Science or Society? - The Social Function of Science Revisited

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Science or society?

—The social function of science revisited

Exactly sixty years ago, J.D. Bernal began his exploration of the social function of science with the following words:

> The events of the past few years have led to a critical examination of the function of science in society. It used to be believed that the results of scientific investigation would lead to continuous progressive improvements in conditions of life; but first the War and then the economic crisis have shown that science can be used as easily for destructive and wasteful purposes, and voices have been raised demanding the cessation of scientific research as the only means of preserving a tolerable civilization.[1]

This is a revealing statement. Even before the atomic bomb attacks on Hiroshima and Nagasaki, and long long before Chernobyl, and the 'big dams' controversies of the 1970s onwards, there was an influential body of opinion which held that the preservation of civilization was incompatible with the progress of scientific research.

More critically, Bernal went on to say that

> For those who have once seen it, the frustration of science is a very bitter thing. It shows itself as disease, enforced stupidity, misery, thankless toil, and premature death for the great majority, and an anxious, grasping and futile life for the remainder. Science can change all this, but only science working with those social forces which understand its functions and which march to the same ends.[2]

In 1945, the dispatches by the Soviet journalist Vassili Grossman provided a good example of the vision that the amalgam of science with society could provide. Grossman travelled with the advanced guard of the Red Army into a Ukraine despoiled by years of Nazi occupation. Surveying the ruins in the Donbas region, he wrote

> New cities shall rise in place of those that have been razed, the fields rank with weeds shall again be planted with grain, young forests shall grow up, pretty white cottages shall spring up on the sites of sacked villages, the Donbas, land of coal and steel, will come back to life.[3]

The language may sound quaintly padre-like. What is important is the conception of an agricultural economy in harmony with industry, and of a social order that combines village neighbourliness with the technological dynamism of an industrial society.

At the end of the twentieth century the battle to overcome the devastating societal characteristics identified by Bernal, is no closer to being joined: any victory lies in the dim future. More disconcertingly, there is now a substantially stronger body of intellectual opinion that would question Bernal's formulation that there is indeed an answer to these societal problems and it lies in the amalgam of science and "those social forces that understand its functions."

Once travelling across the Ukraine's desolate landscape a sudden glimpse of smoke rising from a lone factory chimney, cold and inert for years, signaled hope. Factory, work and bread again. Times change and the smoking chimney signals something else again—quite the contrary. Today, coal and steel production have a negative image as threatening to the sustained existence of forests, and certainly to the preservation of a society enveloped in the warmth of a network of pretty cottages.

To such a body of opinion, Bernal's formulation represents the essence of hackneyed thought: for after all, does science have ends? If so, are these ends good in themselves? If science's 'good ends' have been subverted by inimical social forces, what then? Do benevolent social forces have any hope of coming into control of science? And to add a further question: are social forces of any relevance when the market decides all?

In fact the issues then at stake were precisely the ones these questions raise, except perhaps the last.[4] However, Bernal's was, self professedly, a social and economic, rather than a philosophical inquiry. His most critical concern was with the question as to whether those

social forces currently funding the work of scientists—not science—did indeed have aims and ends. If they did, and he identified the ends to be the further development of industrial production in its broadest sense, then clearly the scientific work they funded also served specific ends.[5] However, he argued in his book: scientists (not science) had both volition and, potentially, political agency.

In fact, since the industrial revolution, and still more so since the Scientific and Technological revolution of the post-World War II period, science has entered directly into the process of production.[6] Consequently, there have evolved the categories of pure research ('science' in the generally accepted meaning of the term), applied research, and developmental research.

Most critics of science would, of course, expend little energy in discussing the nature of applied and developmental research. This research, in their view, is clearly motivated by industrial imperatives that cannot be in harmony with sustainable agriculture, preservation of forests, or a society based on pretty cottages.

It is the nature of pure research that has been the real target of criticism. The question that is raised is no longer, as with Bernal, of whether research in pure mathematics is utterly useless and whether it is socially responsible as in G.H. Hardy's celebration, in 'A Mathematician's Apology'. The question now is whether the statement that it is 'useless' is indeed valid. Are pure mathematicians free of a nexus with the destructive tendencies of modern industrial society?

There is, apparently, support given to this line of criticism by the argument that in an era of high technology industry, the agenda for pure research is often decided by problems that are posed for industry:

> "...scientific progress has become increasingly dependent on technology. Indeed, it is tempting to say that an alternative definition of a high technology industry is one in which problems that arise at the technological frontier exercise a major role in shaping the research agenda of science. In these industries, it is not enough to say that scientific knowledge is *applied* to the productive process; rather, to a considerable extent, such knowledge is also being *generated* there.[7]

So it would appear that even pure research or science does have ends, and that these ends set the direction and pace of scientific progress. In Bernal's terms, those social forces that finance the scientific project as a whole determine these ends.

There has, of course, been some discernible progress towards the application of science for the public good. The formation and functioning of UNICEF, UNESCO and UNCTAD at the international level and the, admittedly spotty, results of the planning process in India provide examples of the ways in which science has advanced societal goals. However, the great social transformation that "The Social Function of Science" advocated, if not foresaw, is even in the most optimistic view, now on hold.

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Simultaneously with this socio-political stasis, there has been a significant rise in both, the radical critique of science amongst some sections of the intelligentsia, on the one hand, and a feeling of apathetic acceptance of the material benefits of modern technological developments by a large section of society, on the other. This latter feature is a far more disturbing trend for Bernalism, than the hostile intellectual currents. A major impetus to this growing apathy has come from the effects of the major technological developments of the last 50 years which have been identified as markers of the Scientific and Technological Revolution. The development of processes for the controlled release of nuclear energy and the development of electronics form one aspect of this era. However, this has coincided with the appearance of specific artefacts, such as the atomic and hydrogen bomb, and the callous commercially-driven introduction of others, such as imperfectly tested drugs like thalidomide. The prevalence of a series of disasters associated with these artefacts such as plane crashes, dam bursts and nuclear disasters in power plants has even led to the sardonic characterization of this era as associated with "normal accidents".[8]

These events have given fresh life to the growth of artefactist thought—a line of philosophical reasoning that argues that the disasters sometimes associated with the use of modern technological artefacts are caused by the very nature of the technological processes themselves. In one of its most recent formulations, the artefactist line of reasoning would, for instance, distinguish between the implications for society between the handtools of the handicrafts era and the machines of subsequent eras as follows: because they are dependent on human users for both their source of movement and for guidance in their action, handtools have a unique relationship and dependency on human beings. To the extent that machines become independent,

not only of human energy sources, but also of a human directing agency (as with automation) they begin to achieve a degree of autonomy.[9] Further, because machines concentrate increasingly greater quanta of energy in the hands of users, they necessarily introduce high levels of inequalities into the social order that would otherwise not have happened. According to this line of reasoning, the person who owns a machine has more power than one who does not. Power is thus seen to grow out of the structure of the tool or machine rather than from the social organization.

Leading on from this argument is the proposition that technology can become autonomous in relation to human users (even if not to its manufacturers). Different kinds of technology can have inherent features that generate quite distinctive impacts on societal orders. Most crucially, this is true independent of the social context within which some particular technology might be embedded or the particular social process it is associated with.

One of the major reasons for the growth and social acceptability of this line of reasoning has lain in the frightening attempts by some proponents of technology to promote technological solutions to societal crisis even before the problem has been sorted out into its sociocultural (and political) and technological components. This is a manifestation of a narrowly technical philosophy of technology (and society). They attempt, as did mechanistic philosophies of science when the social sciences were emerging in the nineteenth century, to present technological reasoning as a mode of thought superior to all others.[10]

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There is, however, another philosophic issue. As mentioned earlier, the 'Project of Modernity' is incorrectly identified with the capitalist industrialization process. Similarly, the identification of 'modern' science with the growth of science within the philosophical framework of Cartesian reductionism which anti-science critics hold as uncontestable[11] is indeed an incorrect view. It is well known that science is not only a structure of knowledge, but also a conceptual mode of thinking that touches on the interrelated parts of our experience. Despite the enormous advances in knowledge within the Cartesian structure, its philosophical basis is the root of frustration such as that of Bernal as

a practising scientist and similarly, its results are the targets of frontal attack by the critics of science.

For a long period after Descartes, philosophical thought in the sciences was based on four principles:[12]

> 1) That a system consists of a natural set of units or parts
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> 2) The units are exactly similar, at least in their effects on the whole, of which they form the parts.
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> 3) The parts invariably precede the whole in that they exist in isolation, and come together to form wholes. The parts have intrinsic properties which they possess even in isolation and which they lend to the whole. In the simplest case, the whole is the sum of the parts. In more complex cases, interactions among the parts may produce additional properties in the whole.
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> 4) Causes are separate from effects, the former being properties of subjects and the latter of objects. Subjects may respond to "feed-back" from objects, but the causing subject and the caused object are ultimately separate and distinct.

Within this set of principles, social practice defines which of a chain of mutually intersecting causes becomes *the* cause of a given effect. In medical research, tubercle bacillus become the cause of tuberculosis, rather than (pace Bernal), the conditions of capitalist urbanization. Posing the problem as one that flows out of a specific form of the urbanization process would imply a political approach to the problem. The issue would then be considered beyond the realm of medical research.[13] More crucially, problems that cannot be resolved within the framework are held to be formally irresolvable, for the specialist (the unit) cannot be expected to view the problem from a perspective distinct to the system of which he or she forms a part.

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The protagonist in Tom Stoppard's *Jumpers* makes an important point in the course of preparing a lecture on the existence of God. The point is that such a lecture can only be delivered, safely, when there is a substantial body of opinion within the establishment that doubts God's existence. Given that at some point in a suitably defined past, the balance of establishment opinion must have been in favour of faith in God's existence, Stoppard points out that there must have been a historical moment when the "noes had it." In other words, at that point

of time, a quantitative movement in the voting pattern had led to a qualitative shift of enormous societal significance.[14]

The point that must concern all those who share Bernal's concerns is whether such a change in the balance (a 'belief' in the benign nature of scientific knowledge moving on through agnosticism to hostility) underlies the apathetic acceptance of technologically created artefacts mentioned earlier. Critics of science have often charged that modernity has simply replaced a faith in God with a faith in science.

Of course, the basis of society's failure to transform this faith into what we in India termed the 'scientific temper'is clear. It is the same gulf that lay between C.P. Snow's two cultures, which operated even within Senior Common Rooms. The root lies in the pattern of resource allocation that failed to provide opportunities for a proper science education for all. It was this feature of modern capitalist society, rather than that of an abstract 'project of modernity,' that froze the spread of informed appreciation of science to the confines of the techno-scientific power elite. For the huge majority who looked forward to a life that was free of both enforced stupidity or a grasping futility, science thus remained a faith.

The battle to preserve this 'faith' must first of all ensure that the "noes" do not have it in the societal counting of votes. But this challenge is now clearly intertwined with the larger effort to advance the scientific temper, seen in its true garb as the 'informed appreciation of science'. This battle is as much social and political, as a philosophical one, as was Bernal's original intervention sixty years ago. □

Notes

1. J.D. Bernal, *The Social Function of Science*, Macmillan, New York, 1939; preface p.xiii.
2. Ibid. preface, p.xv.
3. Vassili Grossman, *The Years of War*, Foreign Languages Publishing House, Moscow, 1946; p.318.
4. He was writing at a time when the follies of permitting the market to decide all were fresh in public memory, in terms of the slump and the accompanying catastrophic unemployment.
5. Poetry also has ends (such as celebrating Elizabeth the First's ascension to the throne), but this does not detract from the addition to the stock of human culture that these poetic effects represent. Of course, any sensible discussion must recognise that the effects of poetry (whatever the extent its origin is implicated by association with an authoritarian state) remain in the realms of the poetic.
6. See, Nasir Tyabji 'Technology and Dialectics', *Economic and Political Weekly*, XXXVI (1997): 651–656.

7. Nathan Rosenberg, 'Critical issues in science policy research', in *Science and Public Policy* XVIII (1991):335-346, reprinted in *Exploring the Black Box: Technology, economics and history*, Cambridge University Press, Cambridge, 1994; p.141.
8. Carl Mitcham in *Thinking through Technology: The Path between Engineering and Philosophy*, The University of Chicago Press, Chicago, 1994, has a food for thought -provoking chronology of the dual aspects of the effects of the Scientific and Technological Revolution.
9. Although artifactist thought does not formally define the concept of a machine, its line of argument is consistent with the accepted definition that the machine, at least in its earlier phases was characterized by three elements: the power source or motive mechanism, the transmission mechanism and the tool. It is important to note that the motive mechanism can be provided by human, animal or natural agency. Machines can thus be dated from the era of wind and water mills, handlooms, and simple harvesting devices.
10. Although Dr. Strangelove exemplifies the approach in its most alarming form, this philosophical basis underlies the development plans introduced in the post-war era in third world countries, in state-led attempts at "technological transformation". Carl Mitcham (1994) sees it as the attempt by *Engineering Philosophy of Technology* to hegemonize the entire field of philosophical enquiry (pp.19-93).
11. Jacques Monod was well aware that despite the spectacular advances within molecular biology, the philosophical basis of research in biology was by no means settled. In 1972, he felt the need to assert that the picture of the flow of information inside the cell "... defies any 'dialectical' description. It is not Hegelian at all, but thoroughly Cartesian: the cell is indeed a machine." *Chance and Necessity*, pp.110-111.
12. Richard Levins and Richard Lewontin, *The Dialectical Biologist*, Harvard University Press, Cambridge Mass; 1985; p.269.
13. Ibid. p.270.
14. Stoppard is not Marxist, so this demonstration of the way the dialectic creeps in on all of us is gratifying proof of its influence.