A Perspective of Medieval Indian Science

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A pioneer in the field of History and Technology in India, A. Rahman in his article, *A Perspective of Indian Science of Tenth- Eighteenth Centuries* takes a look at the medieval Indian Science. India has always posed an enigma to the world as regards its philosophy, knowledge and culture. Rahman is well aware of the challenges in interpreting the historical socio-economic conditions in India. He is critical of the mechanical philosophy, a characteristic of the West, which is utilised in writing and interpreting the history of science in India. He says that such a philosophy popularised by Locke is found to be inconsistent with the productive systems, the ethos and the way of looking at nature in India and the Asian countries. Rahman complains that though the period after the collapse of Greece and up till the beginning of renaissance in Europe is generally referred to as Dark Ages, this concept ignores the great achievements made in the non-European world, including India, during this long span of time.

Rahman admits that although science is primarily concerned with acquiring knowledge and its systematisation, yet there are other aspects of science, which the West ignored. He agrees that the first is concerned with the method of acquiring knowledge, its systematisation, interpretations and drawing conclusions from it, as is understood in the West. The second is the use of that knowledge to shape social, cultural and political life that includes an objective study of society. He says that it is imperative to study the effect of science upon society and also the effect of society upon science in order to understand the true history of science of a region.

Rahman says that a critical study of the history of science against the backdrop of its social and cultural context would reveal a constant effort by the rulers to control science. This, he says, results in the lack of progress in science. He particularly decries the institution of religion, which according to him with its religious dogmas and ideology is used by the vested interests to mobilise the common populace that does not share scientific rationality. Knowledge base was mainly confined to the ruling elite, while for the mass myths were promoted. This was so in ancient Egypt, Greece, India, Islamic world, and in Europe. Throughout the history, when scientific knowledge created a new awareness of environment and opened up a possibility of enlightenment of people as a whole, efforts were made to contain and confine knowledge to the elite in order to promote myths for popular consumption. Quoting Kosambi, a historian of repute, he points out that most of the surviving Indian documents were overwhelmingly religious and ritualistic. The writers were not concerned with history or reality, and were unscientific.

European Approach

European Science, it may be stressed, was a part of a movement in revolt against medieval system of production controlled by feudal nobility and the church, which was conditioned by the extant intellectual climate. The change of intellectual framework began with the challenge to authority and criticism of the established doctrines.

These developments, as they differed from the productive system and ethos and the way of looking at nature of the Asian countries, were used to develop the framework of writing the history of science to marginalize the Asian developments of science and technology, while borrowing from Asian developments as a base of their growth. This European framework of history of science requires to be discarded and the historical developments of science needs to be studied in the context of cultural and social development on the one hand and the purpose it serves in society on the other.

Growth of Science and Linkages with Cultural Areas

Having enlarged the definition of science and thus located the causes of degeneration of Indian science in the social and political milieu, Rahman perceives science in India not as something native but within a broader concept of a 'culture area'. The concept of 'culture area' does not view society as fixed entity in time and space but locates it in its dynamism with constant changes and interactions taking place with other societies. Rahman says that the concept of nation state, which was developed along with the growth of industrialization, disrupted the concept of cultural areas. If one looks carefully at the major periods of development of science, one may notice its growth as a part of development of a culture area, flowing from the neighbouring areas. Greece, which is regarded as the fountainhead of European science, was part and parcel of Phoenician and Egyptian culture. Its development of science was an offshoot of the earlier developments in Egypt, Phoenicia, Mesopotamia, possibly Iran and India also. Rahman also writes that the development of science in Arabian culture area drew from the indigenous knowledge as also heavily from India using extensive translations from Sanskrit and Pali, and also from Greece, and the translations of the Greek texts. Like the earlier Greek developments, it became a churning pot of the three scientific traditions viz., West Asian and North African, Indian and Greek. With the spread of Arabic culture area, with Islam as a vehicle, the Arabic science absorbed the knowledge and technologies of these countries such as Spain, North Africa and China. Similarly, when one examines the European developments, one notices the impact, not only of Greek science, but also of Arabic and Indian science. It is only now it is being accepted that the interaction of Indian science with West Asian and Central Asian cultures was in existence over long periods. Rahman says that the contact of India with Egypt, Mesopotamia, Sumeria, Iran and Central Asia, and later also Greece, was continuous since antiquity through trade, exchange of scientific knowledge and development of culture. In other words, it represents a cultural area where flow of ideas and knowledge was a part of social, cultural, scientific and technical evolution.

Language of Science in India

The Brahmanical writings, whether in science or theology, were dealing with the abstract, hence were timeless. Quoting Kosambi, a historian of repute, he points out that most of the surviving Indian documents were overwhelmingly religious and ritualistic. The writers were not concerned with history or reality. Al-Biruni said that most of these books were composed

in *Slokas,* rendering them rather unintelligible. Al-Biruni had composed a treatise showing how far the Hindus were ahead of them in this subject. Since the Hindus composed their books in *Slokas* and if, they wished in their astronomical books to express some numbers of the various orders, they expressed them by words. He tells us that Brahmgupta said, 'If you want to write one express it by everything which is unique as e.g. the earth, the moon; two by everything which is as e.g. black and white; three by everything which is threefold etc.Arabic and Urdu literature probably adopted this from India. For instance, *786* symbolically expressed *Bismillah-hir-Rahman-nir-Rahim*. Rahman further says that Indians probably did so for concealing knowledge from the masses for maintaining the necessary control and power. Here he also brings in the caste system as being responsible for limiting the knowledge to the few.

Science Society and Interaction

Rahman points out that we are aware of the relationship between the development of mathematics and the needs of the state in connection with the revenue and tax system, both of which were elaborate and complex, arising out of inheritance and division of property, town planning and architecture. While these needs may have provided the initial impetus, further development has been a matter of advancement of the subject. Rahman also refers to Al-Biruni's remark about the perception of Indian science by a new culture, which arose as a result of the Arab Renaissance.

Scientific Literature in Arabic and Persian

Rahman elaborates on the interaction of the Arab scholars with India and says that these scholars were aware of the development of sciences in India through the work of Al-Biruni and others, particularly in mathematics, astronomy and also in medicine and had also absorbed the Greek scientific tradition in term of studying Greek texts, their translations, interpretation through commentaries and analysis of problems. The characteristic features of their literature were:

(1) The use of unambiguous and refined language.
(2) Providing definition of terms used and giving illustrations.
(3) Posing of problems and providing their solutions.
(4) Giving examples for students or readers to solve.
(5) Literature displaying Aristotelian logic and rationality based on
Greek philosophy.
(6) Literature displaying the three-fold purpose of knowledge viz.:
Religious needs, agricultural requirements and meeting the everyday needs of life. In other words Rahman says it was essentially directed towards practical needs, i.e. it was utilitarian.
(7) Acknowledging works of predecessors and discussing different points of views, also presenting views for or against a theory;
(8) Extending the base of knowledge to cover newer areas such as:
(a) Geography and history and writing of chronicles
covering arts, crafts and various practices in different fields.
(b) Geology, gemmology and development of instruments for the purpose.
(c) Detailed knowledge of animals and plants.

(d) Physics specially optics, specific gravity, magnets, etc. and the concept of motion and time. Development of instruments for measuring time.

(9) Compilation of catalogues, Zijes, checking tables, catalogues of other astronomers. Development of instruments for the purpose.

(10) Translation of Sanskrit texts and familiarity with and adoption of many features from Sanskrit traditions; and

(11) Religious considerations often coming in the way of and suppressing scientific opinion.

Rahman has given several examples from the Arabic and Persian literature produced in India, which shows the above characteristics like *Dastur al Bab fil, Ilmal Hisab* written by Haji Abdul Hamid in which he discuses use of sciences for purpose of religion for e.g. use of mathematics in making calculation for *Zakat* and *Sidakh,* or of geography in finding the direction of Qiblah and Astronomy for working out the calendar and timing for prayers. Rahman has referred to the 16th century manuscript *Saba Samvat* written by Fathullah Farooqi, which was a mixture of astronomy and astrology, combining the Islamic and the Indian traditions in astronomy. Another text was *Jawahar Ul Ulum Humayuni* by Mohammad Faddil bin Ali bin Mohammad al Miskini al Samarkandi, written during the reign of Humayun. It was one of the encyclopedias written between 10th and 18th centuries and covers a wide range of subjects like geography, animals and birds, physiology, anatomy, astronomy etc. Rahman also mentions *Nuskha dar Fann:Falahat* by Aminullah Hussaini. It is a book on agriculture. The book contains information on crops, different types of vegetables, fruit bearing trees, flowering trees, herbs, various instruments for different astronomical and geographical features, as well as finding the direction for Qiblah, and also for making horoscopes. Other examples Rahman quotes are *Serate Feroze Shahi*, *Tuzul-I-Jehangiri, Ain-e-Akbari, Al-Danhatul-Maiyyadahfi-Hadiquatis-Sural Wa Maddah*

Nature of Interaction

Referring to the interaction between the Arab, Persian and Sanskrit scholars, Rahman writes that many books had been written combining these traditions, but an integrated unified tradition did not emerge to create a base for further development of science. Rahman says that the question of interaction of the Sanskrit scholars with Arabic and Persian scholars requires to be worked out. This has to be done for each field of science. In mathematics the Arabic and Persian scholars were familiar with the Indian literature and used it. Rahman has given the examples like *Bhaskaracarya Lilavati* translation into Persian, Ulugh Beg's *Zij* which was a source of astronomical computation was translated into Sanskrit under the supervision of Akbar. Similarly Arabic *usturlab* was Sanskritized into *ustarlava* which contains information for developing Astronomical instruments. Rahman says that similar interaction was also there in the field of medicine between Ayurveda and Unani system.

Rahman informs us that Haji Abdul Hamid (fourteenth century) divided science into two distinct categories. First *I'lmal Adyan*, i.e. science of religion, covering theology, *fiqah*, Hadis and observation of religious practices and personal laws. The second *I'lmal Abdan*, i.e. natural sciences. He clearly indicates the use of sciences for purposes of religion, such as use of mathematics in making calculations for Zakat and Sidakh, or of geography in finding the direction of Qiblah and astronomy for working out the calendar and timings for prayers. In

other words, it is suggested that all practical problems were separated from the religious science, as Descartes did later. Rahman tries to show that there was continuous struggle carried out by the Arab scholars to make science a secular subject and to liberate it from religion. Some Hindus too also worked on this and the name of Jai Singh is mentioned in this regard.

Concluding Remarks

Rahman enumerates the following reasons for the lack of development of science in India.

1. Since, during the period India remained an agricultural society, no new challenges arose to create new knowledge to help solve new problems. Only two major developments apart from the field of arts and crafts were in the area of paper technology and the development of military weaponry technology, but no theoretical development could take place.
2. Scientific activity and knowledge, by and large, remained a preserve of the elite, while arts and crafts remained with the less privileged groups.
3. The pluralistic tradition of Hinduism, whereby different philosophies continued to co-exist, as the faith failed to generate a unified pursuit of knowledge.
4. The religious prejudices and the linguistic arrogance may have also come in the way of the evolution of a single tradition.
5. The philosophic and theoretical framework being different, the Vedic logic on one hand and the Ptolemaic, the Euclidean and the Aristotelian logic on the other became a major block, since both were associated with religion. The pressure of the conservatives was too much to discard the overall framework to create and develop a new integrated tradition.
6. It also appears that the two different processes continued to operate during the period: one towards the integration of the two traditions, and the other keeping them apart.
7. Lack of institutionalisation of education was also a handicap.
8. Changes of dynasties and kings with different approaches to knowledge even within a dynasty also came in the way of continuous growth of institutions and spread of knowledge within an institution.

Towards the end Rahman wonders whether there could be a possibility of Indians developing a unified base of science, incorporating new knowledge from Europe? He says that the literature of the period and the effort of Sawai Jai Singh do indicate that development in this direction was probable. However such an eventuality was disrupted by colonisation. The coloniser in turn exploited the conservative ethics and religious groupings of the people, imposing a new scientific system in a new language completely marginalizing and de-linking the earlier knowledge system from the new. The irony of the situation was that they used the knowledge as well as technology for the development of their own system. Rahman says that it is part of another story and we find the effects of it to this day when we not only have lost confidence in our knowledge systems but have become totally dependent upon the knowledge and the science of the West.

Source:

Rahman, A. 1996. A Perspective of Indian Science of Tenth- Eighteenth Centuries. In *Science Philosophy and Culture- Multi Disciplinary Explorations* (Part I) Edited by D.P. Chattopadhayaya and Ravinder Kumar. New Delhi: PHISPC. Pp. 396-426.