Funding fundamental research

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Management science analysis of R&D expenditure shows that fundamental research is a low-expenditure activity. There is no such thing as inappropriate fundamental research, and only excellence must be the criterion for support. But while the community of fundamental researchers is entitled to uninterfering support. it must, in an essential quid pro quo, ensure improvement of the peer-review system and growth of excellence.

A viewpoint on fundamental research can be formulated on the basis of the common management tool of ABC analysis. This tool involves the classification of activities or items into three classes: an A class that accounts for about 80% of the total expenditure on the activities or items; a B class, for 15% of the expenditure; and a C class, for the remaining 5%. The purpose of such an analysis is to concentrate attention on the A activities or items without wasting time on the C-class items which account for a trivial part of the expenditure[1].

ABC analysis of R&D expenditure in many industrialized countries and in India shows that 'development' in R&D is an A-class activity, 'relevant basic research and applied research' a B-class activity, and 'fundamental research' a C-class activity. It must be pointed out, however, that fundamental research is a C-class activity (accounting for roughly 5%) only from the point of view of total expenditure; its impact and the value that it adds are enormous and enduring.

Since the cost of fundamental research is trivial and the return from it is far, far greater than the input, the conclusion is obvious: the roughly 5% (or even more, if requested) should be given for it, *no questions asked*. In return, the funders can insist that the community of fundamental researchers should itself spell out (perhaps via its academies) the steps that the community will take for improving the quality of its peer-review procedures. After that, the community of fundamental researchers and their academies must be left alone to be autonomous and self-governing *vis-a-vis* bureaucrats, technocrats and patrons, and government departments, agencies and ministries.

If the funders take such a view, they will be practising what is widely preached, viz. fundamental research needs no other justification than the fact that it is a root of culture, the basis of intellectual climate, and the source of inspiration for young minds. Further, if funders do not address questions of relevance to fundamental researchers, they have the right to ask that no fundamental researcher must be deprived of funds (even by his peers) on the grounds that his work does not have relevance. Thus, only excellence should be the criterion for support of fundamental research, and not relevance. There is bad fundamental research and shoddy science, but there is no such thing as *inappropriate* fundamental research.

All this is not happening. The first problem is that, unfortunately and unnecessarily, fundamental researchers themselves are on the defensive. They are taking pains to show that fundamental research is essential for R&D and that science is essential for technology. This is like trying to demonstrate that one wheel of a bicycle is more important than the other. They are also turning to history to show that fundamental research has ultimately led to useful products and processes. This is falling, unwittingly, into the trap of justifying fundamental research on the grounds of discounted cash flow, which envisages and itemizes all future costs and benefits. But the benefits of fundamental research cannot be foreseen and itemized. If they could, it means that the results are known before the research, in which case the research need not have been done. Hence, a management that uses discounted cash flow to justify fundamental research knows neither management nor discounted cash flow.

The second problem is that there is certainly such a thing as *inappropriate* technology, which cannot justify itself by the criteria of utility and relevance. And technologists by and large do not shield fundamental researchers and ensure that they do not have to justify their work on grounds other than excellence. In fact, inappropriate technologists may even divert attention from their own irrelevance by encouraging a critique of fundamental research on grounds of irrelevance.

What is required, therefore, is a quid pro quo. The community of fundamental researchers must say: fundamental research is inexpensive; so, give us X% (say 5–10%), and, in return, we will evolve an increasingly better peer-review system and grow more excellence. For a peer-review system and excellence constitute a positive feedback loop—peer review begets excellence, and in turn, excellence begets better peer review. Thus the fundamental researchers must undertake to grow excellence and train scientists in return for autonomy and freedom from interference. And, in the quid pro quo, the funders must invest a trivial 5–10% and in return get excellence in scientists (good science) and scientists with excellence (scientific manpower).

1. The point has been made well by Northcote Parkinson's story of the committee meeting spending hours discussing whether to construct a bicycle shed, and sanctioning the nuclear reactor in the last five minutes.

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