

Science Policy, as fostered in most Third World Nations of Africa, Asia and Latin America is geared to satisfy big business and corporate interests and is primarily concerned with exploiting of the local natural resources and maximising profits. It does not adequately deal with the real needs of the masses; nor does it aim to develop these nations into self reliant industrial countries. "Thus the Management problem of the developing countries", the author maintains, "Is not of making science more efficient, but of making it relevant." —Ed.

The Management of Scientific Research in Developing Countries

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There are two distinct although not entirely independent aspects of the management of scientific research—academic, which is the subjective side, and socio-political—the objective side. As far as the subjective side is concerned, the problems are more or less similar in most of the countries in which scientific activities exist. But the objectives of science are different in the three worlds—socialist, capitalist and the rest. In the socialist world the guiding principle is the use of science and technology for the benefit of the society as a whole. In the capitalist society use of science and technology is made for the private profit of the privileged few. In the countries of the third world which continued to remain underdeveloped science and technology do not play significant roles.

Definitions

An academic discussion on the organization of Scientific Research would need certain definitions and these may well be quoted from a document recently circulated by Unesco.¹ These definitions of science, scientific methodology technology, research and development are independent of the scale of the research effort or the field of operation.

"Science is the process whereby mankind makes an organized attempt, by means of the objective study of observed phenomena, to dis-

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cover how things work as casual systems. Systematic reflection, often largely expressed in the symbols of mathematics, enables science to bring together the resultant knowledge in an effort to reconstruct the world *a posteriori* by the process of conceptualization. Science (or the sciences) accordingly constitutes an interlocking complex of attested fact and speculative hypothesis, in which the principle is observed that—so far as practically, economically and humanly possible—the theoretical element must be capable of being verified experimentally.

“Scientific method means that progression from hypothesis to verification by experiment, to theories that must themselves be modified when new phenomena are observed. This description of science includes the social sciences, in which the scientific techniques of analysis and deduction are used as far as possible to comprehend the behaviour of human beings in groups or societies, although opportunities for controlled experiments may be less in social sciences than in the so-called exact sciences.

“The product or output of science is a coherent system of codified and correlated information of observable phenomena. Technology consists of knowledge which relates directly to the production or improvement of goods or services. Some parts of technology are wholly explicable in terms of fully-fledged scientific theory, whereas other parts are still in a state in which they are not fully codified in such terms.

“The activity of research is that of obtaining by observation, experiment or investigation, the new information required to extend science and technology. The new knowledge, and understanding provided by research must be experimentally developed into some tangible application if it is to be meaningful and significant from a social or economic standpoint as opposed to a purely cultural one. The expression ‘research and development’ is used to denote both the study, reflection, conceptualization and theory-testing and the process of refinement and adaptation which leads up to the point of practical application and exploitation.”

Organization of Scientific Work

As Kalweit² points out, up to the turn of the century the scholars mainly pre-occupied with science were those whose major task consisted of lecturing at establishments of higher learning. They conducted research in so far as this was required for teaching and out of personal interest during their free time. To the extent to which science began to play an important part in social life and grew beyond the scope of individual research capabilities, it became a matter of concern for industrial enterprises and subsequently for the state.

In the Charter of Scientific Workers adopted by the World Federation of Scientific Workers³ in 1948, (on the basis of which the Federation adopted in 1969 the declaration on the rights of Scientific Workers and finally Unesco framed the international instrument just mentioned) is a section on the organization of scientific work. The need under modern

conditions for a scientific organization and planning of scientific work, far greater than in the past, raises a special problem—the nature of the control of scientific work. If scientific workers are treated as normal administrative or business officials and subjected to the same regulations and control as non-scientists, their work can be largely frustrated. It is, therefore, essential for the very carrying out of scientific work that the following conditions be adhered to :

- (i) The direction of detail of scientific work to be in the hands of scientifically trained persons. Scientific work to be administered by bodies containing representatives elected by scientific workers. These should include all grades of seniority, with a larger proportion of active scientific workers.
- (ii) Scientists to be represented at the administrative level in all organizations involving scientific work.
- (iii) Scientists have the right to take part in workers' organizations in all undertakings in which they work.

The role of the administrator in scientific organization continues to be under debate not only in the developing countries but also in advanced capitalist countries where the limit of growth has been reached and decay started.

“Where Science and Society Meet”, according to Alvin M. Weinberg⁴ one increasingly enters an ill-defined area which is fraught with public implications and where complete answers can be given neither by scientists nor by politicians. There must therefore be a tension between these two : the authorities keeping the scientists' work relevant to the practical problem at hand the scientists keeping the authorities from being arbitrary and wrong headed. It is clear that the United States is not going to push ahead on a massive scale in all fields of research and development.⁵ A more discriminating approach will be taken, and decisions will be made on political processes, selecting some areas for contraction. There will be in future greater control over federal programmes by the executive office of the President as well as intensified government efforts to influence the direction of power of private activity. The intervention of the government in the private sector of the economy is likely to take the form of alternation in the rules and incentives under which the market operates by such devices as taxes, subsidies and judicial actions to internalize social costs.

Aberrations of Science Organizations

As Chaussepied⁶ points out, the orientation of costs, the allocation of funds, the choice of sectors to be supported, all of which carry serious dangers for the development of research, are inherent in societies based on profit. The Governments of the western industrial countries are aware of this fact and are taking certain measures, such as the one mentioned in the

previous paragraph. These measures are, however, inadequate to overcome the deep rooted aberrations of science organizations. Kenneth Mellanby⁷ has quoted Forrester's Law—in complicated situations efforts to improve things often tend to make them worse, sometimes much worse, on occasion calamitous—to indicate the futility of the remedial steps taken by the Government of the U.K.

The trends in the Western Capitalist countries are to direct the management of research from institutional orientation to strategy orientation, as pointed out by Weinberg and Smith Bruce. In the U.K., Research Councils have been scrambled and reassembled with new names and different terms of reference: laboratories and research organizations have been moved from Ministry to Ministry. Here also strategy orientated policy is being adopted. Because it was felt that much research financed by government was irrelevant to the interest of the community, attempts have now been made to improve the situation through financial pressure. Part of the money voted directly to research councils is now given to executive government departments. According to Mellanby much research is trivial and directed to wrong objectives and as such most research workers would be only too delighted to be asked to tackle worthwhile problems of which they were unaware. But this too will not redeem the situation because the real ills lie elsewhere.

One of the negative aspects of the regulated funding system according to Mellanby is that grant giving bodies try to avoid giving a grant for work on a subject already being tackled by some other laboratory. As a result of this many subjects have become reserves of particular scientists, who may not all be actively working on them but who may be able to prevent anyone else from doing so. Many grants have been well spent, but getting grants may not always be correlated with the merits of the applicant or his subject. Further grant seeking is a full time and specialized job and it is not always the case that a devoted original research worker is also good at this job. The very presence of many other people in laboratories ostensibly devoted to original research is an important cause of their lack of productivity. There have been a few who have recognized that to pour more and more money into research might not be an answer. The most important heresy, which is unfortunately supported by many people, particularly administrators in senior positions, is that research today must be done by teams rigidly organized in a hierarchical system. According to Prof. Mellanby, such an arrangement has the virtue of administrative tidiness and it may fit into a scheme which permits good career prospects for at least some of the workers. It is also much easier for a man to obtain promotion, if he can claim that he directs the work of others, than for the most productive lone-wolf. What has gone wrong with much research is that teams of potential developers have tackled problems needing the genius of the excellent individual and we have produced a situation which keeps the scientific elite away from the laboratory. The community thus got the worst of two worlds and wasted a great deal

of money and, more important, of rare talent in the process.

The importance of the benchless scientist in the contemporary research organizations is another aberration touched on by Prof. Mellanby. Since 1939, research stall has increased, perhaps by a figure of as many as five in the U.K. while in some cases the volume of publications has actually fallen. Heads of Departments have mostly published nothing original for years, which has contributed to a fall in quality since it is the best scientists who are being sterilized. If not, then inferior men with the power to curtail the initiative of genuine research workers are heading the departments. Before the outbreak of War in 1939, when research in Britain in a great many fields was very healthy, it was the exceptional professor of a scientific subject who did not spend a substantial part of his time at the bench. The most senior stall in laboratories and universities were usually among the most productive. Research students were expected to stand on their own feet and their publications in learned journals were considered more important than the production of a lengthy and turgid Ph. D. thesis.

Socio-political implications

Even if academic aberrations of scientific research organizations are corrected by encouraging gifted men to do the bench work, by evolving a perfect system of assessment, and by cutting down the time spent on administration and committee work, we may not be able to harness science fully for the benefit of mankind. The cultivation of science is one aspect, the utility of science to the needs of society is another aspect, and prevention of misuse of science is the third aspect. Therefore, success in the first aspect is only a partial achievement, and it may be rendered futile if the other two aspects are at the same time neglected.

In fact, science has been cultivated more for destructive rather than constructive purposes, and even inventions intended for the welfare of society are misused in the interests of profits. Continued military interests in some of the emerging technologies has been largely responsible for rapid growth in certain fields and wars or war-like situations generally result in an explosive growth of science and technology. In fact, the war industries of the advanced countries thrive not only on the liberal grants received from their governments but also on the export of war equipment and materials to backward countries. Thus the defence budgets of developed and under-developed countries alike help the war industries of the advanced countries.

As Zimmermann and others point out,⁸ this situation is created by the ruling classes—through government, big business corporations and tax-exempt foundations—who fund most of the research. The scientific elites who exert control on science students, through their influence over curricula and text book content and their personal involvement in training the next generation of elite scientists, are formed of those professional goals are in congruence with the scientific priorities of the ruling classes. For

example, billions of dollars are being spent on space research in U.S.A. and it is believed that the implications of the research for military and the profits of the influential aero-space industries are clearly the decisive factors.

The search of maximum profit, rather than the needs of national development, determines the location of the design and research effort. This philosophy, however, does not take a nation very far. In many countries of Western Europe, and in the U.S.A., scientific workers are either unemployed or forced to take jobs in no way in accordance with their scientific capacities. Unemployment, which in the past has tended to weigh most heavily on basic industries, is now growing in the industries based on advanced technology such as the aircraft and electronic industries⁹. Cut-backs in production, caused by economic recession, inevitably give rise to cut-backs in R & D programmes. The effects go beyond industry to the universities and to government research establishments. Highly qualified scientific and technical staffs are particularly vulnerable in the event of capitalist takeover and merger. The growth of multinational companies poses a further threat of redundancies and the erosion of the conditions of scientific and technical staffs¹⁰. These companies are free to take their decisions unhampered by national considerations and governments are powerless. They are governed by non-accountable boards. These companies can, by shifting their investments around, deprive people of jobs in one country in order to give them to people who are worse paid in another country. They are politically irresponsible: they are willing to disrupt and burst through democratic fabrics in each of the national states in which they work. They are financially irresponsible: The recent speculation against the German Mark was not caused by the gnomes of Zurich—the real problem is some half a dozen financial directors of multinational companies who came together to safeguard their future. They are capable of preventing science itself by buying patents and not using them. They are also capable of directing the governments to do research for them in areas which give them opportunities of earning profits and expanding their business.

Under-developed countries

As Bernal pointed out,¹¹ science in most of the countries of Asia, Africa and Latin America was overwhelmingly aimed at satisfying business interests concerned with exploiting the local natural resources. This science did not adequately deal with the real needs of the population or develop these countries themselves into autonomous industrial units. The management problem of the developing countries is thus not of making science more efficient, but of making it relevant. Any amount of academic exercise to render it more efficient cannot bring about the necessary change. As the appeal from the Symposium on "the Scientist in Society", organized at Varna in 1973 by the World Federation of Scientific

Workers, insists, the problem being essentially socio-political in origin, can only be solved by socio-political means.¹²

In spite of the timely warning of the World Federation of Scientific Workers to the undeveloped countries in its Charter of Scientific Workers (mentioned elsewhere in this paper), the backward countries of today, which were former colonies, made no effort to change the colonial administrative machinery operating on the principle "administration for the sake of administration" inherited by them. This system plans development in theory but opposes it in practice because the development leads to social changes challenging the authority of the men in power. The scientific infrastructures created in these countries shape themselves after the existing administrative systems and indulge in subjective scientific activities without relevance to the needs of those countries.

Under these circumstances the scientific infra-structures in developing countries grow independent of their national needs. They are operated by vested national and international interests. Stress on research of no practical utility, heavy investment in sophisticated equipment, lack of infra-structure capable of using the research, and glorification of science and scientists divorced from the local realities, seem to be common to all developing countries.¹³ Scientific contributions in these countries are made in association with or under the guidance of foreign scientists on topics also suggested by them and acceptable to international journals subscribed mostly in advanced countries.¹⁴ The strength of this indoctrination is so strong and so prevailing that even the most competent committee set up by the local Governments cannot resist the temptation of giving overriding importance to work done abroad, qualifications obtained abroad or papers published abroad. The latest equipment for research in topics of interest in the advanced countries is readily provided, but no effort is made to build ordinary industrial infra-structure to make use of the work done in the country itself. Even the backward of the advanced countries face the same problem. According to Professor Mellanby, it is generally held that the British scientists are rather good at "research", but they fall down over "development" and that foreigners mainly reap rewards on their original investigations.

In spite of the realization by the third world countries that the progress made in the capitalist and socialist worlds is entirely due to science and technology, they have not been able to achieve the desired results. According to K.R. Bhattacharya⁵, the concepts of internationalism of science and technology, of development through assistance and aid, has done immense harm and kept under-developed countries at the mercy of developed ones. Elaborating the arguments further in another paper¹⁶, he admits that there is a store-house of technology, but the knowledge is available only at a price, as a commodity for sale. So also is aid, which in the ultimate analysis must come from commercial sources as an instrument of profit. And the buyer is not the under-developed country as a whole, but its small Westernized elite interested in maintaining its privilege.

This elite to elite transaction was visualized 26 years ago in the Chapter of the World Federation of Scientific Workers in the section dealing with the special needs of science in underdeveloped countries. The entire section is reproduced below for the understanding of the significance of international collaboration between scientific workers in contrast to the elite.

"Science has been most unevenly developed, following closely the evolution of industrial communities and being relatively undeveloped in agricultural ones. We must work for the creation in all countries in as short a time as possible of an indigenous body of scientists working in conditions of political as well as economic liberty. This implies the assistance of scientific workers of the more advanced countries to educate the people and more particularly the potential scientific workers of undeveloped countries. In the meantime, it is the responsibility of scientific workers in industrial countries to help the people of undeveloped countries with their urgent problems. To do this the following conditions must be observed :

- (a) application of science to most pressing needs, e.g. development and conservation of natural resources, study of local agricultural conditions so that there may be maximum production of varied food stuffs without soil erosion, attention to problems of health so that the same expectation of life is looked on as attainable in all parts of the world ;*
- (b) provision for interchange of teachers with other countries and for students to study abroad ;*
- (c) provision of scientific personnel and equipment from abroad to meet immediate problems on the spot as well as for training of workers in the country concerned ;*
- (d) complete separation of any such schemes from economic and political control by a foreign power".*

One of the reasons for the failure of the developing countries to make proper use of science and technology is the growth of irresponsible scientific elitism encouraged by their science policies. There have been similar tendencies in all countries, and as opposition to "anything that would lead to the creation of a privileged class of scientific mandarins", expressed by Swiss and Soviet delegates at the discussions of Unesco's draft International Instruments on the Status of Scientific Research Workers during the 17th session of the General Council of Unesco in October-November 1972, indicates.¹⁷ It was also accepted that scientists should be the servants (and not the bosses) of society, and that it is correct to emphasize both their professional duties and their significance in social development. Mere pumping more resources into science does not automatically ensure reasonable material and cultural amenities and services for every member of society. The Science Policy of India¹⁸, which has been operative for over 15 years, includes fostering, promoting and sustaining by all appropriate means, the cultivation of science, and scientific research in all its aspects—pure, applied and educational ; ensuring an adequate supply, within the country, of research scientists of the highest quality and recog-

nizing their work as an important component of the strength of the nation, encouraging, with all possible speed, programmes for the training of scientific and technical personnel on a scale adequate to fulfil the country's needs ; encouraging individual initiative for the discovery of new knowledge in an atmosphere of academic freedom ; encouraging the creative talent of men and women in scientific activities by offering good conditions of service to scientists and according them an honourable position and by associating them with the formulation of policies. Thus, as Ouaches points out¹⁹, the primary task of the developing countries is to identify and struggle for policies which will provide the necessary means for their countries; it is clear that the road cannot be the same as that of the countries which have colonized, dominated or "protected" them. The road is precisely the opposite. It calls for the cherishing of resources, contrary to the tradition of exploitation. In a word, it calls for the discovery of reality, for a demonstration of the evidence that the countries of the third world are amongst the wealthy, although this wealth is not made up of dollars. It is made of men, of their natural environment, of the potential of soil and the sub-soil, of clean energy of the sun, equally distributed and inextinguishable.

Role of Trade Unions

It is evident from the information gathered in this paper that there is something seriously wrong with contemporary science. There is too much of wastage, irrationality and misuse in the big science we inherit today. It seems the science has been corrupted by money power in all countries in which it is profit based. Even in the countries in which it is not profit based, huge amounts of wastage irrationality and misuse have to be unwillingly tolerated to acquire matching preparedness for the defence of their political system.

Thus, as Chaussepied observes in his paper, already cited, in order to develop scientific research in accordance with its needs, in order to democratize it, in order to orientate it towards the satisfaction of social needs, fundamental changes, economic, social and political, are necessary. Already, since these objectives are common to most sections of the population, scientific workers by their united strength, linked with that of other categories of workers, can successfully fight the policy of subjugation of research to the selfish objectives of a minority of feudal, industrial and financial interests and can insist on respect for fundamental human needs.

One observes today a functional inversion between the establishment and trade unions in almost all countries of the world. The establishment which is supposed to be working for the welfare of society as a whole, protects the interests of the privileged few and the trade unions, which are supposed to safeguard the interests of their members, forming a small section of society, are asking for sacrifices and are struggling for the welfare of society as a whole.

The unchallenged reputation of science in almost all countries enabled influential scientists to secure for themselves very attractive service conditions. Vested interests did cash in on this situation but a few scientists refused to be bought over. Some of them gathered together to form the World Federation of Scientific Workers. The primary aim of scientific bodies which subscribe to the constitution of the World Federation of Scientific Workers, inaugurated in London on 20-21 July 1946, is the increase of human welfare through the application and development of science. They declared that scientists can no longer passively acquiesce in the misuse of science, which not only brings about unnecessary suffering and waste, but also impedes the advancement of science itself. The Charter adopted by the first General Assembly of the Federation held in Prague on September 21-25, 1948, is a concise statement of the responsibilities of scientific workers and of the conditions which must be provided to safeguard freedom, the advancement and the social utility of science.

Conclusion :

The management of scientific research is not an establishment problem alone. Trade Unions have to be equal partners in any scientific organization, they can point out deviations from the identified path, and can take timely action to get it corrected. The strengthening of trade union movements under the general guidance of the World Federation of Scientific Workers is thus a pre-condition for the successful management of scientific research. This is especially desirable in developing countries, in which the market forces play a devastating role. In fact, the developing countries can convert their backwardness into a blessing by identifying an independent programme for development, making use of the experience and achievements of the advanced countries. Of course, this is only possible if they clearly understand the functions of the scientific research they ought to undertake, and manage it skilfully. This job cannot be done by the establishment under charitable guidance from foreign experts serving vital interests. For the success of the research effort, therefore, an involvement of the trade unions is absolutely necessary. □

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PHILOSOPHY AND SCIENCE POLICY

Professional philosophers and scientists have studied the systems and provided the best methods for maintaining the status quo. Willingly or unwittingly they have acted as paid bureaucrats, not as the leaders ; they have behaved as front-line soldiers, not as commanders. Meekly they have sought an easy ride on the bandwagon of the oppressor class....No other area of our action would have greater implications for the future of mankind than our policy in the field of science and technology. Any decision taken today will shape every environment of our social, economic, defense and political world of tomorrow. Therefore the question of Pedagogy and Science Policy particularly in the Third World cannot be and should not be permitted to serve strategic and diplomatic or military and prestige requirements of any clan, elite or government.

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