Book Reviews

Shaping Science and Technology Policy: the next generation of research
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As announced in the book's title, the purpose of this collection is to present young scientists' views of science and technology, in the presumption that they have a clearer vision of the future since they are not hidebound by the view that the future is an evolved extension of the past. Following a request for abstracts for the Next Gen conference, linked to the Next Generation Project funded by the National Science Foundation, ninety young scientists sent in abstracts. Twenty-five of these gave papers and discussed their work and sixteen authors were selected for the resulting volume. The chosen authors are presented as the next generation of researchers in science and technology policy. The word 'shaping,' contained in the title, reveals the institutional dimension of science and technology. In a wider sense, it refers directly to the construction of rules and the recognition of the constraints that directly and indirectly interfere in technological development. This is the same term used by Douglass North in his definition of the institution (as a set of constraints that shape human interaction).

The collection is divided into four sections, each containing four articles, whose subtitles refer to 'shaping' policy, science, technology and life, respectively. In the short introduction to part I, 'Shaping Policy,' the editors underline the importance of policy, whether as a factor conditioning the success of innovation, or as something worthy of attention in itself. Presumably the
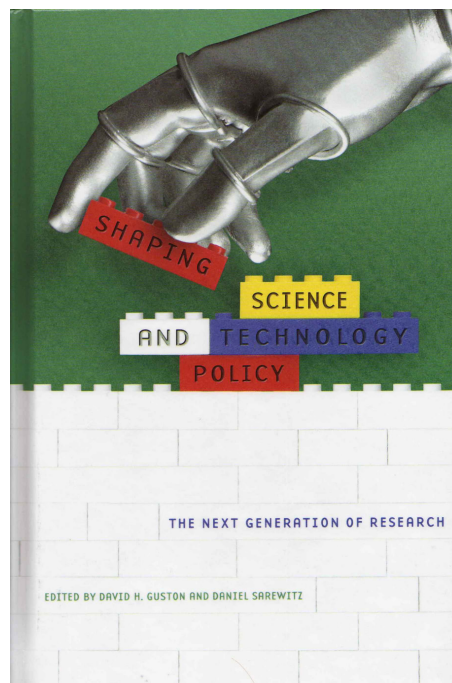
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choice of policy as the opening topic was not random, but intended to emphasize its overall significance. The editors also emphasize the importance of well-designed policy in ensuring widespread public recognition for the widespread benefits of scientific research.

We shall comment on the articles in the order in which they appear in the work. Mark B. Brown, a political scientist, discusses 'Ethics, Politics, and the Public: Shaping the Research Agenda.' Brown criticizes the scientific elite responsible for determining science policy both for failing to incorporate the public into the definition of public science, and in relation to research ethics for claiming to represent the public in a completely democratic way. He discusses and compares four approaches for establishing an agenda for publicly funded research. The first and most common approach assigns the scientific community with sole responsibility for determining the questions to be researched. The second assures the scientific community's autonomy, but accepts the participation of ethics committees in order to set guidelines for research. Neither of these two approaches, however, includes a role for science policy or allows the public to become involved in the decision-making process. The third approach, epitomized by Philip Kitcher as "well-ordered science," allows the public access but only in a hypothetical manner, describing a virtual process in which the public would agree had it taken part. Brown creates the fourth model on the basis of contemporary cases in bioethics and a critique of Kitcher and sets out his idea of a more pragmatic role for philosophy and a stronger role for democracy, concluding that both currently existing and new institutions can effectively and democratically represent the public in the process of shaping of a research agenda.

In 'Federal R&D: Shaping the National Investment Portfolio,' Brian A. Jackson, a biochemist who became a specialist in science policy, identifies three questions that he considers perennial: Is the government allocating its investments adequately? Is it managing them appropriately? What is the performance and outcome of these investments? He discusses the problems involved in evaluating the design and implementation of these federal government policies given that, in the USA, this portfolio is a post-factum construct of decisions made by various independent investors in the federal government. The author suggests a bottom-up method of planning federal investments in R&D. This method is based on the individual objectives of each R&D activity and is more advantageous for the management of federal investments in R&D than the approaches more commonly applied to federal investment groups in programs or at national level. In support of this approach, the author discusses the federal R&D portfolio using investment management concepts for formulating and implementing policies. He introduces the concept of investment objectives for individual R&D investments. The author shows how investment objectives make management concepts such as portfolio risk and balance more significant and also discusses the usefulness of these concepts in policy formation by describing the complex return on R&D and

in monitoring the performance of both individual R&D programs and federal investment in R&D as a whole.

The economist Bhaven N. Sampat, in the article 'Universities and Intellectual Property: Shaping a New Patent Policy for Government Funded Academic Research,' centres his argument on policies capable of disseminating the outputs of research financed with public funds for social and economic benefits at the highest level. Political interest in this question has reawoken, in large part by concerns that publicly financed research is becoming increasingly privatized. This debate is already lively in Brazil, despite private funding and expenditure on research still being very small, one of the biggest problems for research development and innovation in the country. The author discusses these questions within the historical context of the USA and asks whether the current patents policy is creating social benefits or distorting the university research mission, especially through commercialization. He analyze various political solutions.

In his article 'Geography and Spillover: Shaping Innovation Policy through Small Business Research,' Grant C. Black, also an economist, focuses on describing policies that demonstrate the public value of investment in R&D. He discusses conflicts over the geographic distribution of investments in research and suggests that geography is a key variable in innovation. However, producing an empirical study of this relationship remains problematic. Black studies the role of the local technological infrastructure in innovation in small companies in large urban centres. The author identifies a positive relationship between the two and recommends that regions should concentrate on creating policies to improve their technological infrastructure and facilitate the internal interactions within the latter, honing their interest in particular on research universities.

Part II of the collection discusses 'Shaping Science.' After showing how policies influence science, this part discusses the consequences of policies on the science that is undertaken or understood as science. The chapters in this section discuss concrete cases, specific science policies and debates that show how questions from the philosophy of science, such as anomalies, influence environmental science and politics.

Pamela M. Franklin, in the article 'EPA's Drinking Water Standards and the Shaping of Sound Science,' analyzes various aspects of the debate on sound science through a case study of establishing safe levels for chloroform – shown to be a carcinogen in animals and suspected to be carcinogenic in humans – in drinking water.

In the article 'The Case of Chemical Hormesis: How Scientific Anomaly Shapes Environmental Science and Policy,' Kevin Elliott, a philosopher of science, presents an extremely interesting debate that sheds light on the polemic cited in the previous article. He shows how anomalies help to shape environmental policies, which in turn help to shape the process of scientific development.

In 'Earmarks and EPSCoR: Shaping the Distribution, Quality, and Quantity of University Research,' Abigail

Payne, an economist, examines whether changes have occurred in the distribution of investments to universities and regions over the last thirty years, since in the 1970s these investments were concentrated in a small number of universities and states. She discusses two funding programs designed to counter this kind of concentration: one provided by Congress to universities and the other by the National Science Foundation (NSF). Payne concludes that there has been a small change in the distribution of research funds since the 1990s and that one of the programs increases the quantity but reduces the quality of published articles, while the other achieves the opposite. This discussion is highly relevant to Brazil, both in relation to the issue of the concentration of programs and in relation to various aspects of scientific production.

In 'Innovation in the U.S. Computer Equipment Industry: How Foreign R&D and International Trade Shape Domestic Innovation,' Sheryl Winston Smith returns to the issue of geography in order to discuss the relations between international trade and R&D. The question is how flows of knowledge shape innovation in an increasingly global economy, focusing specifically on the intensive research and development encountered in the computer industry. She substantiates the hypothesis that trade and the ability to appropriate ideas from outside sources (the capacity to absorb) are important determining factors in domestic innovation. The author concludes that R&D is neither undifferentiated or isolated and that high levels of domestic investments in R&D not only intensify innovation directly, they also indirectly enhance the capacity to absorb.

The third part of the book, 'Shaping Technology,' discusses how organizational, political, social and cultural aspects inform the selection of one technology over another. Aside from the superior performance or efficiency of a technology, the process of selection – in an evolutionary sense – involves institutional processes that play an active role in shaping this technology.

The article 'Shaping Technical Standards: where are the users?' by Patrick Feng provides a definition of technical standards as protocols, rules and codes that specify how a given set of technologies should operate and interoperate. The basic model of developing a standard follows a set sequence: (a) a member of an organization (country, company, individual or standards development organization) suggests an item to be standardized; (b) if sufficient interest exists, a group is assigned the task of producing a standard proposal; (c) periodically the group's working proposals are made available to other members of the standards development organization for comments and feedback; (d) if the group is satisfied with its work, it releases a final version for the other members of the organization and the standard proposal is ratified, forwarded for improvements or summarily rejected. The process almost always involves a small group of people. Although the user plays a fundamental part in consolidating and disseminating the standard, Feng emphasizes that the user's participation or representation in the formation of the technical standard is almost non-existent due to the

problems associated with the knowledge and resources needed to take part in the groups responsible for developing technical standards. One solution suggested by Feng for greater use involvement in shaping technical standards is the inclusion of defenders of the public interest in two critical phases: (a) during the process of designing the technology, making resources available for public interest groups to participate in the meetings, and (b) in the process of reviewing a standard proposal when the general public has the chance to make recommendations.

In the article, 'Technical change for social ends,' Patton analyzes the effects of measures designed to improve the transport infrastructure in US cities, showing that policy makers can produce sociotechnical changes by eliminating day-to-day barriers to particular social practices. By providing a better infrastructure for a community of practice – in this case, public transport users – the growth of this community is facilitated by supplying a better material support for their activities. The idea of a community of practice is connected to the social learning derived from social and cultural practices that emerge and develop when groups of people with common objectives – in this case, public transport users – interact to obtain these objectives.

In Sandvig's 'Shaping infrastructure and innovation on the internet,' the point-to-point network structure of the internet is shown to enable the modularization of software with the use of standard components such as code libraries. Modularization makes computing a sociotechnical system, enabling developers to incorporate standardized components into new and bigger projects, reducing development times. User-driven innovation plays a central role in the internet's network technology. Use of this principle has the effect of pushing intelligence to the perimeters of the network.

In the fourth part, 'Shaping life,' the authors concentrate on the ethical dimension and the benefits for society of research in biotechnology, especially genomics. The authors make a brief incursion into ethics on issues connected to biomedical research. This is particularly relevant given the intense pace of technological innovation involving the life sciences industry. In the USA last year, seven billion dollars of venture capital were invested in this industry.

In 'Informed consent and genetic research,' the author discusses the ethical questions that should be present in any research into human life. He suggests reformulating ethical frameworks to include the concepts of donation and obligation, which can provide a morally more coherent basis for research into human life. Consent to take part in a research study comes from its perceived benefits to human life.

In 'Parthasarathy: reconceptualizing technology transfer,' the author draws attention to the national specificities that need to be taken into account in technology transfers. The national context, norms and values of a country form an inextricable part of technical decisions, as the author shows in a comparative analysis of the use of DNA sequencing technology in the USA and

the United Kingdom. Without explicitly mentioning the fact, the analysis shares many similarities to Michel Callon's actor-network theory through its use of the idea of a sociotechnical network.

The collection presents highly contemporary and relevant debates, adroitly organized into the four parts, with a wide variety of methods and narratives ranging from a historical perspective to philosophical investigations, from game theory to constructivist studies, and from ecometrics to the organizational tactics of grassroots movements. Using clear language, the authors combine pertinent case studies with innovative suggestions. Some of the studies use slightly outdated data from the last century.

This is a highly relevant collection for anyone interested in the study and management of science and technology policies and their relations to the economic, social and political development of a country – in this case, the United States. It also helps shed light on similar phenomena in other countries.

The comparative perspective used by many authors in the work enables an examination of the constitutive rules that serve as incentives or parameters for technological development. This is particularly important in terms of comprehending the institutional environment as an intrinsic part of technological and scientific development. An understanding of institutional diversity provides a better insight into the technology-society relationship.

Notably, the authors always emphasize science and technology as public assets, the importance of greater participation from society, and the actions of Congress and society as a whole, very often represented through the figure of the 'taxpayer.' It is this application of the principle of accountability in a democratic society that still needs to be consolidated in Brazilian society.

The work's main limitation is the underuse of data from empirical, fieldwork-based research and the inclusion of somewhat outdated data from other sources.