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In the end, I take complete responsibility for all mistakes in this thesis.

**Dhrub Kumar Singh**

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## Abbreviations

BHU	Banaras Hindu University
BNC	Bengal National College
BTI	Bengal Technical Institute
BSIR	Board of Scientific and Industrial Research
CJM	<i>The Calcutta Journal of Medicine</i>
CSIR	Council of Scientific and Industrial Research
IACS	Indian Association for the Cultivation of Science
IISc	Indian Institute of Science, Bangalore
INC	Indian National Congress
IJHS	<i>Indian Journal of History of Science</i>
ISCA	Indian Science Congress Association
NCE	National Council of Education
NPC	National Planning Committee
SPTE	Society for the Promotion of Technical Education

## Preface

This thesis deals with the entwined journey of science and the Indian nation from 1850s to 1960s. Broadly speaking, it was undertaken in quest for self-reliance by Indian cultural interlocutors, scientists and nationalists. The journey was one of considerable 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 started much earlier than the midnight of 15<sup>th</sup> 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 continues. The reforms that began somewhere in the mid nineteenth century and the subsequent long-drawn journey emphasised the inculcation of the new knowledge i.e. science. Reformers of all hues and persuasion all through 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 the nineteenth century, the cultural and industrial importance of science began to be acknowledged and addressed by various reformers and cultural interlocutors.

From the eighteenth century onwards, the journey of India and Europe was an entwined journey. It is almost a truism that in the west modern science first reached its ‘walking and talking’ stage in about 1700 and only in about 1800 did it show signs of adolescence. This was the precise temporal phase when the British were trying to gain a foothold on 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 many cultural realms whose ideas converged and underscored the need to usher science and a scientific spirit into Indian society.

In this thesis, the place and significance of science in the phase of ‘cultural encounter’ that unfolded in the nineteenth century colonial milieu and 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 from the 1850s to 1960s have been documented and discussed. This enquiry entails and includes investigation into aspects of the nature and modes of knowledge production, distribution, and communication pertaining to science and their impact on Indian reformers, cultural interlocutors and society. The protagonists working both at national and regional levels have been brought within the ambit of historical inquiry. The thesis includes in this survey and analysis the impact of modern science on the emerging literati otherwise called the ‘Bhadralok’ at Calcutta—one of the most animated sites of this cultural encounter. It was here that the idea of a national science was mooted and articulated in the 1870s and the urge to cultivate and inculcate science became constitutive of nationalism itself. Similar ideas, concerns and their articulation are discerned for other regions as well, but even if that does not disapprove anything and remains compatible and complementary to the Bengal experience, it does provide us the opportunity to bring within the historical ambit the compulsions, concerns, contradictions and accomplishments of the protagonists and actors of other regions and linguistic groups.

The men who engaged with the question of science are not referred to as ‘scientists’ as this professional category in the early decades of the nineteenth century was still in the making both in India and England. In the Indian context they must be understood in a broader sense as cultural interlocutors and their espousal of ‘rationality’ and engagement with science is captured and documented within the larger 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 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 many realms of existence in India.

This research further chalks out aspects of social history of science and science institutions for almost a century, not 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 the changing economic context and dynamic social world. The contradictions of their time are not erased or flattened to make them exemplary role models but rather stand highlighted. As the men associated with science did not constitute a very large community, the use of collective and contemporaneous biographies with all their connectivities and dissensions has helped to explore their intellectual 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. In a sense, by moving from individual biographies to a prosopographical perspective, the thesis attempts 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’.

The nineteenth century cultural encounter, with science as a cultural referent, occasioned the assessment of traditions and their diversities. This paved the way for 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 India National Congress (INC) in 1885, political reforms began to be debated and demanded. This merged with the ongoing social and cultural reforms and strengthened 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’, the narrative is focused on those aspects of the struggle which endeavoured to establish native institutions outside the colonial pedagogic structures. This has been demonstrated through a rigorous biography of Mahendralal Sarkar, and the institution he founded, the Indian Association for the Cultivation of Science (IACS) that still survives and thrives today. In this critical assessment of the cultivation of science, the narrative further alludes to the delayed organisation of science teaching and research at the Calcutta University *per se*. In this context an appreciation of Asutosh Mukherjee’s role in organising science teaching and research at Calcutta University has been included in a chapter within the larger rubric of science, swadeshi and industrialism.

Drawing from a gamut of available literature the thesis underscores those common concerns which provided an intellectual and cultural background for Sarkar’s engagement with the idea of a national institution for the cultivation of science. Similarly, it is known that Ramendra Sunder Trivedi and Rabindranath Tagore were fostering literature on science and science teaching through the mother tongue and extended their support to the *Bangiya Sahitya Parishad* and the National Council of Education in this regard. As a background to

these initiatives that unfolded at the turn of the nineteenth century and continued in the twentieth century, the narrative attempts to plausibly explain Mahendralal Sarkar's connections to Akshay Kumar Dutt's ideas and to those of Rajendralal Mitra, and how close the rationalist-Sanskritist Vidyasagar was to Akshay Dutt. Through such intellectual and social connectivity, the context of the complementarity that sustained science as a cultural and social referent is explicated and explained. Though '[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.'<sup>1</sup> This thesis contends that it is possible to redress the dismissive '*maybe*' by exploring the role of those cultural interlocutors who anchored their social vision on science. The contestations and articulations of the men associated with science and its cultivation both in the disciplinarian sense and also as a moral force is explored and analysed. Science as a moral force, a value and temperament allows us to understand various shades of nationalisms in a more rigorous fashion.

Science was a cultural referent for reforms and also an important ingredient of industrialism. Science and industrialism were constitutive of nationalism and nationalism was a factor in the quest for modernity. Clearly the Indian quest for modernity became a national quest and the quest for science also became a significant factor in negotiating modernity and the promise it held. Therefore, the questions regarding science and the nation became intimate cofactors in the larger quest for 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. In the Indian context, pervasive colonialism and an overarching colonial state within the larger empire and imperium complicated this formulation. The emerging national movement that challenged colonialism added to the complications but science remained an important factor nevertheless.

In light of the broad ideals articulated by the Indian national movement the new emergent sovereign Indian nation state was to be a welfare state. For this welfare state, science was again a promising factor to discuss and usher in change. It was understood that the inculcation of science and scientific temperament was economically and socially liberating. The pursuit of science did not depend upon ascribed status of caste, as science was

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<sup>1</sup> Sumit Sarkar, 'The City Imagined: Calcutta of the 19<sup>th</sup> and early 20<sup>th</sup> centuries', in *Writing Social History*, New Delhi: OUP, 1997, p. 160; emphasis added.

the new open knowledge. The distinction between knowledge, which was a prerogative of a few castes or sects, and open knowledge that elicited, attracted and invited anyone to its domain was important. The urge to inculcate science within the new universities by native intellectuals was part of the larger quest for modernity, as these institutions were the new sites and symbols of knowledge inculcation, production and dissemination of science.

The early part of the thesis presents the broader phenomena of science becoming a cultural referent and the efforts to create scientific institutions for the cultivation of science in late nineteenth century Bengal as entry to other regions. It recounts aspects of a century-long process by and through which western science became a new moral force, a cultural and social referent, a way of organising economic life and an active ingredient of industrialism. It sheds light on the efforts of individuals who founded institutions to foster science. The documentation also provides context to the claim of parity by Indian scientists from the early decades of the twentieth century. It takes into account the efforts of propagators of science based everyday technologies and links all these efforts to the aspirations and goals of swadeshi and self-reliance. The narrative explores some of the forgotten and unknown protagonists of the first half of the twentieth century who imbibed, radiated and reinforced the spirit of science and swadeshi by initiating science writings in Hindi. Their efforts enhanced and ensured accessibility to science for students, local entrepreneurs and the general public of the Hindi-speaking sphere that geographically and demographically constituted a large part of the subcontinent. Among science writers, including teachers and amateur entrepreneurs in Hindi of this period, were hitherto unknown individuals like Mahesh Charan Sinha, Lakshmi Chand, Pandit Tejshankar Kochak, Shankar Rao Joshi, Shitala Prasad Tiwari, Phuldeo Sahay Varma, Nihalkaran Sethi, Mukund Swarup Verma, Gorakh Prasad, Satyaprakash and Braj Mohan to name a few.

In recounting the entwined journey of science and the Indian nation, aspects of the thesis that focus on the first three decades of the twentieth century highlight the mediation of the spirit of science and swadeshi along with the struggle for the quest for self-reliance by Indian scientists that was raised and realised at various fronts. The continuous and creative process of the cultivation of science in India merged with the larger quest for National Education. Cultivating science through the mother tongue figured prominently in the aspiration for National Education in the opening decades of the twentieth century. Both colonialism and nationalism provided the broader context for this journey of science and the nation. This thesis also documents instances of such individual and quasi institutional efforts

that aided, supported and sustained the proliferating publication of Hindi tracts on science, technology, and medicine. It examines the compilation of swadeshi directories and advertisements extolling and canvassing for new swadeshi products of everyday use and of crafts that produced compatible and affordable daily use commodities. The narrative also discusses and documents print culture in the vernacular by tapping songs and poems in the form of *bhajans* and *ghazals* by noted regional and local poets that vividly portray and invoke the spirit of swadeshi, science, craft and Indian industrialism in the first three decades of the twentieth century.

These protagonists 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 science was not just for science's sake but was a powerful cultural referent and productive intervention in the larger quest of modernity. It is not incidental that many of these propagators of science and swadeshi targeted to bring in focus alternative ways of science-based production and tried to perpetuate such industrialism which could be sustainable in the Indian context. This new industrialism was in affinity with the Indian or swadeshi craft tradition. As this new industrialism was imbued and suffused with the spirit of science and swadeshi, and swadeshi being the common factor by implication, the other factor i.e. science and technology was also to be in affinity to craft and there was no hiatus in craft and science *per se*. Clearly craft and everyday technologies were amenable and conducive to science and technology for the champions and propagators of this new industrialism in the 1920s and 1930s.

In the last part of the thesis and within the rubric of planning and planners aspects of development discourse and reconstruction with its bearing on science organisation is touched upon and spans the period from 1930s to 1950s. Thematically speaking the larger context of worldwide Economic Depression of the early 1930s and the Asian decolonisation process of late 1940s and early 50s help to critically contextualise the arguments, debates and discussions initiated by the Indian political leadership and the intelligentsia for the case of development planning. In the overarching context of the Second World War and, from within the decades of the 1930s and 40s, the sovereign Indian nation state emerged and it is in these years that the protagonists of the idea of planning could wrest attention and were able to draw on a rich harvest of discussions and contentions. This aspect of the narrative in the thesis

documents and delineates the various strands of the idea of planning and reconstruction that impinged on the notion and nature of the anticipated and yet to be realised sovereign nation state.<sup>ii</sup> The engagement with the idea of planning and development from within the national movement and also as it was understood, 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.

The narrative regarding science and reconstruction from 1930s to 1950s anchors and takes its cue from the fact that foremost among Indian scientists non other than M.N. Saha and, one of the most celebrated engineer and administrator of India, Sir Visveswaraya were instrumental in initiating debates on the need, efficacy and role of planning for India's anticipated future. 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 the INC would not be realised. This narrative also documents the formation of the National Planning Committee (NPC) in 1938<sup>iii</sup> by the initiative of Subhash Chandra Bose and critically analyses aspects of its thrust areas by gleaning from the twenty six NPC subcommittee reports that were submitted on various themes of importance for the reorganisation of the modern nation state geared to achieve productive, prosperous and equitable national life.

In the years between 1938 and 1950, the idea of planning assumed great importance. The anticipated proximity to political self rule made planning a contested idea. In the post-Depression era, this contested idea compulsorily provoked political parties, political analysts, intellectuals including scientists and industrialists of the era. These groups responded and passionately participated in the ongoing debate on the nature of planning in India. Various plans were proposed, published and propagated through print.

After the constitution of the expansive NPC by the INC the development discourse was in the process of acquiring a shape of its own and, in no way, it was to be outwitted, outmaneuvered and overshadowed by the colonial state's promise and 'advertisement of post-war reconstruction in India.' The discourse of development, planning and reconstruction

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<sup>ii</sup> 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.

<sup>iii</sup> *Subhash C. Bose Pioneer of Indian Planning*, New Delhi: Planning Commission, 1997.



mooted by the nationalists had scored over the belated response of the colonial state where planning figured as the ‘essence of post-war developmental’ promise. This narrative attempts 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.

As the form and content of science and technology changed considerably after the 1930s, their linkage to the larger political economy requires adequate scrutiny. In the Indian context, this analysis can be attempted, it is argued, only if we situate ourselves at the suggested interface of scientists, politicians, economists and industrialists as occasioned by the development discourse in the 1930s and 40s. An understanding of the genesis of at least two institutions, the CSIR and the Planning Commission is instructive in this regard and allows one to interrogate and perhaps appreciate the developmental process better.

The outbreak of the Second World War and the political developments in India in the 1940s were critical to the final demise of the structure of the 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 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 the colonial state. The interplay of contestations and convergences of various shades and orientation from within these two larger camps has been critically analysed and documented.

The Second World War was a technological spectacle and had a great role in the shaping, organisation and demonstration of the power of BIG SCIENCE. In the aftermath of the Second World War, in public perception, the distance and distinction between science and technology stood blurred much more than ever before. Both massive and micro or mini technological artifacts become embodiments and representatives of the strength of new instrumentation based science and technology. Big science and technology were to be harnessed in planning the future development of decolonised nations. The independent Indian state under Nehru's leadership would soon embark 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 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. Together they were to catalyse the productive potential of the nation. All of this was to take place within the political dynamics and matrix of the Cold War that involved realignments in the world order. Cold War also meant secrecy, which redefined the science internationalism of yester years and complicated the question of national identity. The impact of these emerging contexts of the new world order on the 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 to be dealt with within the planning process.

The intellectual exercise of planning initiated by the INC tried to remain sensitive to and also focused upon those foundational and fundamental work that was to be done not only at the epistemological level, but also of innovations that were to be brought at the institutional level to facilitate industrial research in particular. Research in various aspects of applied science was emphasised. These were often to be carried out under the most trying circumstances. In our narrative, a life in physics or a life in chemistry or for that matter a life as an economist remains juxtaposed to and subsumed within national life in totality, lived in the then milieu of intellectual ferment impacted upon by the demands of the new welfarist nation state. A life in physics or chemistry is remoulded and recast as a planner and organiser of science and is impacted by the entire gamut of political, social and economic factors that sustained such endeavours. This will bring Subhash Bose, Nehru, Saha, Mahalanobis and Bhatnagar within the intellectual contours of planning.

The historic ‘Science Policy Resolution’ (1958) of independent India encapsulates the essence and ethos generated by the entire science movement in India. This document acted as a *preamble* providing broad guidelines for the ways science and scientists were expected to serve the national sovereign welfare state and the society. In light of this resolution, the Government of India offered ‘good conditions of service to scientists and accord(ed) them an honoured position, by associating (them) with the formulation of policies,’<sup>iv</sup> and this is attested by the larger role scientists acquired and played not only in organising science but also in planning the nation.

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<sup>iv</sup> *Science Policy Resolution of Government of India*, 4th March 1958, p. 2.