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0521019125 - Prometheus Bound: Science in a Dynamic Steady State

John Ziman

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John Ziman is one of the most influential writers on the practice of science. In the course of a distinguished career in the natural sciences he became concerned about the social relations of science and technology. He was for many years chairman of the Council for Science and Society, and between 1986 and 1991 he headed the Science Policy Support Group. He is as much at ease writing a specialist research paper as a newspaper article. His books include: *Reliable Knowledge*, *Teaching and Learning about Science and Society*, *An Introduction to Science Studies* and *Knowing Everything about Nothing*, all published by Cambridge University Press.

After expanding for centuries, science is reaching its limits to growth. We can no longer afford the ever-increasing cost of exploring ever-wider research opportunities. In the competition for resources, science is becoming much more tightly organized. A radical, pervasive and permanent structural change is taking place. This already affects the whole research system, from everyday laboratory life to the national budget. The scientific enterprise cannot avoid fundamental change, but excessive managerial insistence on accountability, evaluation, 'priority setting', etc. can be very inhospitable to expertise, innovation, criticism and creativity. Can the research system be reshaped without losing many features that have made science so productive? This trenchant analysis of a deep-rooted historical process does not assume any technical knowledge of the natural sciences, or their history, philosophy, sociology, or politics. It is addressed to everybody who is concerned about the future of science and its place in society.

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# Prometheus Bound

Science in a dynamic  
steady state

*The Father of the Gods wished to punish the Titan who had stolen Fire from Heaven and brought it to the People of Earth. Prometheus was chained to a mountain top, and savaged day after day by a voracious eagle.*



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# *Preface*

Science is reaching its 'limits to growth'. It is expected to contribute increasingly to national prosperity, yet national budgets can no longer support further expansion to explore tempting new research opportunities, by larger research teams, equipped with increasingly sophisticated apparatus. As a result, science is going through a radical structural transition to a much more tightly organized, rationalized and managed social institution. Knowledge-creation, the acme of individual enterprise, is being collectivized.

This transition is pervasive, interlocking, ubiquitous and permanent. It affects the whole research system, from the everyday details of laboratory life to the politics of national budgets. Changes in one part of the system, such as the abolition of academic tenure, have repercussions elsewhere, for example in the commercial exploitation of scientific discoveries. A new policy language of 'accountability', 'evaluation', 'input and output indicators', 'priority-setting', 'selectivity', 'critical mass', etc. has become commonplace throughout the world, from Finland to Brazil, from Poland to New Zealand, from the United States to Papua New Guinea. Indeed, science is becoming a truly international enterprise, organized systematically on a global scale.

Many scientists and scholars look back regretfully to a more relaxed and spacious environment for academic research. But nostalgia is a fruitless sentiment. What all scientists know is that science cannot thrive without social space for personal initiative and creativity, time for ideas to grow to maturity, openness to debate and criticism, hospitality towards innovation, and respect for specialized expertise. The real question is not whether the structural transition is desirable, or could have been avoided: it

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is how to reshape the research system to fit a new environment without losing the features that have made it so productive in the past.

Although this question is unanswerable, it informs action merely by being asked. But that means that it must be clearly posed. The general idea of a major structural change has been around for a long time. It underlies the eloquent writings of Derek de Solla Price (1963), Jean-Jacques Salomon (1970) and Jerome Ravetz (1971). Since then, working scientists in the UK and elsewhere have become uncomfortably accustomed to level funding, and complain loudly about its various effects on the research enterprise.

Nevertheless, this striking phenomenon has not yet become a major research site in the world of science and technology studies. I first began to formulate the main issue myself in a short article (*Minerva*, 16, 327–39, 1978) entitled ‘Bounded science: the prospect of a steady state’ – actually a review of Bruce Smith and Joseph Karlesky’s disturbing account of the then state of academic science in the USA. I also began to notice various structural effects, such as increasing societal influence on problem choice in fundamental research (*Minerva*, 19, 1–42, 1981), the shift away from the traditional individualism of scientific activity (Bernal Memorial Lecture, *Proc. R. Soc. Lond. B*, 219, 1–19, 1983), and changing career patterns in basic science (*Knowing everything about nothing*, 1987).

These strands were eventually woven together in 1987, in a series of informal workshops organized by the Science Policy Support Group (SPSG). About a dozen very senior people, from all sectors of the UK research system, took part in these discussions; Science in a ‘Steady State’: The research system in transition (SPSG Concept Paper No.1, December 1987) sketched out the remarkably coherent picture that emerged from the convergence of their experience and opinions. The present book is essentially an enlargement of this picture, clarified and made more vivid for a wider circle.

In writing it, I had in mind the ‘attentive public’ for science, typified perhaps by regular readers of *New Scientist*, or regular watchers of *Horizon* or *Equinox*. I have tried to use direct, ‘quality

newspaper' language, free of the scholarly impedimenta of footnotes and bibliographic references. I have not assumed any technical knowledge of the natural sciences, their history, philosophy, sociology, or politics. The argument is illustrated by numerous particular examples, mostly drawn from the countries of the English-speaking world, but reference is made to parallel developments in other countries, especially in Europe. A neutral ideological stance on political and economic issues is attempted, although my personal preferences (if not prejudices) are not very carefully concealed. In particular an intemperate and ungainly deployment of shriek quotes – e.g. 'accountability' or 'selectivity' – clearly indicates my deep misgivings about the way that perfectly reasonable words have been degraded into fashionable terms of art for some very questionable practices.

For good or ill, this text, as it now stands, is entirely my own responsibility. But a work such as this owes a great deal to the friendly interest of many well-informed people. A full list of these would be very long indeed, and a short list would be invidious. It would include, first of all, the original SPSG working party, who actively commented on successive drafts of the SPSG Concept Paper. Add to that the hundred participants in the two-week NATO Advanced Study Institute at Il Ciocco, Italy, in October 1989, where the theme of 'Managing Science in the Steady State' was analysed from a number of different points of view (see *Cozzens et al.*, 1990). In addition, my thinking on the subject has benefited greatly from the penetrating questioning of many alert scientists and metascientists to whom I have presented the argument at conferences and seminars in a number of different countries. Even if I don't attempt to name you all, be fully assured of my gratitude. This is also an ideal opportunity to acknowledge the personal pleasure and profit of five years of fruitful cooperation with my former colleagues in the Science Policy Support Group – Peter Healey, Lynda Robb, Carlye Honig, Lisa Harding and Michael Hanna – who provided the organizational base that made this project possible.

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