of India's Modernity*, Chicago: The Chicago University Press, 2013.

⁵⁵ Sandipan Baksi, ‘The Hindi-Speaking Intelligentsia and Agricultural Modernisation in the Colonial Period’, *Review of Agrarian Studies*, vol. 6, no. 2, 2016, pp. 98-122.

These men were professionals in their own right and were instrumental in creating a science community. Through their multiple and interventionist roles as educators, propagators and popularisers, they paved way for negotiating industrial European modernity through the spirit of science and swadeshi. In this sense they can be regarded as modernisers of India. For them the engagement with science was not just for science's sake, but it was seen as a powerful cultural referent and productive intervention in the larger quest of modernity. Such propagators of science and swadeshi targeted to bring in alternative ways of science based production and tried to perpetuate an industrialism that was sustainable in the Indian context. This new industrialism was in affinity with Indian or swadeshi craft tradition as it was imbued and suffused with the spirit of science and swadeshi. Swadeshi as a common factor also implied that science and technology were in affinity to craft and there was no hiatus in craft and science *per se*. Clearly craft was amenable and conducive to science and technology for champions and propagators of this new industrialism in the 1920s and 1930s.

The search for identity and strength through the cultivation of science and focus on the mother tongue as an aspiration and articulation of the swadeshi spirit by scientists and cultural interlocutors constitutes the basic thrust of the first half of the twentieth century and parity in the domain of science and strength in terms of self-reliance of the nation were at the centre of discussions among scientists. The underpinnings of differing shades of swadeshi and industrialism both at local, regional and national level also acted as a template for the animated and contested discussions on ideas of planning the nation from late 1930s onwards.

Indian Planners and Planning 1930s to 1960s

The larger context of worldwide Economic Depression of early 1930s and the Asian decolonisation process of the late 1940s and early 50s is important to critically contextualise the Indian or South Asian case of development planning and the protagonists involved with it. In the overarching context of the Second World War, the various strands of the idea of planning and reconstruction that impinged on the idea and nature of the anticipated and yet to be realised nation state was in the vortex of discussion during the 1940s.⁵⁶

Prior to the advent of the sovereign nation state the engagement with the idea of planning and development from within the national movement and also as it was understood,

⁵⁶ Benjamin Zachariah in his essay 'India: The Road to the First Five Year Plan' has perceptively and rightly remarked that 'A longer history of the developmental imagination in India, or indeed of the transition from the colonial State to the independent Indian State needs to be far less respectful of the apparently crucial date of 1947, and far more attentive to the trends that emerged during the Second World war and continued into the 1950s.' See Benjamin Zachariah, 'India: The Road to the First Five Year Plan', in Sekhar Bandyopadhyay (ed.), *Decolonization and the Politics of Transition in South Asia*, New Delhi: Orient Blackswan, 2016, pp. 199-227.

articulated and attempted by the colonial state as a postwar promise, perforce brought in its ambit scientists, technocrats, economists, administrators and political leaders and interlocutors. Beginning from the late 1930s, several plans were floated by various groups of protagonists. Science and technology and their relationship with planning, development and reconstruction in augmenting and enhancing production and reducing poverty were invoked from various vantage points. The Indian community of scientists and technocrats interacted intensely with the emergent community of economists. The idea of planning and development provided a new intellectual context to the entire nationalist articulation and complicated the imaginings of India simultaneously widening the horizons of Indian nationalism.

Foremost among the Indian scientists non other than M.N. Saha and, one of the most celebrated engineers and administrators of India, Sir Visvesvaraya were the protagonists who were instrumental in initiating debates on the need, efficacy and role of planning for India's anticipated future.⁵⁷ It was understood that without this exercise of planning indulged in and interpreted by experts, here certainly nationalist experts, the economic programme and goals articulated by Indian National Congress were not to be realised. The formation of the National Planning Committee (NPC)⁵⁸ in 1938 and all the twenty seven plus (27 plus) NPC subcommittee reports submitted on various themes of importance for the reorganisation of the modern nation state were geared towards achieving productive, prosperous and equitable national life. The NPC subcommittees were constituted and headed by experts from nationalist ranks to forge a consensual policy framework for various strategic and sectoral themes regarding the overall reorientation and reorganisation of national life.⁵⁹

With the advantage of hindsight, a survey of the decades of the 1930s and 40s brings a glaring fact to the fore. In the then prevailing milieu of competitive politics characterised by both mass mobilisation and pressure tactics of the constitutional variety, the plethora of plans that were floated in public for nation building as constructive expressions of nationalism had gathered enough publicity, inertia and momentum of their own and were manifestly able to wrest whatever little credibility the colonial state had and whatever little it had to offer as constructive imperialism. The phase of transition had begun by the 1930s, and by the mid

⁵⁷ M. Visvesvaraya, *Reconstructing India*, London: P.S. King & Son, Ltd., 1920; M. Visvesvaraya, *Planned Economy for India*, Bangalore: Bangalore Press, 1934, p. 3. Within two years, the second print came out in March 1936 with an enlarged index. The main content of both editions remained the same.

⁵⁸ *Subhash C. Bose Pioneer of Indian Planning*, New Delhi: Planning Commission, 1997.

⁵⁹ K.T. Shah, *Report: National Planning Committee*, Bombay: Vora & Co., 1949.

40s, independence was in sight. After the constitution of the expansive NPC by the Indian National Congress the development discourse was in the process of acquiring a shape of its own and, in no way, was it to be outmaneuvered and overshadowed by the colonial state's promise and 'advertisement of post-war reconstruction in India.' Despite the contentions and disunity of discourse that the plethora of plans created, the debates fostered by the nationalists had scored over the belated response of the colonial state where planning figured essentially as the 'essence of post-war developmental' promise. In this context it is important to situate the reflex, response and role of the maturing scientific community, the community of economists, and industrial and business leaders along with the political leadership of the national movement in the development discourse of India.

A number of intellectuals cutting across varying political persuasions expressed their views on how independent India should look like—from Sir Visveswaraya, Acharya P.C. Ray, P.C. Mahalanobis, M.N. Saha down to S.S. Bhatnagar. The older concerns and priorities of the Swadeshi days were recast in the wake of the NPC's constitution. The debates it fostered, among politicians, economists, industrialists and scientists saw the reworking of debates of the swadeshi era in the unfolding industrial and technological context of the Second World War and its aftermath. The spirit of the nation was now to be translated into goals and objectives of the nation-state. A great deal of scholarly analysis has been done about planning and development predicating upon economists' opinion and utilising their conceptual categories and tools, but the concerns, priorities and stakes of the scientific community cannot be contextualised without its juxtaposition to that of industrialists, economists, other political interlocutors and propagandists.

As the form and content of science and technology changed considerably after the 1930s,⁶⁰ their linkage to the larger political economy requires adequate scrutiny. In the Indian context, this analysis can be attempted only if we situate ourselves at the interface of scientists, politicians, economists and industrialists, as occasioned by the development discourse in the 1930s and 40s. The context of the genesis of two institutions the CSIR and

⁶⁰ Saha hinted at the departure from the low cost amateurish science to a more industrially alive and goal oriented scientific activity. In his words 'Even "pure" science, it is generally admitted now, subserves directly or indirectly human and social needs the expression "science for science's sake" like the sister adage "art for art's sake" is fast passing out of the vocabulary of those who have looked into the genesis, history and future of both science and art. Not that scientific research cannot and should not be carried out with the interest centred chiefly in itself but it is fallacious to think that, for this reason, it is objectively dislodged from the social framework in which the work is proceeding. As is known, even the recent developments in theoretical physics have had their repercussions on our philosophical and social concepts.' [M.N. Saha, Unsigned Editorial, *Science and Culture*, vol. 2, 1937, p. 529. Also see, Santimay Chatterjee (ed.), *Collected Works of Meghnad Saha*, vol. 2, Published by Saha Institute of Nuclear Physics, Kolkata and Orient Longman, Calcutta & Delhi, 1986, p. 305.]

the Planning Commission acquires significance in this regard.⁶¹ The history of the CSIR and of the Planning Commission allows one to interrogate and perhaps appreciate the developmental process better.

With the outbreak of the long drawn Second World War, the NPC led massive exercise of planning was hampered. It was further impeded due to the Quit India Movement and its consequences. The Second World War and the political developments in India in the 1940s were critical to the final demise of the structure of formal empire from South Asia and the emergence of the sovereign Indian nation state. The Indian polity of the 1940s in general and the Indian scientific community in particular were reshaped by this total war. The colonial state caught in the vortex of war was forced to promise and present the constructive facet of imperialism in the sense that, in 1944, the Government of India itself created a Department of Planning and Development under the leadership of Sir Ardeshir Dalal as member of the Viceroy's Council of Ministers. The promised purpose of this new department was to plan for the reorganisation of the Indian economy through industrial development. The decade of 1930s to 1950s provides the occasion to draw from the interface of scientists, industrialists and economists as planners both from the nationalist camp and from the side of colonial state.⁶² The interplay of contestations and convergences of various shades and orientation from within these two larger camps can be critically analysed only if the context of the changing nature and scale of science organisation is kept in mind. The Second World War was a spectacle par excellence for the shaping, organisation and demonstration of Big Science, and in public perception, the distance and distinction between science and technology stood blurred much more than ever before⁶³. Both massive machines and mini and micro technological artifacts become embodiment and representative of the strength of science. Big science and technology were to be harnessed in planning the future development of the decolonised nations. The independent Indian state under Nehru's leadership soon embarked on such a path. Indian planners and scientists were of the view that real decolonisation would usher in political freedom that could also translate into economic upliftment. This could be realised and made sustainable only if leapfrogging was made

⁶¹ For a history of these institutions see N.R. Rajagopal, *The CSIR Saga: A Concise History of its Evolution*, vol. 1, Publications and Information Directorate, 1991.

⁶² In 1944 itself, and thereafter, many meaningful plan proposals for India from various groups were floated for the consumption and cognition of the colonial state and the public. A group of successful and highly accomplished industrialists of mainly Bombay presented what came to be known as the Bombay plan. On behalf of the labour groups, under the leadership of M.N. Roy the People's Plan was presented while the Gandhians too soon formulated their ideas of planning.

⁶³ For the impact of Second World War on science, see Guy Hartcup, *The Effect of Science on the Second World War*, Palgrave Macmillan, 2000.

possible with the fostering of frontier areas of big science and technology like nuclear science and space science, on the one hand, and application of plant genetics to plant breeding and agriculture, on the other. Big science and the exercise of planning were to bind and unite the nation. All of this took place within the political dynamics and matrix of the Cold War that involved realignments in the world order.⁶⁴ Cold War also meant secrecy, which redefined the science internationalism of yesteryears and complicated the question of national identity. The impact of these emerging contexts of the new world order on Indian scientific community and the larger organisation of science and technology in India for leapfrogging and strengthening its developmental goals and agendas through scientific and technological progress and achievement was immense and the Government of India lost no time in constituting a committee on scientific manpower.⁶⁵

The significance of the historic ‘Science Policy Resolution’ (SPR, 1958) of independent India has been alluded to. SPR captures the essence and ethos generated by the entire science movement of India. This document acted as a *preamble* providing broad guidelines for the ways science and scientists were expected to serve the nation state and society at large and legitimised and mandated scientists to take part in national development. In light of this resolution, the Government of India pledged to offer ‘good conditions of service to scientists and accord(ed) them an honoured position, by associating (them) with the formulation of policies.’⁶⁶

The organisation of Big science and the emphasis on import substitution within a compressed period of time compelled the nation-state to drift away from the amateurish curiosity driven science which was in alignment to craft and had the potential to create diversified everyday technologies as a basis for welfarism and employment. For instance, the advocacy of wage goods model of manufacturing being argued by a group of economists and planners chief among them being C.N. Vakil and Brahmanand was never given a chance. The small was beautiful but the big was a spectacle and in their partnership was the future of India. That future is yet to be realised in India.

⁶⁴ Gabrielle Hecht and Paul N. Edwards, ‘The Technopolitics of Cold War: Towards a Transregional Perspective’, in Michael Adas (ed.), *Essays on Twentieth Century History*, Philadelphia: Temple University Press, 2010, pp. 271-314.

⁶⁵ *Scientific Man-Power Committee, Interim Report*, New Delhi: Printed by the Manager, Govt. of India Press, 1947. Also see *Report of the Scientific Man-Power Committee*, August 1948, New Delhi: Printed by the Manager, Govt. of India Press, 1947.

⁶⁶ *Science Policy Resolution of Government of India*, 4th March 1958, p. 2.