Measuring success in science

The Evaluation of Scientific Research (A Ciba Foundation Conference). David Evered and Sara Harnett, eds. John Wiley and Sons, 1989, Price: £32.50, $57.95. 284 pp.

The Ciba Foundation normally sponsors gatherings concerned with medical and biological research. By departing from this normal policy and holding this international conference wherein experts in the field of evaluation take stock of the state of the art, the Foundation has done a valuable service to science. The book consists of fourteen brief articles; when one reads these one sees the range of topics covered in this conference. Various techniques, methodologies and case studies have been used to evaluate: national performance in science and technology, British technological universities, a fifth-generation-computer programme, links between science and technology, the impact of different modes of funding, the effectiveness of research training, the performance of academic institutes and research groups, the impact of science policy, forecasting, the peer review system. There is also one paper which evaluates the evaluators! There are serious discussions on 'science and surprise', 'evaluation and uncertainty', and 'beyond bibliometry'—a veritable feast, sometimes a bit indigestible.

For most of the studies bibliometry and the *Science Citation Index* (SCI) invented by Eugene Garfied are used. Almost fifty years ago Lawrence Bragg used statistical methods to assess the number of good scientists England produces. He concluded that as only one good physicist comes out of each million of the population, great care has to be exercised in training and using them. It was also Lawrence Bragg who appointed D. J. de Solla Price to the archives of Cambridge. Inspired by Bragg's work, de Solla Price started the *field now called science of science* Statistical methods have become an important feature of contemporary scientific development. The next step was the enunciation by John Ziman of the premise that science is a corporate activity and so scientists have to communicate with each other and expose their science in scientific journals for critical evaluation by the scientific fraternity. The implication is that, while scientific discoveries may be made by individuals or groups, their acceptance and assimilation into the body of science rests solely on the scientific community. I feel that Eugene Garfield took off from this point and found that the only method by which one can find

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Let me begin by reminding you that twenty-five years ago, throughout the developed world, public support for science was growing at an astonishing rate. In the United Kingdom at that time the annual budget for the research councils grew by some 17 or 18% per annum in real terms, and the concern of the Advisory Council for Science Policy, the Department of Scientific and Industrial Research (DSIR), the research councils, the universities and other agencies was to devise ways of spending that money reasonably. That's not the situation now, as most of us in this room know. Even twenty-five years ago there were a few people, and we're lucky in having with us one of them, Dr Weinberg, who recognized that circumstances were bound to change, and in particular that governments would try to define more precisely the purposes for which they invested in scientific research, that they would be concerned with assessing the results of that investment, and that the rapid exponential growth of public support for science could not continue indefinitely. Twenty-five years later, these issues are at the forefront of science policy discussions, and I hope and expect that our discussions over the next three days will help us towards a deeper understanding of them.

Before we embark on that discussion it might be useful for me to distinguish between the primary objectives of public support for science and the secondary objectives, which we are likely to spend most of our time considering. The primary objectives, as I see them, are to develop a deeper understanding of the universe and our place in it; to achieve social benefit from that understanding through the development of individual understanding, the promotion of health and welfare and the control of the environment; to further the development of a prosperous economy through the discovery of new knowledge capable of being exploited in wealth creation, and the training of scientists and engineers for roles in shaping that economy; to underpin national defence; and perhaps to further international goodwill and understanding through collaboration in a transnational human experience.

There may be some disagreement about the details of that list, and its order probably isn't the order of priority that most governments would attach to such a list, but I suspect that those are something like the overall aims of most governments in supporting research. We are likely to focus very largely on a part of that, on the generation of new knowledge, for example, and we shall be concerned with such matters as how good, that is to say how worthy of support, are individual scientists or research groups? How fruitful are particular lines of enquiry? How effective are alternative forms of research organizations?

In doing so, I hope that we shall remember that our measures of success at this level may be poor indicators of success in meeting the overall objectives, that there is a risk of distorting the whole scientific enterprise so that it satisfies whatever measures we invent rather than the objectives of the investment, and finally that even as we sit here the nature of the scientific enterprise is changing around us as our understanding develops That's slightly cautionary beginning perhaps. Nevertheless I hope we shall remember that it is easy to focus on particular secondary objectives and to lose sight of the primary purposes

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