Science Use and Misuse

Scientific capacity alone is not a panacea for all ills or an all conquering weapon. A small 'hot' war against a Third World country, Vietnam, saw as much scientific expenditure and lethal weaponry used as in World War II. But, the indomitable Vietnamese spirit of self-reliance and courage withstood the big science war machine.

SCIENCE AND TECHNOLOGY

Science and Technology are an engine of development. The Third World countries in their endeavour to bring justice and economic benefits to their population have over the last two decades or so been acutely interested in this problem. On June 30th a Conference begins in Colombo of Scientists and Technologists of the non-aligned nations aimed at discussing some of the problems facing science and technology in their countries. The Conference is sponsored by the Sri Lanka Association for the Advancement of Science. In the discussions below, we highlight some of the problems in the growth of science and technology in our countries.

Scientific and systematic knowledge is not a Western invention although its particular type of growth in the last 300 years or so is closely associated with the European countries.

Apart from informal observations and codification of knowledge which have occurred in every known human gathering, formalized approaches are recorded in all the literate cultures. For instance the knowledge of arithmetic was known to the ancient Egyptians whilst Sumer had clay mathematical texts around 1700 B.C. In more recent times, the geometry of Greece, the algebra of India and the Chinese knowledge of magnetism are well attested. The annals of the countries that constitute the Third World are replete with numerous descriptions of the growth and use of formalized knowledge in everyday life and it is not necessary for us to repeat these ancient achievements. In Sri Lanka too, we witnessed the great achievements in building and the development of a great hydraulic system as well as involvement in much more tantalizing areas like the discovery of the zero in which latter area historical research is only beginning. We refer to the work of Bimal Matilal who places the discovery of the zero concurrent with and fed by the deep intellectual ferment associated with the growth of Madhyamika philosophy. The great Madhyamika philosopher was Nagarjuna, a South Indian and his chief associate and disciple was the Sri Lankan Aryadeva.

The growth of European Science (modern science) occurs from roughly the 16th century onwards and it is coincident with the European expansion towards the rest of the world as well as with the growth of capitalism in these countries. Most explanations of the growth of European science have rested on what the great science historian Needham calls the 'internal dynamic' and have emphasized the importance of such factors as the Renaissance, Reformation and the Rise of Capitalism.

There have been no efforts so far at giving a different interpretation to this basically Eurocentric view of science, but one can see the outlines

of a possible revisionist view giving (at least in the early stages of modern European science) a different orientation emphasizing the importance of the external non-European dynamic. Such a revisionist approach has similarities to current thinking in the economic sphere about the growth of Western societies on the spoils of non-western ones, as well as to recent work on cultural dependence. A parallel approach to these theories in the field of science would emphasise the expropriating and imprinting functions of European culture. Within such an approach one can point,for example, to the acquisition by European Science of the knowledge of the Arabs, the ancient European classical tradition of the Greco-Roman world and the Chinese ideas like those on gunpowder and navigation. This view of the initial acquisitive push in the growth of European scientific knowledge could also be illustrated by parallels in the great European voyages of discovery of the time. The 'discoverer' of America, Columbus is apparently pre-dated not only by Vikings but also by Africans and Asians indicating the hidden non-European encounters that historically occurred. The recorded example that the great European 'discoverer' Vasco da Gama used Indian and Arab navigators on his biggest ocean stretch from the South of Africa also points to the acquisition of existing non-European knowledge.

Although, it is not possible to ascertain as yet the manner and degree to which non-European science gave rise to European science, the conquest of Asia and America by Europe was largely completed before the scientific revolution based on pre-scientific technology of fire-arms and ocean-going ships. However, one can note the growth of modern science as occurring in Europe largely during the last 300 years and describe its spread to the rest of the world as a process similar to the spread of other cultural products of Western origin to the rest of the world.

The Empire building in far flung territories set in motion a process whereby cultural artefacts were sometimes adopted from remote regions legitimised in Europe and transmitted to other parts of the world. This process of collection of cultural artefacts and re-transmission supplemented those that arose within the European countries themselves.

Cultural artefacts so transmitted included not only consumption items but also systems of ideas and concepts like religion. Such transmission and their reception were dependent on the socio-economic, political and cultural conditions of the colonised peripheral countries as well as of the countries in the Western metropolitan centre.

These cultural artefacts sent from the European centre have been historically adopted by the groups closest to the European presence. As the European presence was itself generally an unwelcome one it was these groups that were allied to the Europeans that formed an important link in adoption (that is of imitation) of European cultural norms.

Therefore, these acts of imitation first occurred among those groups that have close economic and political ties with the colonial rulers, groups that we may call comprador classes. The adoption of cultural elements by the comprador classes is different in nature from the adoption of cultural elements in the metropolitan centre. In the European centre, cultural elements are generally adopted after debate, discussion and even controversy over a virile period of exposure to the public. In the colonial periphery, the comprador classes adopted cultural artefacts purely by the fact that they were transmitted from the centre as desirable products and legitimised as such. Therefore, legitimisation at the European centre was by discussion whilst at the colonial periphery it was by imitation.

Science is also a similar cultural artefact, which though initially was partially generated in the rest of the world has within the last 300 years tended largely to be generated and legitimised in the West. Science has developed in the Third World closely allied to the colonial presence. Also because the structure of higher education in Third World countries attempted to map one-to-one the education structures of the colonial "mother" countries this process was further enhanced. Science can (at least partially) be seen as another cultural packet transmitted to an upper strata elite.

Transfer of Knowledge

This process of transfer of knowledge, of the sciences is a diffusionist one. The bulk of the knowledge relating to the sciences grows in the West and still largely does so (the UN estimates that 98% of the world R & D is done in the developed countries whilst only 2% is done in the Third World, of the latter only half—i.e. 1% of the total world research is on problems of the Third World) and is transferred to developing countries. This implies that the major thinking in the sciences still occur in the West and only minor variations of the major viewpoints are handled in the Third World. It also implies that there is usually a time lag in the level of debate in the sciences in the West and the dependent countries. In the case of quick transfers of knowledge with the availability of ample literature as well as a large interchange of staff and students with the metropolitan centre, such a time lag is relatively small and could be counted in a few years duration. But where such academic exchanges are infrequent and reading material is lacking such lags can be extended to decades.

One of the important aspects of the difference between knowledge at the centre and that of the dependent periphery, is the absolute difference in quantity and the rate of growth of knowledge. This is shown by taking any valid measure say the number of academic papers, journals or absolute number of persons practising (although the last aspect is perhaps tending to decline rapidly with the massive growth of graduates in the developing countries). One necessary outcome of this difference in the quantity and rate of growth of knowledge between centre and periphery is that the knowledge transmitted to the periphery is but a small part of the knowledge at the centre. This transmission is by nature incomplete in that, for it to be complete, one would have to have a complete replication at the periphery of all the papers, journals, as well as, scientists at the centre.

With the growth of foreign exchange problems as in the South Asian countries, transmissions of

journal material which never was complete becomes very incomplete and as in the case of Sri Lanka in recent years sometimes virtually non-existent. Further for similar reasons scientific equipment to parallel the science in the centre cannot be afforded.

An important element in this diffusion and transmission process are "experts" from the metropolitan centre who operate in the dependent countries. Often the colonial division of labour is again evident in that the expert or the visiting scientist will attempt to impose his views whilst attempts are made to relegate the local to only peripheral or the applied aspects of a problem (so called policy oriented research). As the visiting foreign academic has access to a large degree of resources in the form of money, prestige (usually associated with a white skin in a black country) and exposure to the latest literature he usually finds himself at an advantage. He often hires his assistants who are formally as educated as he (sometimes even more) but because of the particular nature of the relationships, it is the visitor who sets the tune for the research, gets the publication and ultimately credit for the work.

Knowledge transmission under such instances tends to be incomplete and also have a debilitating effect on the growth of knowledge in the peripheral countries themselves, because of the certified knowledge nature of the information transmitted.

In academically and economically dependent countries, one finds also that the transmission of what may be described as distorted knowledge at the centre assumes importance. This is done by interested groups having disproportionate access to resources giving emphasis to specific problems of their own tending to 'distort' the development of science from what it could have done under 'organic' conditions. Thus, knowledge at the periphery will always be distorted, limited, 'outdated', and dependent on the centre.

Science in the Metropolis

But there is new work in the 'science of science' which indicates the strong social context within which science grows in the world. As Dolby (1971) puts it "a scientist does not establish his own results". There can only be scientific knowledge of what a group of people can agree upon. This immediately removes scienee from the subjective level of creative certainty. It also introduces the possibility of relativism in the standards of those to whom the scientist directs his arguments.

The present crisis in Western science has been viewed as an ideological one by the influential work of Ravetz (1971). He has shown that only a small proportion of research results become "facts" to be recognised as such in the body of scientific knowledge. Those which are to reach this status and survive are those selected within and through the social context of science. It is therefore a seeming paradox that what is considered "certain, objective and universal can only emerge through the use of fallible individuals of such informal and subjective methods" (ibid). The present crisis in the sciences had led to more deep questioning of the role of science and technology and the growth of new movements concerned with the social responsibility of science. It has given rise to several new journals which have attempted to carry the questioning of science at a fundamental level.

The questioning has been of a substantial dramatic character and within the period of the last 10 years or so there has been such a rapid change in emphasis, that to quote Dickson 1974 "technology is no longer seen as the omnipotent God that it was even 10 years ago, when the British Labour Party won a general election on the pledge to create a white heat of technological revolution".

Science has therefore in truth become a force—a revolutionizing intellectual force; a force in the production of goods and services; a political force influencing and influenced by both the political and social behaviour of man. This force must admittedly be 'controlled', but can this be achieved without adequtae knowledge of 'science' in its components, its methodology, its effects on society and the converse effects of society on the development of science.

As scientist J. G. Crowther put it:

> "Science does become an organism with a degree of autonomy whose growth is stimulated in part, through its own intellectual mechanisms of development, but it cannot pursue a life independent of social conditions. It is like a powerful limb on the body of society which to some extent passes its own life and growth, and can accomplish many things but it is not an independent organism and dies when the social body that supports it is diseased".

The question that has been poised is how can Third World science and Third World science policy breakthrough its restraints and come out as a liberating force. Subsequent papers explore further dimensions of this problem.

This then is the broad contextual framework within which science and technology in our countries attempt to develop. In the following contributions we touch on some of those facets that advance our scientific and technological development and those that do not. In the case study articles by Osmund Jayaratne and R. O. B. Wijesekera we see succinctly how the healthy growth of science is stifled in our countries by socio-economic environmental factors. In the recommendations made by UNESCO as well as the highlights of the UNCTAD study on transfer of technology we see the further presentation of recommendations as well as further problems. The cases of Africa and China provide interesting broad case studies specially the latter's attack on science and technology as part of a broad political problem. Finally we highlight some of the attempts being made to harness science and technology against the Third World and counterpoise it with the future of Third World science, where we emphasize the need for boldness of conceptualisation and imagination in our scientific endeavours. For we believe that the Third World today is in the world stage poised at the same phase of aggressive development that Europe was in the 15th and 16th centuries.