



**IMPACT OF SOCIETY ON INDIAN SCIENCE AND TECHNOLOGY IN EARLY TIMES**

**GENERAL DISCUSSION REMARKS**

by

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India is a land of ancient culture. No other country except China can trace back its language and literature, its religious beliefs and rites, its social customs through an uninterrupted development of more than 3000 years. Successive waves of invasions came to India's life from the Persians, Greeks, Scythians, Muhammedans and the British. The life and literature grew practically unhindered and unmodified. The people thrive on plurality of thoughts, ideas, faiths and traditions.

Some men, real or mythical, by their examples and preachings have very strongly influenced the social life in the country since ancient times. One may only mention Ram and Krishna, Buddha and Mahavir. Krishna taught, 'To action alone hast thou a right and never at all to its fruits, let not the fruits of action by thy motive, neither let there be in thee any attachment to inaction'. (The Bhagavat Gita, Ch.II, verse 47). Buddha enunciated the eight fold path of emancipation (right views, right aspirations, right speech, right behaviour, right livelihood, right effort, right thoughts and right contemplation). Mahavir placed great emphasis on 'ahimsa', roughly translated as 'non-violence'. Even in this century Gandhi and Ramakrishna, by their examples again emphasized the same social values. Even Einstein said 'Man is here for the sake of other men' or 'caring for man and his destiny must always constitute the principal interest of all technical effort'.

We must examine the development of science in ancient India against the background mentioned above. We observe that the ancient Indians were deep thinkers and developed many concepts and theories which now find parallels in modern physics. The technology that they developed was essentially for the wellbeing of the people.

India developed in great depth concepts like truth, self, ahimsa, zero, infinity and decimal place value. It made important discoveries in fields like trigonometry, health and disease, basic principles of hygiene, medicine, construction of surgical instruments etc. No less contributions were made in the areas of town planning, brick making, irrigation, agriculture, textiles, arts & crafts and even in navigation. In this paper, we have tried to bring out some of the factors, which in the opinion of the authors, were responsible for retarding the progress of technology in later times.

However, in discussing this, there is one aspect which cannot be overlooked. India had been under foreign domination for long and much of science and natural philosophy developed here in ancient times has not received the attention it deserved. It has to be rediscovered and brought to light, if only so that we may better appreciate and obtain a deeper understanding of many concepts of modern physics like complementarity, space and time.

(A) Tradition:

India is a land of living traditions. The Brahmin still repeats in his daily worship the vedic hymns composed over 3000 years. Two distinct traditions of knowledge with two apparently opposite objectives are found from the earliest time. The knowledge which helps one to attain material progress, enrichment and fulfilment of ones desires was known as Inferior Knowledge (aparā vidyā) and the knowledge which ensures attainment of self-realization or salvation in life as Superior or Spiritual Knowledge (parā vidyā). These two forms of knowledge were complementary to each other. Both traditions were found embodied in the same philosopher and apparently there was no contradiction from ideological point of view. May be, the teacher-student tradition (guru-sisya paramparā) led to such a development.

The alchemical tradition was likewise bound by two traditions. The physical aspect was concerned with experimental study of transmutation of baser metals into gold and silver, and with preparation of drugs for immortality. The metaphysical aspect aimed at the transformation of man from his sinful nature to the salvation of his soul, that is attainment of immortality in the present life. Transmutation of metals was viewed as symbolic of the transmutation of man.

The tradition of putting daily fire (nitya agni) and obligatory fire (kamya agni for wishfulfilment) helped to develop the construction of altars of different geometrical shapes. This led to the discovery of a number of important results like the general statement of the theorem of the square of the diagonal (Pythagoras Theorem), value of  $\sqrt{2}$  (correct to five places of decimal), idea of rational and irrational numbers, etc. These led to the development of śulbavida (experts in handling problems with cords). The tradition produced schools of Baudhāyana, Āpastamba, Kātyāyana, Manava and others, but these slowly died when priest-crafts and rituals were decried by the late Buddhist and Jain scholars.

(B) Spirit of Scientific Enquiry:

Starting from the Rgveda down to the Upanisads, one can experience the awakening of man's soul and sense of wonder and doubt in intellectual enquiry. In the Vedic age, the Rsis or Vedic priests did not form any exclusive caste of their own. But all this was changed when Brahmins reasserted their supremacy on the decline of Buddhism. To quote Acharya P.C. Ray (History of Chemistry in Ancient & Medieval India, Calcutta, 1946, p.240).

"The caste was established de novo in a more rigid form. The drift of Manu and later Purānas in the direction of glorifying priestly class, which set up the most arrogant and outrageous pretensions. According to Susruta, the dissection of dead bodies is a sine qua

non to the student of surgery and this high authority lays particular stress on knowledge gained from experiment and observation. But the very touch of a corpse, according to Manu, is enough to bring contamination to the sacred person of a Brahmin ..... It was considered equally undignified to sweat away at the forge like cyclo-  
ps". He further writes, "The arts thus being relegated to the low castes, and the profession made hereditary, and the intellectual portion of the community being thus withdrawn from active participation in the arts, the how or why of phenomenon - the co-ordination of cause and effect - were lost sight of".

Science cannot grow cut off from society. The cleavage of the society into higher and lower castes led to a separation of theory from practice or application of science. By sixteenth and seventeenth centuries in India science was reduced to a tradition of distant past revolving around the classical trio of mathematics, astronomy and medicine.

(C) Religion:

In Vedic India 'religion' was a working hypothesis for correct human conduct. It adapted to different stages of spiritual development and different conditions of life. All great religious teachers lay great emphasis on the spirit of enquiry. To quote Buddha, 'Believe nothing merely because you have been told it, or because it is traditional or because you yourself have imagined it. Do not believe what your teacher tells you merely out of respect for the teacher. But whatever after due examination and analysis you find to be conducive to the good, the benefit, the welfare of all beings that doctrine believe and cling to and take it as your guide'. Buddhism became a dominant religion under the patronage of Ashoka and it spread to other countries. But gradually it lost in quality and distinctiveness. Monasteries became rich and centres of vested interest. Magic and superstition crept into popular forms of worship. Similarly,

preaching of other great leaders also lost the vitality and were reduced to rituals. This led to the suppression of the spirit of enquiry.

As in other places and times, in ancient India too the religious beliefs of an individual prevented him from accepting new concepts and ideas. Lalla, an eminent mathematician refused to accept some of the scientific concepts of Aryabhata I since the latter did not agree with the Brahmanic interpretations. Brahmagupta accepted the Rahu-Ketu theory for eclipses, since he believed that everything which is in the Veda, Smṛti and Samhitā is true. We find statements on inadvisability for killing a cow and the medicinal values of cowflesh side by side. Al-Biruni (11th Century A.D.) observed: "The Hindus (of his time) believe that there is no science like theirs, no civilisation like theirs, ..... . If they travelled and mixed with other nations, they would have changed their mind, .....". Manu's injunction that the Sudras should not read the Vedas also created conditions unfavourable for the development of science. The technicians, like metal-smelters, having come from the lower most strata of the society had no access to the scientific contents of the Vedas.

#### (D) Organisation of Science:

Many rulers in ancient India supported and patronized individuals of exceptional merit and established schools and academies. The schools of Agniveśa, Punarvasu and Aswnikumar in medicine, of Āryabhata, Mahāvira and Bhāskara in Mathematics and Astronomy, and of Visvāmitra in architecture, Nāgārjuna in alchemy were very famous. But the credit for most good work went to the school or the patron, and incentive for an ordinary worker was often missing.

The social and economic set-up was also not conducive to organised activity in science. The economic unit was limited to a village or the estate, and its wealth primarily depended upon land use. The market

and the tax structure were such that they hardly left any agricultural surplus to support non-agricultural activities like arts, crafts and other technological practices. The artisans worked on their own, from the initial stage of making their tools to the final stage of selling their products.

(E) Concluding Remarks:

India is a country of long tradition and has always encouraged plurality of thoughts and ideas. With time any set of ideas, however good, tend to fossilize and degenerate. There have been repeatedly powerful movements against dogma and rigidity of the caste system, but not always with great success. Buddha and Mahavir had the courage to challenge superstition, rituals and vested interests. Their preachings brought a new awakening in the people, but with time even these were blunted. Sankaracarya did not recommend the study of Vedas by the lower castes (Sudras). Even Christianity, which came to India very early, gradually developed its own caste system. The Moslem social structure in India, inspite of its vigorous denunciations of all such barriers within the community was also partly affected. This led to a division between those who practiced theory and those who practiced some trade. The scope of education was also mostly restricted to higher caste - that is to a small fraction of the Society.

It would appear that social conditions greatly influence the development of science and technology in a country and in India, though mathematics, astronomy and theoretical sciences made great advances, the practical sciences were neglected, except for agriculture and medicine.