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Bernal's conception of science in the examination of history

Fifty years after the first publication of J. D. Bernal's classic "The Social Function of Science", many people still vividly approve of Bernal's ideas, but some are also critical about them, while others are proceeding from his findings and going beyond them. These disputes cannot be seen merely as an exegesis of the historical text by the late great author nor as an ancestral cult. On the contrary, Bernal's assessments, some of his formulations of and solutions to problems and some of the directions of his life's work have, widely undisputed, stood the test of time across all scientific and political differences of opinion. Permit me to raise six points here.

1) Bernal is widely recognised as an encyclopaedist of 20th century science, who made his original contributions to the development of the most different disciplines of science (Goldsmith, 1980; Hodgkin, 1980: 17—84; Steiner, 1986; 1989). He is certainly one of the rare cases in the history of science where a scientist succeeded in going down in the annals of three schools of thought simultaneously as one of their creative members — in X-ray structural analysis, at

the cradle of molecular biology and as a founder of the science of science.

2) His conceptual and historical research into the socio-economic determination of science, the social function of science and the social responsibility of scientists was pioneer work, and led to the formation of a science of science.

3) He also pioneered in the foundation of peace research based on the findings of the entity of all sciences. Science in and for a "World without War" was the decisive impetus of his commitment to independent peace research long before it became an independent, active field of research.

4) Bernal based all his thinking about the tasks of science and the social problems it should solve on global concepts, and he did so at a time when this was quite unusual and not yet generally accepted. As for the scientists' responsibility towards Asia, Africa and Latin America, Bernal contributed a great deal to creating a scientific public that comprised far more people than just the narrow circle of specialists.

5) He gave an example of how to combine

scientific research work in a laboratory with activity in the fields of science policy, publication and practical application of science.

6) All his thinking and acting — as a patriot of his country fighting against fascism during World War II, as a committed cosmopolite of world-wide science and as a Marxist internationalist — were always directed towards the humanistic and social progress of humanity.

The lively reception of the book right after its publication in Great Britain, its emanation on an international scale and, last but not least, the scientific and public activities taking place on the occasion of the golden jubilee of the book's first edition (books published and scientific events held in various countries) add a historic dimension to the key significance of this one of Bernal's works.

The 50 years of development of science, society and politics that have elapsed since the book's first edition, however, make it necessary to put the concepts and basic statements of this work to the test stand of history, as Bernal did in his own way 25 years ago (Goldsmith and Mackay, 1964).

One of today's core problems is the ambiguity of the possible social effects of science that Bernal dealt with in his book "World without War" in 1958. Latest developments and the experience gained in the period since the year 1958, nevertheless, call for more precise, further-reaching and above all, more effective judgements and conclusions. When looked at from this angle, the ambiguity mentioned above is nothing new, neither as a fact of history nor in its intellectual recognition.

Irrespective of a growing understanding of the dangers emanating from science, in the 1950's and 1960's, concepts were worked out that caught on and developed further Bernal's programme of the social function of science. It was Bernal himself who coined the term of "scientific-technological revolution" (or "scientific-industrial revolution") in 1957 to characterise the emerging new qualities in the interrelations between science, technology, production and society (Bernal, 1957/1961; 1958/1960; 1963).

Since the 1970's the other side of the contradictory effects of science has become

manifest through new social movements. Besides those effects of science that jeopardise peace through nuclear and conventional armament, through the militarisation of social life and through actual warfare, additional threats and harm induced by other forms of applied science came into the focus of attention (use of nuclear energy in any form, genetic engineering, etc.).

This process, however, is neither a linear one, nor does it develop free of contradictions. It leads to inescapable consequences. Three of these, which have far-reaching contradictory impacts, should be named here:

1) the unprecedented scope of application of science in material production, as ushered in by new types of productive forces such as microelectronics and biotechnology;

2) the further socialisation of science through its introduction into everyday life, its penetration into all spheres of life, including household appliances, information and communication technologies, etc., as well as into family life and leisure;

3) the contradictory development of the international — ie. intersystemic — socialisation of science through the exchange of information, cooperation and commercial-scientific relations, on the one hand, and bans, national secrecy, Cocom lists, etc., on the other.

But, as complex and tedious as all this may be, bans and restrictions in the fields of research and international scientific exchange have no perspective.

A definition of the social function of science, adequate to contemporary and future conditions and requirements, has to — soberly and unillusively — state the actual situation (eg. the existence of national secrecy), but it has also to formulate the presently possible tasks and objectives for the future.

In 1939 Bernal dealt almost exclusively with those effects of science that were conducive to progress. 25 years later (in 1964), he took a self-critical stand, or at least a more differentiated position.

Presently, I believe, five sets of issues require differentiated dialectical discussion and analysis.

Science for peace

The scientists' responsibility for peace, consciously accepted and observed by many scientists nowadays, is going beyond the limits of a minor movement of a small group of politically minded intellectuals. Scientists have begun to accept and share in the responsibility for the protection of peace. They have recognised the feeling of responsibility as an important imperative guiding their conduct. This must be regarded as a turning point in the conduct of scientist in relation to the question of peace in the 1980's — as compared with the 1940's, 1960's and even more so with the 1930's, when Bernal wrote his book.

If one tries to elucidate the social functions that science has to fulfill today, the following points will have to be made. First, science should produce proposals, programmes and contributions for the equal security of all. Second, scientists should work out ways for technological and spiritual disarmament. Third, science should develop ideas leading to change. Fourth, scientists could contribute to the promotion of global communities of interests and to the creation of a mutual capability to keep peace. And fifth, science could help with the process of establishing a public climate conducive to peace.

The necessity to integrate economic, scientific-technological, social and ecological aspects in the determination of the goals of social production

All through the development of industry since the first half of the 19th century the economic, technological, social and ecological objectives, and the tasks arising from these, have developed and succeeded disproportionately. From the very outset the economic and technological purports — in their interdependence — have been an intrinsic prerequisite of a capitalistically oriented development. Social purports began to become effective only as a result of the joint action of various forces and interest-groups. Ecological

goals, however, have played a minor role in both capitalist and socialist societies up until very recently.

In time these social purports and ecological goals have been recognised, but their realisation, nonetheless, has turned out to be a long-term process depending on economic as well as scientific-technological conditions — even in terms of making up for past neglect.

But science and technology need to be systematically applied, properly oriented and provided with material funds, so as to enable them not only to solve current problems and inherited deficits but more and more also to attain prospective social goals — including ecological ones (Pauke and Bauer, 1979; Kosing et al., 1989).

Science for material production

The scientific-technological revolution — brought about by the development of microelectronics, biotechnology, etc. — generates a new type of productive force for which science is a prerequisite, and which materialises and applies science in all spheres of society, implying all kinds of consequences. This force requires the revolutionary progress of scientific knowledge from basic research to application in technical devices for everyday use. Today, these devices need to be perfected to applicability and to be supplemented, on this basis, with technologically and economically effective solutions, investments into training and qualification, with a structural policy for the solution of economic questions and a reshaped technological-economic organisation of labour. None the less necessary are changes in the vocational, educational and qualification structure of the workers as well as changes in the entire spiritual life and the existing political structure.

Through material production the socialisation of science and technology acquires a new quality in terms of the entire society. K. Marx's outline of the future worker who steps out of the process of production, thus taking a position beside it instead of being the principal agent

of production, has turned out to be reality — a reality, the impacts of which have been hitherto unknown (Marx, 1953: 592—593).

Scientists, technologists and scholars of all disciplines of science, business executives and politicians, writers and journalists all argue that the future of labour, the future division of labour, jobs and the ethical and practical issues concerning risks of science and technology (nuclear power plants, genetic engineering, etc.), imply ideological and practical problems in the relation between man and nature in the process of social production. Though Bernal followed Marx's visions of the development of material production quite far — he brought up many of these problems and made several contributions to either solving them, or at least, to pointing directions towards solutions (especially during the last two decades of his lifetime) — these had not yet been the subject of his book, which was published in 1939.

Science and the public

The socialisation of science becomes effective via scientific activity itself, through material production, education, politics and, eventually, through everyday social life and publicity in all spheres. Each of these spheres needs to be analysed separately, but they must also be seen as embedded in interrelations with all the others.

Nonetheless, it is especially in public life where the contradictory effects of science become evident. The increase in living standards, the improvement of the quality of life, the elucidation and comprehension of the interrelations between nature and society, the appropriation of the natural and social environment by social communities and by individuals, are still accompanied by the manipulation of the masses through applied science. This manipulation is facilitated by the means of formation of political opinion, by news of catastrophes and accidents and of the pollution of the water and air.

Today the publicity of science finds its expression in the most differing ways. It is

manifest in the great number of scientists and scientific institutions and in the publication of scientific and technical knowledge (at universities, in the media, etc.). In production-technologies, it is evident to an increasing degree in the field of consumer appliances and even in weapons technology.

More than ever, the responsible utilisation of science for the good of humanity has become a moral imperative, due to the universal significance and impact of science in all spheres of society. The social function of science makes itself felt, last but not least, through the role it plays in public. For this reason, public discussion of strategies and directions for the development of science combined with democratic preparation and implementation of the necessary decisions is required.

Though Bernal regarded the relations between science and the public as something most important, he did not define (in 1939) the specific function that a critical public would have in relation to science.

Science and socialism

Bernal's idea of the future — from the very outset of his public activities — had been linked with his commitment to science and socialism. For him science and socialism — each in itself and still more so in combination — constituted the content and the means, the hope and the guarantee of social progress. The social conditions in Ireland, Bernal's home, the capitalist crisis of the 1920's and 1930's, and his very first political activities directed against the growing danger of war set Bernal on the path he was to follow. Likewise, news of the success of an alternative development in Soviet Russia, the backwardness and misery of the countries fighting and eventually liberating themselves from colonialism, as well as his generally recognised scientific sagacity in formulating and investigating new problems, were determining factors that made Bernal pursue the social programme of science and socialism.

His stance was highly appreciated and taken as exemplary by many. But it also met with

disagreement and scant appreciation by some. This concerned not only his understanding of science, but to the same extent also his relationship to socialism and its practical implementation in the Soviet Union. His enthusiasm about the social changes, the peace policy and the development of science in the USSR had an impact on his world outlook and it partly had some influence on the concept that determined his scientific work.

In "The World, the Flesh and the Devil" he confined himself to a merely political confession. Later, in "The Social Function of Science" his examples of the socialist development in the USSR (and after 1945, also in those countries that then started to build socialism, in his *World without War* as well as in other publications) gained the significance of a real socio-political programme for coping with current problems.

His opponents reproached him of an uncritical relationship towards the Soviet Union (even some of his friends did so), since he spoke in favour of socialism, especially the kind of socialism that was being built in the Soviet Union in those days. It is difficult to assess how far he actually agreed with everything, or — in order to prevent others from abusing his criticism for the purpose of anticommunist propaganda — renounced statements on such questions in public.

There can be no doubt, however, that Bernal's main concern was an alternative in contrast to the development of capitalism. As a gifted scientist and experienced experimenter he succeeded in sorting out the "rough outlines of the future" from the diverse and most contradictory outward appearances in the USSR.

It is in this principal sense — not really in every minute detail — that Bernal's understanding of the relationship of science and socialism has stood the test of history.

The five sets of problems outlined above show that the necessary differentiated continuation of the concepts and effects of Bernal's book of 1939 on the social functions

of science is a task to be fulfilled by us, his heirs, on the basis of J. D. Bernal's ideas and in his spirit.

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