POLICY FORUM: MEGASCIENCE

International Scientific Cooperation

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Radio astronomers are planning a new generation of ultrasensitive telescopes, but how will they be protected from electromagnetic interference from growing fleets of low-orbiting telecommunications satellites (*1*)? Life scientists accumulate enormous amounts of data on living organisms in electronic databases, but who will ensure that the databases are complete, consistent, and compatible with one another (*2*)? Such problems cannot be resolved by scientists alone, for reasons that extend, beyond funding, into other public policy domains, such as regulation of the radio spectrum and the management of natural resources.

An appreciation of such issues led the science ministers of the 29 member countries of the Organization for Economic Cooperation and Development (OECD) (*3*), when they met in Paris in 1992, to establish the Megascience Forum (MSF), an intergovernmental body that brings together senior science policy officials for discussions relating to the coordination of large-scale scientific endeavors (*4*). The birth of the Forum followed the agonizing demise of the United States' Superconducting Supercollider, which most experts acknowledged could have been saved by making it an international project. By creating a permanent venue for meetings of officials responsible for big projects, ministers hoped to avert further misadventures of this type. At their meeting in June, the OECD Science Ministers renewed and updated the Forum's mandate for a further 5 years. From my past experience as a national delegation member, I describe what the Forum has achieved so far, analyze its strengths and weaknesses, and discuss its evolving role in international scientific cooperation.

The Forum was not intended to duplicate the work of existing intergovernmental bodies such as the European Laboratory for Particle Physics (CERN), the International Thermonuclear Experimental Reactor (ITER), or the European Space Agency (ESA). Rather, the governments wanted to create a flexible, general-purpose structure that would allow any science policy issue to be debated for a finite time without having to create a new (and, all too often, permanent) body for each separate issue. The MSF was thus designed to provide opportunities for consultations, not negotiations, and the final power of decisionmaking was left to individual governments (the customary rule within OECD). Accordingly, the Forum had no funding authority, did not manage research projects, and the size of its bureaucracy (three or four full-time staff) ensured that it could not become, in any sense, a "world science ministry." Topics were chosen through a consensus of national delegations. The procedures maintained a channel for scientists, without, however, turning the meetings into a place where researchers could lobby government officials in support of their favorite programs.

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Two European multinational facilities: ESRF (European Synchrotron Radiation Facility), a synchrotron radiation source, and ILL (Institut Laüe-Langevin), a neutron source, both in Grenoble, France.

During 1992–1995, the MSF convened large meetings of experts in a number of scientific fields where big projects play a major role (*5*). Since 1995, it has established government-level working groups (*6*) to address specific challenges relating to international cooperation. Under the vigorous leadership of its chairman, Peter Tindemans of the Netherlands, the Forum has, for example, analyzed the future supply and demand for neutron sources for basic and applied research; helped develop a shared global vision of the future of nuclear physics and of its applications; and made recommendations for the protection of radio astronomy from man-made electromagnetic interference, while allowing for the continued dynamic growth of the telecommunications industry.

The Forum dealt not only with large facilities but also with large distributed programs of global concern, such as biodiversity, atmosphere and ocean research, and food sufficiency. An MSF workshop on "Integrated Assessments of Global Issues" (Stockholm, March 1998) brought together scientists and policymakers to formulate the best practices in this field. To respond to the database problem cited earlier, a work plan for the implementation of a multinational Global Biodiversity Information Facility (GBIF) was developed, as were recommendations for promoting international cooperation in the application of information science to the study of the brain.

The Forum also dealt with generic problems such as the basic policy question of what rules should govern the use of a large facility by scientists from countries that did not contribute financially to the construction and operation of the facility. The International Union for Pure and Applied Physics (IUPAP) adopted recommendations (*7*) stating in essence that access should be based on scientific merit of the proposed work, that national and institutional affiliation should not be criteria, and that researchers should not be required to contribute to the operating costs of the facility. Most scientists strongly support this position, at least in principle. However, the MSF concluded that free, merit-based access could not always be maintained, especially in the case of multinational facilities where national administrations demand a fair return on their investments. Delegates to the working group analyzed the practices and policies at existing megafacilities, as well as the motivations and obligations of government officials and facility administrators. The Forum observed that international facilities often depart from the IUPAP recommendations, in giving preference, for equal scientific merit, to researchers from contributing member countries. It recommended that "When it is anticipated that their national research community will have a significant and consistent need to use a large-scale research facility, governments should consider contributing towards its construction and/or operation" (*6*). The divergence between IUPAP and the Megascience Forum

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recommendations illustrates how the scientific and governmental approaches can differ, even if their goal is the same, namely to promote international cooperation and maximize scientific returns from investments in research facilities.

The ambitious program of the Megascience Forum has no equivalent in other intergovernmental organizations. Although much has been achieved in a relatively short time, there were some weaknesses as well:

(i) lack of consensus due to diverging interests and policies has on occasion led to limited outcomes, such as state-of-the-art, well-documented reports that lack concrete action recommendations for governments or the scientific community;

(ii) lack of contact and influence of some delegates with their national authorities;

(iii) poor links between experts within the technical working groups and policy officials in the national delegations; and

(iv) low interest on the part of some key governments.

This last point deserves further discussion. In my opinion, the Forum delegations could be sorted into three groups:

The United States and Japan, which are able to build and operate a significant number of very large facilities, were most supportive of the Forum and made efforts to exploit it as a resource in their national planning and decisionmaking. They took the lead in bringing forward specific topics (for example, bioinformatics and global issues). Sometimes, other countries appeared uneasy with their predominance in the Forum. It is interesting to note that the world's two largest economies are continuing to invest in megascience-based research and in international cooperation, despite very different economic conditions.

The large European countries—Germany, France, UK—which are already well equipped with large scientific instruments, many of them operated in a multinational mode (see the photo, previous page), gave critical and often reluctant support to the Forum. This behavior seemed related to internal politics: a desire to master science policies on a national basis, wariness about conducting international discussions in the open, and a wish to redirect large investments away from big projects, especially in the physical sciences. The stagnant economic situation and the ambivalence of many Europeans about "globalization" also played a role.

A third group included smaller, research-intensive nations, especially the Netherlands and the Nordic countries, which used the Forum to present their needs and wishes in a global context and to maintain a balance between the first two groups. These nations were very proactive and supportive of the Forum, pushing for more initiatives and for commitments from governments, in contrast with larger countries.

Because of these diverging national viewpoints, there has been no organized consensus among the European Union member countries, even though the European Commission was always present and active, as a full member of the MSF. The future of large European projects, or of the European share in global projects, has now become a pressing issue. The controversy about the recent decision (*8*) of the French government to drop "Soleil," a national synchrotron project, in favor of an association with the UK project "Diamond" arose from difficulties in communicating with scientists about the right balance between research needs, scientific efficiency, and budgetary constraints. An opportunity was missed to use the MSF for a foresight study in this area, as was done for neutron sources (*6*).

The restricted membership of the OECD itself presents another problem. Although nonmember countries can be invited to participate in specific working groups and workshops, some of the important actors in world science are missing: China, India, and the South American countries. Their participation will surely be needed in the future if the Forum hopes to deal with "global issues." However, a restricted membership of governments that share many ideals and practices can be a distinct advantage as well, allowing coherence and consensus to be reached that sometimes elude organizations with a much wider membership.

Has the Forum been worthwhile, and did it justify the resources that were invested in it by participating countries? The question is not easy to answer, partly because some of the benefits are intangible, such as the fostering of personal relationships. Even when formal debates proved unproductive [as when the discussions about nuclear physics strayed into the extremely politically sensitive area of the transmutation (*9*, *10*) of nuclear wastes], there was a clear benefit from establishing personal contacts and airing the various points of view in the coffee room. Beyond these hidden but real benefits, the Forum contributed to a precise formulation of pending issues such as who should have access to large-scale facilities, and initiated concrete action. For example, the meeting of OECD Science Ministers (*11*) followed the Forum's recommendations by endorsing the creation of GBIF and of a task force on radioastronomy. Governments can entrust to the Forum the roles of continuing to prepare rules of the road, to serve as a think-tank, to assess issues about new international projects, and a venue for international policy consultations.

From the point of view of most governments, the overall assessment of the Megascience Forum appears positive. An exhaustive evaluation of the Forum, performed partly by a panel of independent experts, was favorable (*6*). Earlier this year, the mandate was renewed for 5 years, although the Forum now has a new name, the Global Science Forum, and a new Chairman, John Boright of the United States. Clearly, in the future, there will be less emphasis on large, expensive facilities, with more attention devoted to global-scale problems and programs in areas such as environment or health—as exemplified by the GBIF and radioastronomy projects—corresponding to the trend in science policy to emphasize cross-disciplinary, socially relevant programs.

The overall rationale, however, will remain the same: to examine key international science policy issues in a setting that puts the needs of governments first, and where governments remain in control of the process, while receiving input from scientists. In carrying out its broader mandate, delegates will encounter new challenges, not the least of which is how to establish national delegations with expertise in all areas, present or new, where the Forum may choose to be active. The main ingredient for success will continue to be the commitment of governments to international undertakings, and a sincere desire to analyze, plan, and implement their science policies in a global context.

References and Notes

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2. J. Redfearn, *Science* **285**, 22 (1999).
3. The Organization for Economic Cooperation and Development is an intergovernmental organization based in Paris, whose members are the 29 wealthiest industrialized democracies; among them all the countries of western Europe, the United States, Canada, Mexico, Japan, Korea, and Australia. Recently, Poland, Hungary, and the Czech Republic were admitted. Russia has observer status in the OECD.
4. F. Praderie, *The OECD Observer* **187**, 4 (1994); _____ in *Megascience and Its Background* (OECD, Paris, 1993), p. 25–40.
5. S. Michalovski, *The OECD Observer* **217/8**, 59 (1999); see also the book series *Megascience, the OECD Forum* (OECD, Paris, 1993–1998).
6. All reports can be accessed on the OECD Forum Web site at www.oecd.org/dsti/sti/s_t/ms/index.htm.
7. Recommendations for the Use of Major Physics Facilities, adopted by the 22nd General Assembly of IUPAP (Uppsala, 1996), www.iupap.org.
8. A. Hellemans, *Science* **285**, 819 (1999); see also *ibid.*, "ScienceScope," p. 1649 (1999).
9. C. Rubbia, *Am. Inst. Phys. Conf. Proc.* **346**, 44 (1995).
10. "Transmutation of nuclear energy wastes," OECD Nuclear Energy Agency database, www.oecdnea.org/html/trw (OECD, Paris, 1999).
11. Conclusions of the OECD Science Ministers Meeting, Paris, 22 to 23 June 1999, www.oecd.org/subject/cstp/1999/body.htm. The views expressed here are personal ones and do not reflect those of the OECD or of the French government.

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[8] **ScienceScope**
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