

SCIENCE AND CULTURE UNDER COLONIALISM: INDIA BETWEEN THE WORLD WARS

JAGDISH N. SINHA *

(Received 25 September 2003)

The paper seeks to study the relation between science and culture in India between the two World Wars. It examines the nature and consequences of the interaction between the two in the background of India's history. India was a British colony at the time but she was then fighting to be free. In this, while science and culture were used as tools by both the rulers and the ruled, Indian culture and scientific tradition came in direct conflict with those of the West. Though this was inevitable from the beginning and manifested itself in many ways, it entered a crucial phase between the World Wars when it became subtle, articulate and decisive.

The major indigenous discourse on the subject came from Mahatma Gandhi who led the country's freedom struggle to independence. Ironically, while the British succumbed to the political adroitness of the Mahatma, the latter found himself virtually alone in his cultural confrontation with the West. True, he was able to wrest freedom from the imperialists but he could not wish away their science and technology which had by then the votaries in India, too; in the turmoil, the Indian culture was left in a lurch. Gandhi evaluated western science and technology in the light of India's traditional heritage and values; but for Indians like Visvesveraya and Tatas, western capitalism and industrialisation offered an alternative model for progress. Jawaharlal Nehru and noted scientist M. N. Saha, on the other hand, wanted to adopt the Soviet model. The Second World War played a decisive role in sorting out this ideological tangle just before India became free. Ultimately, it ensured victory of western science and technology over the indigenous sciences and arts of the country, leaving an upsetting effect on its culture. The consequences have remained a perpetual problem since then and yet to be solved.

This paper tries to go into the details of this cultural encounter and examines its implications for science and technology in a state of cultural diversity.

Key words : Colonialism, Cultural encounter, *Khādi*, Science and Culture, *Swadeshi* movement, *Swaraj*, Western science.

* Reader in History, Rajadhani College, University of Delhi, New Delhi, India.

INTRODUCTION

This paper seeks to study the relation between science and culture in India between the two World Wars. It examines the nature and consequences of the interaction between the two in the background of India's history. India was a British colony at the time but she was then fighting to be free. In this, while science and culture were used as tools by both the rulers and the ruled, Indian culture and scientific tradition came in direct conflict with those of the West. Though this was inevitable and from the beginning manifested itself in many ways, it entered a crucial phase between the two wars when it became subtle, articulate and decisive. Interestingly, this period of intense and growing political activities against the British rule was also a period of unprecedented interest in, and a golden period of, science in India.

It was a period of rapid changes in India as in many parts of the world. Here the changes were catalysed, besides the First World War, by the struggle between colonialism and nationalism, and the rise of socialism. Together, these events released great forces of change and influenced almost every aspect of life in the country. Of them, science and culture are of our immediate concern here. For, in India the interaction between science and culture was not a smooth affair. India did have a long and rich culture heritage, including of scientific knowledge and technology¹, but as a British colony, she was then confronted with an alien culture and its science and technology that had come with the British as the tools of colonisation². This paper probes into the nature and consequences of this cultural confrontation, with focus on the interaction on science and technology. There are many aspects of this subject, but we would confine ourselves to examining only some of the major trends dealing with intellectual discourse and organisational efforts made as indigenous response to science.

BACKGROUND

The science and culture of India had come under confrontation with those of the West the moment the Europeans entered India. However, initially it was not a very hostile affair so long as the Europeans operated in India as traders. The indigenous population did not find the western knowledge and technology interfering much with their own. Whatever interaction occurred between them appears to have invoked curiosity on both the sides³. However, the steamboats from the West started making dents in the Indian economy in the meanwhile, and the modern firearms and the British railways extended it to the political and social life of the country as well⁴. Between 1757 and 1857 India was subjugated to the British authority; and it was by

the Revolt of 1857 that the Indians realised fully that the Western technology had not only destroyed their economy and social stability but also their political freedom. In the meanwhile, their own traditional industries, as cotton textile, and sciences like mathematics and Ayurveda had been ruined beyond repair⁵, so much so that many Indians started looking to the Western knowledge and sciences for their own process by this time. Raja Rammohun Roy⁶, Sir Sayyid Ahmad Khan⁷ and Mahendra Lal Sarkar⁸ were important among them.

But by the end of the 19th century an urgency for rethinking on the issues connected with science and technology, like politics and economy, from the viewpoints of indigenous problems and resources was felt. This was occasioned by the escalating high handedness of the British and Curzon's efforts to consolidate the colonial authority over India. This was the time of the partition of Bengal and the upsurge of the Swadeshi movement in the first decade of the 20th century⁹. It was here that the western knowledge and its offsprings came for closer scrutiny in relation to the indigenous knowledge and skill, and met with an appreciable challenge by the Indian intellectuals¹⁰. A spate of literature - books, articles, tracts, etc. - forcefully demonstrated that India did have a rich tradition of knowledge and technology, and so, the western knowledge and technology alone were not the panacea of India's problems¹¹. Even if what was good in the western science and technology, was unlikely to benefit Indians unless that was managed by the Indians themselves and in their own interest¹². Thus, a close connection was seen between knowledge, and the nature and motive of their control; moreover, the question of viability and appropriateness in relation to the socio-cultural orientation, too, came for discussion¹³. As in politics so in the field of science and technology, the indigenous response until then was one essentially of adjusting with colonialism. The Swadeshi marked the beginning of a period of assertion by Indians of their own abilities and resources to shape their destiny. As this movement derived inspiration from India's past achievements and heritage, it closely related to the culture of the land and immediately gathered intellectual overtones. However, the intellectual reaction that followed, especially to the western science and technology, soon proved a whimper as the western technology and power displayed their mettle when the First World War broke out in 1914.

SCIENCE AND CULTURE BETWEEN THE WARS

Yet this was not the end of the story. In spite of the colonial manoeuvres, the spirit of *swadeshi* could not be extinguished fully. Even as the Allies became victorious in the First World War, they came to realise the contributions of their colonies to

the victory and their dependence on them, in fact the mutual dependence of nations across the globe¹⁴. In the process, however, they also came to know about the backwardness and poverty of the colonies. These revelations were best illustrated in relation to India as a part of the British Empire. When the Great War broke out, Indian resources were liberally used to conduct it successfully, in recognition of which the British Imperial government declared that it would develop India through industrialisation after the crisis was over¹⁵. Accordingly, a high power commission under the chairmanship of Holland was appointed, in 1916, to examine into, and advise on, how to industrialise the country in the years to come. The commission submitted its report to the a Government of India in 1918¹⁶.

The commission included on its panel some Indians, too. One of them was Pandit Madan Mohan Malaviya (1861-1946), a leading nationalist leader and Congressman¹⁷. Though a member of the Commission, Malaviya did not agree fully with its recommendations, and, so, registered his dissent in a long 'Note' which was appended to the main report¹⁸. In his note, he raised several questions with regard to what may be broadly rounded about as the British propriety to rule over India and to provide her a model for development. Interestingly, he started with a review of India's history and culture to demonstrate that India had not been backward economically and industrially almost up to the middle of the 18th century, and her decline in these areas was concomitant with the subjugation of the country to the British rule¹⁹. As such, for the recovery of her economic wellbeing and development, recovery of her self-rule was essential. Moreover, in the background of India's achievements and needs, the West could never provide a model for progress. If at all it was so needed, India could better look to an Asian neighbour Japan and to Germany²⁰. Thus, Malviya refuted the erroneous perception of the West of India's history, and highlighted the irrelevance of the western knowledge and technology for her progress. He, above all, tried to clinch their socio-political contents²¹. Thus, Malaviya carried forward the call of *swadeshi* probably with a greater clarity of premises and purpose, and to a direction of economic *swaraj*. Realising his limitations and the wavering in the colonial attitude in the matter, he went ahead to translate some of his ideas into practice. At the Banaras Hindu University (BHU) which he had established in 1916, efforts were made to promote both the modern and traditional sciences and technology side by side in the overall ambience of India's indigenous culture²².

Already, these issues had been taken up by a few other Indians, too. P.C.Ray (1861-1944), a noted scientist and subsequently considered as the father of the chemical researches in India²³, had looked into Indian's history and produced a *History*

of the *Hindu Chemistry* by 1909²⁴. His approach to the subject was to an extent in line with that of Malaviya. Though trained in modern western science, Ray admired India's achievements in the field of science in the past; moreover, even while practising the western science, he placed the sole emphasis on the local needs²⁵. Gradually, he found the western technology exploitative and useless in the Indian conditions, and condemned industrialisation in favour of the indigenous cottage industries. Later, he fully identified himself with the economic philosophy of Mahatma Gandhi who opposed western science but more especially technology²⁶.

Meanwhile, J. C. Bose (1858-1937), another Indian scientist of international repute, had received inspiration for research from the Indian traditional knowledge, especially the Sāṅkhya and Upanisads²⁷. Going by that he tried to prove the existence of life and senses in everything — living and non-living, demonstrating a fact of unity and equality in nature. He, above all, endeavoured to achieve a synthesis of the knowledge of the East and the West, for which an institute was founded in Calcutta in 1917 and named after him²⁸. Though in subtle and subdued way, he also talked to equality of man (in the light of the inequality between the rulers and the ruled)²⁹. The indigenous philosophical tradition and spiritualism was brought into active play with the modern science also by Srinivasa Ramanujan (1887-1920), a mathematical genius from India. Though his active life was cut short by early death, he left his mark on mathematical research and issues to be contemplated and resolved³⁰. What is especially interesting for us is his linking his works and findings to his faith and Hindu philosophy. Of course, he was considered to be vague and ambiguous in his ideas, but that does not obviate the significance of the point he raised — the question of relation between science and human spiritualism, or in a still broader sense, relation between science and culture³¹.

The *swadeshi* spirit in these and many other Indians inspired them to help establish educational institutions, research institutes, professional associations and journals so that they could articulate their ideas and try to promote science from there. Reference could be made, for example, of the Science Congress Association (1914), Banaras Hindu University, Banaras, and University College of Science, Calcutta (both in 1916) and Bose Research Institute (1917). More such organisations came into being in the years to come.

But it was Mahatma Gandhi (1869-1948), the leader of India's freedom struggle, who really took up the issue forcefully and came forward with an elaborate discourse on the subject. As a matter of fact he had started looking into the question

as early as 1908 when he published *The Indian Home Rule or Hind Swaraj*³². In his book, he presented a discussion on modern civilisation (Chaps. VI, XII, XX), and attacked the western civilisation for its emphasis on materialism — greed for money and physical comfort — at the cost of ethical values and harmony between human being and the nature (Ibid.; also Chaps. VIII). It was in the latter context that he applauded the Indian culture — its traditional knowledge and practices, and ethical values, and advised Indians to stick to and emulate them (ibid.). He attacked the evils of modern machines and medical sciences for their dehumanising effects and for their dangerous consequences for the relation between man and nature (Chaps. XIX). While doing so, Gandhi did have a context in mind — the poverty and backwardness of India resulting from the colonial rule. So, whenever he talked of machine and industrialisation or medical science, he had in his mind also their socio-economic and political repercussions in India (Chaps. IX, XII, XIX).

Gandhi did never retract from his basic ideas expressed in the *Hind Swaraj* until his death in 1948³³. Of course, the later experiences helped him gain clarity in them and make some adjustments. Moreover, they sharpened his focus. Incidentally, after his seminal intellectual flourish in the *Hind Swaraj* in the beginning of the last century, it was exactly between the two World Wars that the Mahatma endeavoured to delineate the rubrics of his ideas and concretise them into his socio-economic and political programmes. As freedom of the country was his first and foremost concern, his initial response came broadly in that context. Now the question was how to fight the British out? He could have readily fought them with the same means they had conquered and exploited India with — trickery and violence, articulated and supported by western technology, but he preferred to go to his own cultural traditions and resources for help, and he chose truth and non-violence as his prime tools for action. This unique choice was in itself a method of protest to the European imperialism as it challenged the worth and efficacy, among others, of the western science and technology as a means of civilised human behaviour. It arose not from his sense of helplessness or cowardice; rather from a moral courage deriving from his own socio-cultural values³⁴. Gandhi was not a scientist (and he is often charged of conservatism and obscurantism), but in his social understanding, he was a social scientist par excellence³⁵. No wonder, while fighting imperialism, he did not like to fight piecemeal; instead, he attacked its fountainhead—the western civilisation and their tools, modern science and technology³⁶. For this he derived enough resources and inspiration from his own culture³⁷. This engaged him in a war between the cultures of the East and West; and determined his attitude towards the wider problems, including that of human progress

and the role of science and technology in it. This obliged him not to see science and technology in isolation of their social and cultural milieu³⁸.

Coming down to launch the struggle against the colonial rule, he attacked western science and technology as imperial tools of India's exploitation as a colony, and as they did not tune with the Indian culture and psyche³⁹. In the process, he attacked large-scale industrialisation⁴⁰. He declared in 1928:

‘God forbid that India should ever take to industrialization after the manner of the West. The economic imperialism of the tiny island kingdom (England) is today keeping the world in chains. If an entire nation of 300 million took to similar economic exploitation, it would strip the world bare like locusts’⁴¹.

No wonder he continued to perceive a nexus between the western science and technology and colonialism and the consequent poverty and backwardness in India⁴². He was clear and firm in his basic postulates. With political *swaraj*, he also wanted freedom of choosing the type of science and technology that suited the needs of his society and culture. He would not accept any science and technology that did not also satisfy the cultural and spiritual urge of the man⁴³. He diligently highlighted the political content of the western science and technology. Naturally, his political programme started with a call for rural reconstruction based essentially on the traditional knowledge and cottage industries⁴⁴. Therefore, he called upon to revive and promote the traditional indigenous arts and skill that involved simpler machines which amply satisfied the material and emotional urges of the people at large. For this, he proceeded with his popular programmes of *khādi*⁴⁵. The knowledge and technology involved in it had evolved out of the actual needs — material and emotional — of the local society, and were materially, socially and culturally viable. Moreover, unlike the western technology, they were not exploitative and destructive to the nature and environment sustaining the life around. Going by his cultural perceptions and values, he could not visualise the material life separated from the nature and the spiritual life, and science and technology from either of them⁴⁶. In order to promote his ideas, he also tried to introduce a new system of education called *Naitālim*, whose main feature was learning by doing. This system was essentially based on handicrafts, which meant bringing technology, social life and culture together⁴⁷.

On the other hand, however, the experiences and the developments all around persuaded him at the same time to make certain adjustments and modify his ideas a bit. In 1922, he wrote in *Young India*:

'Under *swaraj*, nobody ever dreams, certainly I do not dream, of no railways, no hospitals, no machinery, no army and navy On the contrary, there will be railways; only they will not be intended for the military or economic exploitation of India, but they will be used for promoting internal trade and will make the lives of third class passengers fairly comfortable...

Nobody anticipates complete absence of disease during *swaraj*. There will, therefore, certainly be hospitals....

Machinery there certainly will be in the shape of spinning wheel, which is after all a delicate piece of machinery; but I have no doubt that several factories shall grow up in India under *swaraj* intended for the benefit of the people, not as now for draining the masses dry'⁴⁸

Gandhi's emphatic adherence to India's past traditional knowledge, skill and values was essentially also a political necessity in the fight against imperialism, for which he needed a strong foothold. Otherwise, he did have an open mind and was receptive to the goodness of all the cultures of the world. In 1921, he said:

'I do not want my house to be walled in all sides and my windows to be stuffed. I want the cultures of all the lands to be blown about my house as freely as possible. But I refuse to be blown off my feet by any. I refuse to live in other people's houses as interlopers, a beggar or a slave...'⁴⁹.

In retrospect, today the Mahatma appears to be one of the earliest to perceive the socio-political contents of science and technology and their role in the rise and growth of imperialism, poverty and backwardness of the colonies. Most important of all, he was one of the first few to view science and technology in relation, besides society, to culture and nature at large⁵⁰. In that he may be considered a forerunner not only of the exponents of the Social Functions of Science Movements in Britain and elsewhere but also of the various movements dealing with the moral and humanistic aspects of science after the Second World War, and of the still later movements concerning environmentalism. In essence Mahatma's main concern was humanising science. While the people in the west promoted S&T to control nature and subjugate man and exploit both of them for their material comfort and wealth, Gandhi, like many other Indians, wanted to harness S&T to understand the nature so that the human societies all over the world could live happily and in harmony with the nature. His ideas did have a wide and strong appeal and he created many a votary. His cause was taken up by others as well, some of whom also thought independently but clinched the same issues as Gandhi did, and arrived at similar conclusions.

Anand Kentish Coomaraswamy (1877-1947) was one of them. Son of a Tamil aristocrat from Sri Lanka and his English wife, he was a scientist by training and outlook but an artist by instinct. He was an international authority on art and craft, especially of the Indian subcontinent, and a philosopher of many dimensions⁵¹. Looking through art, he deliberated on economy, politics and culture. Like Gandhi, he was one of the earliest to pay attention to 'Cultural Imperialism'⁵² and responded through an idea of 'National Idealism'⁵³. This obliged him to espouse the cause of *swadeshi*⁵⁴, a favourite subject of Gandhi, too⁵⁵. It was in this context that Coomaraswamy took up the cause of India's indigenous arts and crafts over those of the west and extolled the social, ethical and spiritual virtues of the Indian culture against the western civilisation⁵⁶. Beginning in the first decade of the last century until his death in 1947, he kept on explaining the intrinsic relation between art and craft on the one hand and the socio-cultural milieu of a people on the other⁵⁷. He admired Gandhi for the latter's ideas and, like him, opposed modern industrialisation and supported traditional arts and crafts of the country⁵⁸. He closely interacted with Rabindranath Tagore and like-minded Indians of the time⁵⁹.

Rabindranath Tagore (1861-1941), an Indian literateur, artist and philosopher, who was awarded the Nobel Prize for literature in 1913, was a contemporary of Gandhi. Tagore had reflected on issues concerning science and technology in relation to culture almost from the same time since the Mahatma did⁶⁰. Coming from a Brahmo family and influenced by Raja Rammohun Roy, initially Tagore appears to have been lured to the western science and technology. He sent his son to the USA for studying agriculture, and himself visited it early last century to see for himself agricultural practices there so that he could establish a modern agricultural farm back home⁶¹. Subsequently, he also studied and wrote about such things as the solar system and the space⁶². But gradually he appears to have endeavoured to find a fine balance between the material life and the spiritual contentment. This brought him, through literature and arts, to the indigenous handicrafts and the nature around him⁶³. His intellectual search was embodied best in the *Gitanjalee*, for which he was awarded the Nobel Prize, and in the Shantiniketan, now a university, which he established for giving shape to his ideas and promote them for application in actual life⁶⁴. Of other things, encouragement to the indigenous arts and skills, and an effort to bring harmony between man and nature constitute the hallmark of his philosophy⁶⁵. Both of them, in a way, draw the line between the concept of modern science and technology in the West, and that of the East. Happily, his efforts indicate that while he fully understood the value of indigenous knowledge and arts for the well-being of his countrymen, he was, continuing with the

past tradition of India, prophetic in that he understood the value of nature in the spiritual satisfaction and material wellbeing of humankind. While the West had used its modern science and technology for creating empires, perpetuating exploitation of the colonies and for wars until then, the poet laureate was evoking a spirit of universal co-existence with the wisdom and skill rooted in his own culture and not antagonistic to other societies. In view of the approaching atomic catastrophe, the pinnacle of the western science and technology, which, fortunately, destiny denied him to see as he died in 1941, his friendship with Albert Einstein amply betrayed the need of the hour⁶⁶

But in spite of all this, the developments that were taking place in the meanwhile soon demonstrated that probably the Mahatma, like Tagore and others, was fighting almost a losing battle. The time was fast changing; so were his colleagues in the Congress party. A new generation of leadership was emerging in the country — both within the Congress and outside it. Graduating in the western education, they were fascinated by newly emerging philosophy of socialism and deeply inspired by the socio-economic reconstruction in the USSR. The two of them, Pandit Jawaharlal Nehru, the young leader of the Congress, and M. N. Saha, a noted Indian astrophysicist and a leader of the Indian scientists in the 1930s and 40s, deserve attention.

After Gandhi, M.N.Saha (1893-1956) took up the issue of science and culture in a direct and most thorough manner; so much so that he helped establish in 1934 a Science News Association that brought out from 1935 a journal named *Science and Culture*⁶⁷. Soon a band of scientists and other intellectuals gathered round this forum, who are now referred to as the Science and Culture Group. The journal and the group strove to popularise and promote modern science and technology for all-round progress of the country⁶⁸. As a matter of fact, they aimed at creating a new society and culture based on modern science and technology and broadly governed on the socialist model⁶⁹. No wonder, Saha devoted the first editorial of the newly founded journal to 'Science and Culture.' In that he wrote:

'The call that brings "Science and Culture" into existence is truly the call of the times. Now it is obvious to every thinking man that India is now passing through a critical stage in her history, when over the cultural foundations of her ancient and variegated civilisation, structures of a modern design are being built. It is necessary that at such a juncture the possible effects of the increasing application of discoveries in science to our national and social life, should receive very careful attention; for if the present is the child of the past, it may with equal emphasis be asserted that the future will be the child of the present. The present generation by its policy and action will shape the course of the future⁷⁰.

Subsequently, he and his friends delved deep into the various aspects of the subject, including the role of science in the evolution of civilisation and culture⁷¹, science and religion⁷², a new philosophy of life⁷³, philosophy of industrialisation⁷⁴, etc. They attacked the colonial government for not employing modern science and technology for the progress of the country in a right perspective in the past, and made a fervent appeal for an all-round national reconstruction⁷⁵. However, Saha and his group did not approve of the Gandhian model for this purpose; instead, many of them leaned towards the Russian way. In their heady moments of ideological enthusiasm, both Saha and Nehru visualised a panacea for India's ills in socialism and modern science and, in fact, for the rise of a new India and a new world⁷⁶. In his message on the occasion of the silver jubilee of the Indian Science Congress in 1937, Nehru proclaimed:

‘Congress represents science, and science is the spirit of the age and the dominating factor of the modern world. Even more than the present, the future belongs to science and to those who make friends with science and seek its help for the advancement of humanity’⁷⁷.

It was with this understanding that Saha persuaded the then Congress President Subhash Chandra Bose to appoint in 1938 a National Planning Committee (NPC) to draw an all-India plan for the all-round development of country with the help on modern science and technology. Jawaharlal Nehru (1889-1964)⁷⁸ was made its Chairman, and the best brains in their respective fields were put on various sub-committees. Saha was one of the influential members together with scores of other eminent scientists⁷⁹. Indeed, it was a historic exercise in which the top brains of the country sat to plan the all-round development of the country even before it became free. The committee started with enthusiasm but the outbreak of the Second World War and the internal political turmoil in India gave it a serious setback. It could not resume its work until the end of the global crisis when it published its reports in about 25 volumes⁸⁰. The colonial government was cold, if not hostile, to the whole exercise; and, not unexpectedly, the plan could not be put to practice in the absence of any political authority in the hands of its framers. Happily, however, after Independence of the country, these reports served as a base and guide for planning for the national government.

But, like the Mahatma, also Saha and Nehru were endeavouring in a not-so-conducive condition. The British colonial control apart, the Indian society was still to get out of its feudal mould. To add to the problem, by now there was a strong capitalist lobby in and around the Congress. In scientific and technical matters, it was represented

by Sir M. Visveswaraya (1860-1962), the noted engineer and technocrat and Dewan of Mysore State⁸¹. He strongly pleaded, since early 1920⁸², for a planned development of the country on the capitalist model and with the help of modern science and technology⁸³, which was broadly outlined in the Bombay Plan for national reconstruction in 1944⁸⁴. This was, indeed, a dampener for the NPC initiative. No wonder, the NPC report that appeared after 1945 came as a halfway house, a compromise between capitalism and socialism. While the NPC plan talked also of the indigenous knowledge, as in the field of medical science and health care⁸⁵ and of the cottage industries⁸⁶, it was probably not more than a lip service aimed at assuaging the public opinion. Be it the leaders of the NPC or the framers of the Bombay Plan, everybody favoured large-scale industrialisation and, hence modern science and technology. Thus, the case for the revival and promotion of the indigenous knowledge and crafts was virtually lost forever. The Second World War came as a great blow to the Gandhian philosophy. The little prospects for the indigenous industries to develop in response to the requirements of the war, or for the modern science and technology to make a real advance like that in other countries during the crisis, was pre-empted by the colonial control and the political turmoil in India. Thus the inter-war debate on science and technology in relation to culture, imperialism and nationalism practically came to an end.

SCIENCE IN A CULTURAL CRISIS

The development of S&T between the two World Wars in India was sapped and deflected as much by an unfavourable political control under colonialism as by an intellectual and ideological plurality and social and cultural diversity. While the imperial government wanted to promote and harness western science and technology for their own interest; the local needs demanded something else. In the process, the whole thrust of official policy remained confined to an attitude of *ad hocism*. Already, in the absence of patronage and support to them, the indigenous traditional sciences and arts languished to death in the face of the state-supported western science and technology. Now, when the colonial authority was seriously challenged in the wake of the rising freedom struggle, the British did not mind extending their old policy of 'divide and rule' into the areas of science and technology, too. They tried to exploit the socio-cultural diversities of India and divide the scientific community on communal and regional lines as they did in politics⁸⁷.

But more intriguing and important, gradually the Indian themselves took off their socio-cultural moorings and tended to lose interest in traditional knowledge and

arts. Here, it is worthy of note that provoked by communal and sectarian feelings, certain segments of the Indian society did not respond kindly to the *swadeshism* emanating from the feelings of common heritage and collective welfare. For, while many Muslims did not feel like admiring the achievements in field of science and technology in ancient India which they did not share historically; many a Hindu responded similarly towards the achievements of the medieval times. Moreover, the over-enthusiasm of leaders like Nehru and Saha for modern science and technology also partly contributed to the confusion over the issues relating to the choice of technology. This and other factors badly sapped the force of *svadesism* that propelled the indigenous offensive in the inter-war period. Indeed, the Mahatma remained almost unchanged on his stand on the subject but after the outbreak of the Second World War, he was too preoccupied with politics and partition to pay attention to the subject under discussion.

The Second World War and the political turmoil inside the country swept the issue in the background; and in the pressing crisis of the war and the Allied presence in the country⁸⁸, it forced the indigenous sciences and arts to give way to the western science and technology⁸⁹. In the melee varieties of global influences overwhelmed the indigenous culture. In the circumstances, while the Indian political leadership attempted and succeeded in wresting freedom from the colonial authorities, the later had silently ensured a place for their science and technology to serve their economic interest, subsequently manifesting as neo-colonialism⁹⁰.

After the initial admiration for their enthusiasm for heavy industrialisation and western science and technology, the ideas and goals of Nehru and Saha are being subjected to closer scrutiny now and loopholes are coming into light⁹¹. To begin with, the idea of developing India on the socialist lines without taking her out of her feudal ambience lacked sound logic. Second, in view of the ground realities in the country, it was agriculture and not heavy industrialisation that deserved immediate attention. Moreover, even science and technology need a socio-cultural milieu to grow; as such the western science and technology could never be just transplanted in the Indian conditions. In that it were the indigenous sciences and culture that really needed to be promoted and harnessed for national development. Of course, it was not easy to attempt rejuvenation of the traditional heritage in the changed times, yet an effort could be made in the same manner as China and Japan have done in the past. But this demanded a whole range of supporting factors: clear ideological stand and political will, an appropriate indigenous linguistic medium, and conducive socio-cultural conditions. Unfortunately, India lacked in many of them.

CONCLUDING REMARKS

The period under review was one of intense intellectual interaction as much in the field of science and technology as in politics, in India. With the growing mass of information on India's cultural achievements in the past, the colonisers were no longer in a position to continue their 'Whiteman's burden' attitude after the First World War. So, they concentrated on articulating their policy and administrative measures to control the scientific and technical matters to serve their interest best. Now it was time for the Indians like Gandhi to look to their past achievements and use their socio-cultural resources as a tool as much for winning freedoms as for planning their national progress. This led to a war of wits between the rulers and the ruled. However, despite its great upsurge, especially in the 1920s, *swadeshism*, became victim of various forces, including the socio-cultural diversities skillfully blown and exploited by the British, and the Second World War. Thus in the midst of clash of diverse ideas, ideologies and the Great War, it finally succumbed to modern science and western technology. This was, indeed, an unhappy situation for India. While the western science and technology were unlikely to address the real problems of the country, the doomed traditional knowledge and crafts, that still served the vast masses in India, were left to languish and die. This was bound to have serious repercussions for the country then and ever since. The puzzle is: progress on which model and with which type of science and technology?

Nevertheless, the Indian response during the period did have something significant and reassuring. One of its major calls was to humanise science and technology by reigning them in with social ethics and moral values. As the Indians had had first-hand experience of how the western technology had wrecked devastation and misery to their life under colonialism, some of them opposed them tooth and nail; others wanted to use them on entirely different lines as under socialism. Even those who pleaded for the capitalist model, wanted to go the way of democratic America. Be it Gandhi or Saha, they came closer on several points, and identified and attacked the western science and technology as tools of imperialism resulting in the exploitation and poverty of the colonies⁹². So, they wanted a radical change in the whole scenario right from the levels of political and social control to international co-operation. No wonder, with their political freedom, they also wanted to liberate science from imperialism and colonialism. Unlike in the past, they now appealed for promoting science and technology for global progress of all, in harmony not only with the different

societies and cultures of the world but also with the nature. Saha visualised in science the basis of a new civilisation, which he portrayed in his own words:

‘Economic and scientific studies show that the world has resources enough for whole population and if there is a rational programme of production and a programme of judicious and equitable distribution nobody would suffer from hunger and privation.....For this purpose rivalry amongst nations should give way to co-operative construction and the politician should hand over his functions to an international board of trained scientific industrialists, economists and eugenists who will think in terms of the whole world and derive means by which more and more of the necessities of life can be got out of the earth. Production should be supervised by scientific industrialists and distribution by economists. The eugenists should devise means of assigning a fixed quota of population to each geographical unit, which it should not be allowed to exceed. It may be a dream, but it is feasible provided the educational programme of the coming generation is thoroughly revised. A new educational scheme should be devised by a world congress of the foremost thinkers like Bergson, Einstein, Russell, Smuts, Spengler and others, with the special objective of weeding out medieval passions from the minds of coming generations and for training them to a proper grip and sufficient appreciation of the beauty and power of science’⁹³.

Indeed this was one of the earliest and most timely call for humanizing science and technology for the progress and welfare of the whole of the humanity.

ACKNOWLEDGEMENT

This paper was initially presented at the XXIst International Congress of History of Science, held at Mexico city, Mexico, in July 2001. I wish to express my gratitude to the Indian National Science Academy, New Delhi, for sponsoring this presentation and to the Indian Council of Historical Research, New Delhi for encouraging me by offering partial financial assistance.

NOTES AND REFERENCES

1. For details, see D. P. Chattopadhyaya, *History of Science and Technology in Ancient India*, Firma KLM, Calcutta, 1986; A. Rahman, *Science and Technology in Medieval India*, INSA, New Delhi, 1982; and D.M.Bose et al., eds., *A Concise History of Science in India*, INSA, New Delhi, 1971.
2. Deepak Kumar, *Science and the Raj 1857-1905*, 1995; OUP, Delhi, Paperback edn. 1997; see also Satpal Sangawan, *Science, Technology and Colonisation: An Indian Experience 1757-1857*, Anamika, Delhi, 1991.
3. Ibid; also see A. J. Qaisar, *The Indian Response to European Technology and Culture, 1498-1707*, Delhi, 1982.

4. Sangwan 1991; Kumar 1997.
5. Ibid; Refer also to Zaheer Babar, *The Science of Empire: Scientific Knowledge, Civilization, and Colonial Rule in India*, OUP, Delhi, 1998, especially Ch.6.
6. V. C. Joshi, ed., *Raja Rammohun Roy and the Process of Modernisation in India*, Vikas, New Delhi 1975.
7. Shan Mohammad, ed., *Writings and Speeches of Sir Sayyid Ahmad Khan*, Bombay, 1972.
8. Jogesh Chandra Bagal, *History of the Indian Association, 1876-1957*, Calcutta, 1953.
9. Ibid. Also see A. Lovat Fraser, *India under Curzon and after*, London, 1911.
10. *The Swadeshi Movement - A Symposium*, G. A. Natesan & Co., Madras, N.D.; Haridas Mukherjee and Uma Mukherjee, *A Phase of Swadeshi Movement, National Education, 1905-1910*, Chukerverty, Chatterjee & Co., Calcutta, 1953; Idem, *The Origin of the National Education Movement (1905-1910)*, Jadavpur University & Chukerverty, Chatterjee Publications, Calcutta, 1957; and Sumit Sarkar, *Swadeshi Movement in Bengal*, PPH, New Delhi, 1973.
11. Ibid.; also P.C.Ray, *History of Hindu Chemistry*, 2 vols., Calcutta, 1902-9.
12. Ibid.; also see Kumar 1997, Ch.6.
13. Ibid.
14. Refer to Johannes H. Voigt, *India in the Second World War*, Arnold-Heinemann, New Delhi, 1987, especially Ch.I.2; and Geoffery Barraclough, *An Introduction to Contemporary History*, 1964; Penguin Books, Harmondsworth, 1967.
15. Johannes H. Voigt 1987, especially Ch.I.2.
16. *Indian Industrial Commission 1916-18: Report*, Superintendent Govt. Printing, Calcutta, 1918.
17. Mukut Bihari Lal, *Mahamana Madan Mohan Malaviya: Jeevan aur Netritwa*, Malaviya Adhyayan Sansthan, Kashi Hindu Viswavidyalaya, Varanasi, 1978.
18. 'Note by the Hon'ble Pandit Madan Mohan Malaviya', in the *Indian Industrial Commission 1916-18: Report*, 1918, pp.292-355.
19. Ibid., p 294.
20. Ibid., pp. 301-303.
21. For detailed discussion, see Shiv Visvanthan, *Organizing for Science: The Making of an Industrial Research Laboratory*, Delhi, Oxford, 1985; Jagdish N. Sinha, 'Science and the Indian National Congress.' in Deepak Kumar, ed. *Science and Empire*, Anamika, New Delhi, 1991; and *idem*, 'Origin of India's National Science Policy: M.L.Sarkar to M.K.Gandhi, 1875-1935,' *Indian Journal of History of Science* 27.2 (1992) 171-182.
22. Mukut Bihari Lal 1978.

23. Prafullachandra Ray, *Life and Experiences of a Bengali Chemist*, 2 vols., Calcutta, 1932; and J. Sen Gupta, *P.C.Ray*, NBT, New Delhi, 1972.
24. P.C.Ray, *History of Hindu Chemistry*, idem, *The Hindu Achievement in Exact Science*, New York, 1918.
25. Ibid.; also refer to Prafullachandra Ray 1932; and *Acharya Prafulla Chandra Ray Birth Centenary Souvenir Volume*, Calcutta University, 1962.
26. Ibid.
27. M.Gupta, *Jagdish Chandra Bose, A Biography*, Bharatiya Vidya Bhavan, Bombay, 1964. Also see *Subrata Dasgupta, Jagdish Chandra Bose and the Indian Response to Western Science*, OUP, Delhi, 1991.
28. Ibid. Also see M. Gupta 1964.
29. J.C Bose, 'Presidential Address at the Indian Science Congress Association', *Proceedings of the Indian Science Congress*, 1917.
30. S Ranganathan, *Ramanujan, the Man and the Mathematician*, Asia, Bombay, 1967.
31. Ibid.; and Ashis Nandy, *Alternative Science: Creativity and Authenticity in Two Indian Scientists*, Allied Publishers, New Delhi, 1980, pp.92-142.
32. M. K. Gandhi, *Hind Swaraj or Indian Home Rule*, 1908; Navjivan Publishing House, Ahmedabad, 1911.
33. *Harijan*, 14 October 1939.
34. Ibid; also see M.K.Gandhi, *Modern V. Ancient Civilization*, edited by Anand T. Hingorani, Bhartiya Vidya Bhavan, Bombay, 1970, especially p.49.
35. Richard B.Gregg, 'Gandhi as a Social Scientist and Social Inventor,' in S Radhakrishnan, *Mahatma Gandhi*, Bombay, 1956, pp.57-63.
36. M.K.Gandhi 1970, Chaps, 1,8,9,27,32,37,38,63.
37. M.K.Gandhi 1970; idem, *Industrialize and Perish*, compiled by R.K.Prabhu, Ahmedabad, 1966.
38. Ibid.
39. M.K.Gandhi 1970, pp 6-8,22.
40. Ibid,
41. Quoted in Deepak Kumar 1997.
42. M.K.Gandhi 1970, especially Chap.9.
43. Ibid; also see Sunil Sahasrabvudhhey, 'The Dissenting Voice,' *The Illustrated Weekly of India*, Bombay, 27 January 1985.
44. M.K. Gandhi, *Khadi* edited by Bharatan Kumarapa, Ahmedabad, Navajivan, 1955.

45. Ibid; and idem, *Economics of Khadi*, Ahmedabad, 1941.
46. Ibid.
47. Richard B. Gregg 1956, pp. 57-63.
48. *Young India*, 9 Mar. 1922. For more evidence, refer to *Harijan*, 3 July 1937, and 28 January 1939.
49. *Young India*, 26 January 1921.
50. *Young India*, 18 November 1926.
51. Jag Mohan, *Anand K. Coomaraswamy*, Publication Division, Govt. of India, New Delhi, 1979.
52. Ibid, pp.33-39.
53. Anand K. Coomaraswamy, *Essays in National Idealism*, Colombo Apothecaries, Colombo, 1909.
54. Anand K. Coomaraswamy, *The Indian Craftsman*, Probasthain, London, 1909; Idem, *Art and Swadeshi*, Ganesh, Madras, 1910.
55. Ibid, also pp. 28-32.
56. Anand K Coomaraswamy 1909; Idem, *Art and Swadeshi*, Ganesh, Madras, 1910.
57. Jag Mohan 1979.
58. Ibid, p. 95.
59. Ibid, pp.22,55.
60. Krishna Kriplani, *Rabindranath Tagore: A Biography*, OUP, London, and Grove Press, New York 1962; idem, *Tagore: A Life*, 1961; National Book Trust, New Delhi, 1971.
61. Ibid.; also refer to M.V. Kanath, *The United States and India 1776-1976*, The Embassy of India, Washington DC, 1976, pp. 161-62.
62. Rabindranath Thakur, *Vishwa Parichaya*, Hindi translation by Hajariparasad Diwedi, Indian Press, Allahabad, 1937.
63. Kriplani 1971
64. Ibid.
65. Ibid.
66. Ibid, p.199.
67. *Science and Culture* (Calcutta) 1935—, edited by M.N.Saha; for Saha, see Santimay Chatterjee and Enakshi Chatterjee, *Maghnad Saha*, NBT, New Delhi, 1984.
68. Ibid.
69. *Science and Culture* most frequently and prominently published articles on the various aspects of socio-economic reconstruction in the USSR. For Saha's views, refer to the *The Collected Works of Meghnad Saha*, edited by Santimay Chatterjee, 4 Vols., Orient Longman, Calcutta, 1982—

70. *Science and Culture*, vol. 1, No. 1, 1934.
71. Ibid; also see *Collected Works of Meghanad Saha*, Vol. 4, 1993, pp.287-307.
72. *Collected Works of Meghanad Saha*, Vol. 4, pp. 282-86.
73. Ibid, pp. 287-89
74. Ibid, pp.290-301.
75. Ibid.
76. *Selected Works of Jawaharlal Nehru*, vol.8, New Delhi, 1976, 806-808, *Nehru on Science & Society*, edited by Baldev Singh, Nehru Memorial Museum and Library, New Delhi, 1988, is a handy reference for Nehru's views.
77. *Selected Works of Jawaharlal Nehru*, vol.8, New Delhi, 1976 pp 806-808.
78. Jawaharlal Nehru, *An Autobiography*, 1936; Jawaharlal Nehru Memorial Fund & OUP, New Delhi, 1982.
79. *National Planning Committee (Being a Summary of National Planning Committee Booklet No. 1,2,3 &4)*, Compiled by K.T.Shah, Vora & Co. Bombay, 1946.
80. *National Planning Committee Series (Reports) 25 vols.* edited by K.T.Shah, Vora & Co. Bombay, 1945-49.
81. V.S.Narayana Rao, *Mokshagundam Visvesvaraya*, 1982; NBT, New Delhi, 1995.
82. M. Visveswaraya, *Reconstructing India*, P.S. King & Sons, London, 1920.
83. M. Visveswaraya, *Planned Economy for India*, 1934; Bangalore Press, Bangalore, 1936; also see his *Report of the Technical and Industrial Education Committee*, Govt. Press, Delhi, 1921.
84. M. Visveswaraya, *Reconstruction in Post-War India: A Plan of Development All Round, 1944*, All India Manufacturers' Organisation, Bombay, 1945.
85. NPC Report.
86. Ibid.
87. J.N.Sinha, 'Science Policy of the British in India during the Second World War,' Ph.D. Thesis, University of Delhi, 1994, Chap.1.
88. Johannes H. Voigt, *India in the Second World War*, Arnold-Heinemann, New Delhi, 1987.
89. J.N.Sinha, Ph.D., 1994.
90. Ibid.
91. Dinesh Abrol, "Colonised Minds' or Progressive Nationalist Scientists: The Science and Culture Group", in Roy MacLeod and Deepak Kumar, eds., *Technology and The Raj: Western Technology and Technical Transfers to India, 1700-1947*, Sage Publications, New Delhi, 1995, pp. 265-88.
92. For Saha's views, refer to *Collected Works of Meghnad Saha*, Vol.4, 1993, Chap. 7 in particular.
93. Quoted in Shiv Visvanathan, *Organizing for Science*, OUP, New Delhi, 1985, p. 108.