

SCIENCE AND TECHNOLOGY POLICY RESEARCH:

*Some Lessons of Experience and a World Bank Perspective*¹

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I want to thank the organizers of the SPRU 25th Anniversary Conference for giving me the opportunity of addressing you in this plenary session. This is a most pleasant reunion of friends and colleagues --many of whom I have not seen for years-- who share the common concern of mobilizing science and technology (S&T) for improving the human condition.

This conference is also a welcome and appropriate occasion to express my gratitude to the director of SPRU, Geoffrey Oldham, a mentor who has given me support and guidance for more than two decades. I also wish that Jorge Sábato and Máximo Halty, who developed many of their ideas on science, technology and development in association with SPRU, and who are no longer with us, could join us in this celebration.

Over a coffee a few minutes ago, Charles Cooper mentioned that this event may pass in the history of science and technology policy meetings as "the conference of

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unfinished conversations". In my remarks today, I wish to begin several conversations with you, trusting we shall be able to continue them over time. I will describe recent developments in the field of science and technology at the World Bank, share with you my experience in the utilization of policy research results, and comment on the tasks ahead for S&T policy in developing countries.

The World Bank and Science and Technology.

After spending nearly two decades of my professional life as a "Bank Watcher" from the outside, I have now been almost four years at the World Bank. At gatherings such as this one, where the Bank is criticized for what it does and for what it does not, I often do not know whether to defend it or to add my own criticisms. Therefore, it may be best to begin by describing some key features of the World Bank, focusing on its roles as a financial institution and a development agency.

The World Bank was created in 1944 and is the largest of the multilateral development banks. It is owned by 153 countries, about 90 of which are active borrowers. The Bank obtains over \$10 billion annually by issuing bonds in capital markets, carries more than \$90 billion of outstanding debt, enjoys the highest possible rating (AAA) from credit rating agencies (which allows it to borrow money at low cost), and maintains a very conservative 1:1 gearing ratio, meaning that its outstanding loans to developing countries cannot exceed its authorized capital and reserves.

Although a conservative Institution by nature, the World Bank plays a leading role in international capital markets and is a highly regarded innovator in global finance. It pioneered interest and currency swaps, has mobilized more than \$22 billion through cofinancing operations with private and public lenders during the last two years, and it was the first institution to issue "global" bonds traded in several markets at the same time.

Financial resource mobilization is the first strategic direction for Bank development activities. All of the resources obtained by the World Bank from international capital markets, as well as those gathered from donations for its soft-loan window --the International Development Association (IDA)--, are loaned to developing countries for investment projects, sectoral investment programs, structural adjustment operations, debt reduction, technical assistance and emergency reconstruction. Without the intermediary role of the World Bank (and that of the regional development banks), most developing countries would find it practically impossible to obtain long-term resources from international capital markets at low cost.

During the last Fiscal Year (mid-1990 to mid-1991), World Bank loans exceeded \$16 billion to 42 countries, with an average interest rate of 7.73 percent, a repayment period of 14 years and 5 years of grace. IDA credits totalled more than \$6 billion to 44 low-income countries, to be repaid over a 40-year period with 10 years of grace and an interest rate of less than one percent.

The second strategic direction for World Bank activities refers to capacity building in borrowing countries. This comprises human resources development

(education, health, population, nutrition), institutional development (management training, technical assistance, policy advice), and technology development (venture capital, higher education, information technology, research support).

The third strategic direction, emphasized in recent years, is promoting environmental sustainability. It involves actions at the national level through the incorporation of environmental considerations in lending operations, policy dialogue and technical assistance. The World Bank also addresses regional and environmental problems through research and studies, special initiatives (such as the Mediterranean Environmental Technical Assistance Program), and by channeling resources through the Global Environment Facility (in which the World Bank collaborates closely with the United Nations Development Program and the United Nations Environment Program).

To fulfill its mission the Bank has to balance the financial and development aspects of its mandate, which may generate tensions that can only be resolved, in practice, in the context of specific country situations and lending operations. The World Bank is frequently seen as a conservative, slow and difficult to change institution, and it certainly has made its share of mistakes during its nearly half century of existence.

However, the World Bank's cautious stance, conservative policies, and reluctance to take excessive risks with other people's money, are precisely the qualities that have allowed it to serve well its borrowers: the Bank has built a solid and most enviable reputation in financial markets, an essential condition to mobilize the large amount of resources that are made available to developing countries at low cost.

These are some of the good reasons why the World Bank appears to be slow in absorbing new ideas and approaches to development, and explain to a significant extent why it has not rushed to support the development of technological capabilities in developing countries.

In addition, attitudes of World Bank staff towards technology issues have often moved between two extremes. On the one hand, economists argue that there is no need for specific interventions to develop technological capabilities, they will emerge automatically once "you get the prices right" and adopt the correct economic policies. On the other hand, sectoral specialists working on investment projects argue that technological capabilities are created directly as a result of "making the right technology choice decisions", without further actions being required.

The fact that knowledge about interventions to improve technology capacities that cut across projects and sectors is fragmentary, and builds primarily on the experience of a few newly industrializing countries, has also made it difficult to justify making the development of generic S&T capabilities a key objective for World Bank lending. However, during the last ten years, and especially during the last five, the World Bank has expanded significantly its involvement in the development of science and technology capacities, not only through research and studies, but also through lending operations.

Since 1977, the World Bank has financed 31 investment projects for a total of \$2.44 billion in the field of industrial technology development, of which 23 projects adding up to \$2.05 billion have been approved since 1988. Starting in the mid-

1960s, the Bank has also financed more than 150 agricultural technology projects, nearly 40 science and technology education projects, and more than 20 projects dealing with the technological aspects of transport, water supply, energy and telecommunications.

The World Bank has also provided continuous support for the Consultative Group on International Agricultural Research (CGIAR), a Bank-led consortium of 40 public and private sector donors established in the early 1970s, which channels more than \$230 million annually in donations to 16 international agricultural research centers and their counterparts in developing countries.

A startling new development has been the growing extent of World Bank involvement in information technology. Lending for information technology systems and telecommunications in Fiscal Year 1990 (mid-1989 to mid-1990) reached a total \$1.8 billion. This is a significant increase from the previous Fiscal Year, when the corresponding amount was \$750 million, and in relation to Fiscal Year 1986, when the total was \$500 million. Moreover, during the last five years, about 90 percent of Bank loans have had information technology components, reaching the level of 93 percent in Fiscal Year 1990.

Several units of the World Bank have begun to pay more attention to science and technology, particularly in connection with higher education in Africa and Latin America, science education at the primary and secondary levels, technological capacities and industrial competitiveness, and technology capabilities for sustainable development. Finally, there is also the possibility that the World Development Report for 1993 or 1994 will focus on science and technology.

All of this indicates that the World Bank has begun to recognize the importance of technology in the process of development. Lending has increased significantly, research and studies have multiplied, and information technology figures prominently in World Bank lending. Furthermore, the 1991 World Development Report has clearly stated that:

*"The key to global development has been the diffusion of technological progress. New technology has allowed resources to be used more productively, causing incomes to rise and the quality of life to improve. ... Using new technologies effectively has often required adaptation and innovation in economic institutions, and occasionally political and social institutions, too."*³

In short, there are clear indications that during the 1990s the World Bank is likely to become a major player in the field of science and technology development, and a significant user of the results of S&T policy research.

Some Lessons of Experience In S&T Policy Research.

The second conversation I want to start with you refers to the use of policy research. Concern about the application of research results has been growing during the last decade, as the focus shifted from improving our knowledge of the role of S&T in economic and social development to the practical aspects of the S&T policy process. Many of us have made the transition from research to policy making responsibilities, and several have made the journey back to academia after a brief

^{3/} The World Bank, World Development Report 1991: The Challenge of Development, Washington, D.C., p. 14

Incursion into the world of politics and bureaucracies. As a result of these transitions, we have learned to make policy research more effective.

Let me offer four propositions on the utilization of policy research. They are by no means the only --or perhaps not even the most important-- matters to bear in mind as we strive to make S&T policy research more relevant to the problems of contemporary society. They summarize some of the lessons of experience I have been trying to assimilate for a number of years.

The first proposition is that to be effective in policy making it is essential to know the system. Without a thorough understanding of the viewpoints, objectives and motives of the various constituencies involved, it is most difficult to influence policy formulation and decision making. A detailed knowledge of the operational aspects of the policy process can also help considerably.

No matter how good our ideas or intentions, it serves no purpose to shout and preach from the outside; this may make us feel important and righteous, but it is likely get us nowhere. To transform the results of policy research into actual sources of influence for policy and decision making it is essential to understand the logic of the system we are trying to change, and also to know its language and communication codes.

The second proposition is that there is no limit to what you can achieve, provided you let others take the credit for it. This is a rather difficult lesson to learn. Academic researchers are supposed to publish extensively, and aspire to be the first with a new concept or piece of empirical evidence. Similarly, those working

on technology research seek to protect their findings by securing intellectual property rights. In both cases the idea is to associate the researcher's name with the publication or patent, to seek either recognition or financial reward.

Putting in practice the results of policy research requires a completely different approach. When the objective is to influence the general climate of opinion about an important issue, it is imperative that as many influential people as possible --opinion leaders, advisors, journalists-- make the ideas and findings their own. When the purpose is to influence policy or decision makers, it is best to persuade them to "own" a proposal or initiative, possibly attaching their name to it. Seldom will a politician, senior policy maker or high level manager champion initiatives clearly identified with someone else.

The third proposition is that knowledge and ideas matter. The role of an intellectual, and of a policy researcher in particular, is to develop the concepts and ideas with which other people think. Policy research should give decision and policy makers the mental building blocks with which to apprehend reality, construct explanations, identify options and decide on actions.

It never ceases to surprise me how important ideas are in policy making, regardless of how practical or even pedestrian the matter at hand may seem. Whoever puts forward the first set of concepts determines the agenda; options emerge as a reaction to it, and alternative courses of action are defined taking those initial suggestions as point of reference. By enriching the conceptual tool-box of policy and decision makers, policy research enhances their effectiveness in a most significant way. In addition, policy research improves our knowledge of the policy

design and implementation process, and allows us to disseminate and share this knowledge.

My fourth and final proposition is that S&T policies have to be put in context, not only in the context of macroeconomic and sectoral policies they are usually linked with, but also in the broader context of social and political factors affecting development. Those with access to knowledge and wealth in all societies are a privileged few, and political pressure groups usually represent them. The task of the policy researcher is to look beyond existing power structures and their immediate interests, adopting a broader and longer-term perspective for policy design and implementation.

This involves inescapable value judgements. Whether we like it or not, ethical and moral issues are an integral part of policy research, and of the way the knowledge it generates is put at the disposal of policy and decision makers. Equitable distribution of the benefits of technological progress, concern for the fate of future generations, and peaceful uses of science and technology are among the many values that should inform the actions of those engaged in S&T policy research.

On S&T Policy Research and Development.

The last conversation I wish to begin deals with future directions for S&T policy research. One concern I have may be introduced by referring to a trivial but revealing exchange. At one stage in the preparations for this conference, it was suggested that I should include the phrase "Towards 2000" in the title of my address. However, while acknowledging that the end of the millennium has a certain allure, I

have been feeling increasingly uneasy about the "Christianocentrism" implicit in the use of "Year 2000" as a milestone; why not the corresponding "Year 5760" of the Jewish calendar, or "Year 1420" in the Islamic calendar?

This vignette draws attention to the potential problems of "Eurocentrism" in S&T policy research. With very few exceptions, most interventions at this conference have adopted a European or, to a lesser extent, North American or Japanese point of view. This gives me the (hopefully mistaken) impression that the once thriving contingent of SPRU researchers working on science, technology and development issues may have lost some of its vitality.

This is not a problem of SPRU alone. In the larger context of S&T policy research, support for work on development has dwindled and the attention of young researchers has shifted to topics such as the technological implications of European economic integration, the new patterns of inter-firm collaboration and competition in advanced technology, and the national efforts to master strategic technologies.

Yet, there remain many critical and intellectually challenging S&T policy issues associated with development problems. Let me mention a few, in the hope they will attract greater attention from the community of S&T policy scholars, so well represented at this event.

The first is the need to devise effective S&T policies for the social sectors -- employment, education, health, nutrition, housing, water supply, population-- in a context of resource constraints. As social demands expand in developing countries,

largely as a result of population growth and increases in the labor force⁴, it will be necessary to develop and foster the use of low-cost and efficient technologies for the delivery of social services. This requires answering questions such as: which combinations of traditional and advanced technologies are appropriate in different social and cultural settings? Which mixtures of "hardware" (equipment, buildings, machinery) and "software" (organizations, rules, procedures) are most effective in specific social problem areas? Which policies and interventions are likely to have the greatest success in increasing the availability and utilization of such combinations and mixtures of technology?

A second theme for S&T policy research refers to the interactions between technology, environment and poverty. The full incorporation of environmental sustainability considerations into the design of S&T policies is a major task in any context, made even more complex when a poverty reduction dimension is added to it. Following the successful search for "win-win" solutions --those which protect the environment and improve productivity at the same time-- in energy conservation and sustainable agriculture, there is an urgent need to explore technology options and policies that simultaneously address environment and poverty concerns. This calls for S&T policy research in fields as diverse as urban transport, use of tropical forests, water supply and sanitation, mining and minerals processing, and the preservation of genetic diversity.

Three additional research themes are derived from the need of developing countries to respond to the rapid pace and increasing complexity of technological

⁴/ For example, more than 95 percent of the additions to the world's labor force during the two next decades will occur in the developing countries.

change. One refers to the characteristics of the process of innovation in unstable and resource constrained economies, a second to the ways in which social technology assessment can be organized and carried out, and a third to strategies for capacity building in science and technology. All of these involve difficult empirical and theoretical questions to be elucidated through S&T policy research.

A final theme I would like to suggest is one I have been concerned about for some time: the need to provide a reinterpretation of the concepts of development and progress, using the capacity to generate and utilize knowledge as the main explanatory variable. As the pervasive impact of scientific and technological advances in contemporary society is becoming obvious, there is a need for fundamental change in our conception of "development" and of the ways to bring it about. Theories to guide development strategies, policies and decisions must take into account the fact that science and technology capabilities are becoming the main determinants of economic growth and social progress as the 20th century draws to a close.

Concluding Remarks.

The three conversations I have begun in this address give you a sense of my present concerns in the field of S&T policy. But starting conversations was not primary reason why I wanted to join in this celebration of the 25th anniversary of SPRU. The primary reason was to have an opportunity to renew contacts and enjoy the company of friends.

I have always looked at SPRU as a place where I can share views and concerns, explore new ideas and learn from others. Under the leadership of Chris Freeman and Geoff Oldham, SPRU has gathered men and women I trust, and whose outlook on life can best be expressed in the words of British poet George Linneus Banks:

*What I live for:
For the cause that lacks assistance,
For the wrong that needs resistance,
For the future in the distance,
And the good that I can do.*

Let me finish by joining all previous speakers in offering my best wishes for the next quarter century of the Science Policy Research Unit at the University of Sussex.