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BOOK REVIEW: Fuglie, Keith O. and David E. Schimmelpfennig, eds. *Public-Private Collaboration in Agricultural Research: New Institutional Arrangements and Economic Implications*. Ames: Iowa State University Press, 2000, xv + 354 pp., Indexed, \$84.95 hardcover. ISBN 0-8138-2789-2.

Twenty-two agricultural researchers and/or administrators contributed the 15 chapters of this book. Most have distinguished themselves in their contributions to the knowledge of agricultural research and of its important role in feeding mankind or in the administration of this research and related processes.

The text begins with an overview by the editors of the four parts of the book. In general the book is devoted to an 'up-to-date' look at research on agricultural research. Part I examines new innovations in financing agricultural research and the increasing importance of private-sector relative to public-sector financing. This trend toward private vs. public research is occurring in other industrialized economies. Part II is devoted to reporting on recent studies of both plant and animal research. Plant research in the private sector has focused on hybrids and cultivar development with near-market potential. In animal research, the private sector has focused on product development for animal health and nutrition, new machinery and equipment for producers, and to a lesser extent on animal breeding. The public sector has been concerned more with basic research on breeding and genetics and on food safety of animal products.

In Part III of the overview the editors discuss the increasing opportunities for public-private research collaboration in the agricultural sector. Federal legislation has changed patent policies and promoted technology transfer. This legislation has increased incentives for private-sector research and provided new ways to help fund public research. Part IV is devoted to international transfers of agricultural knowledge. These transfers have also been increasing due to activities of mul-

tinational firms and to the important contribution U.S. agricultural universities have made in graduate training of foreign students—especially at the doctoral level. Chapter 15 concludes the volume.

In Chapter 2, coeditor Fuglie discusses public-goods research which depends largely on governmental support and reviews trends in the funding of US agricultural research over the past 30 years. In this review, focus is on the trends in the public and private funding of agricultural research and the implications of these trends for research policy. Fuglie indicates that the public funding of agricultural research has not increased in real terms in the last 30 years. Privately funded research has. This is a matter of concern since marginal increases in private investments in agricultural research will cease when they equal marginal private returns. This amount of investment is less than the public interests would demand for an abundant and healthy food supply. Concerns also arise because private firms have little incentive to make long-term investments in research to preserve and enhance the natural environment and to provide new basic knowledge to support future applied research.

In Chapter 3, Julian Alston, Philip Pardey, and Vincent Smith discuss the financing of agricultural R & D in five developed countries—Australia, the Netherlands, New Zealand, the United Kingdom, and the United States. R&D policy changes in each country have similarities which the authors attribute to common 'vectors of change' found in each country in recent years. The result is that each country has been attempting to shift some types of research from the public to the private sector. Over half the article is devoted to data on in-

vestments in agricultural research from the five countries of primary interest and for the 22 OECD countries over the period 1971–93. Universities' share of public agricultural spending is presented in Table 3.2, and public expenditures in China and four developing regions in 3.3. Data on private investments and public and private intramural investments in research are presented. Recent institutional changes in public R&D are discussed and the chapter concludes with a tentative assessment of recent changes in public agricultural research.

George Frisvold and Stephen Vogel are the authors of the last chapter of Part I. They use a computable general equilibrium model (CGE) to place a numerical value on the cost of funding agricultural research through commodity taxes vs. general revenues. They estimate that the cost is less (15 cents per dollar raised) using commodity taxes vs. general revenues and that this cost is borne equally by the agricultural sector and by the general economy. Research represents an investment for the future. The authors recognize that the source of these investment funds is not independent of how the funds are invested and hence not independent of the net present value of the investments nor with who gets what from the bottom line.

In Chapter 5, Kenneth Frey discusses changes in plant breeding in the US over the past 30 years and presents data on human and financial resources devoted to plant breeding. He assesses the status of the crop gene pool and argues effectively for gene pool enrichment. He also argues for greater attention to investments in minor-crop breeding programs, discusses potential sources of support and offers a plan of action.

Jose Falck-Zepeda and Greg Traxler co-authored Chapter 6. Their work is preliminary but insightful. Their concern is with the effect of legal changes which have strengthened intellectual property rights on the flow of germplasm among the federal, state, and private institutions involved in seed-technology generation. Their case study is with cotton, and they see an increasingly vital role for USDA in providing free access to startup firms

for quality germplasm in the current environment of growing private concentration in the sources of seed available to farmers.

The last chapter of Part II is authored by Keith Fuglie, Clare Narrod, and Catherine Neumeyer and devoted to a review of public- and private-sector roles in animal research in the current environment of rapid structural change in the animal industries. The authors review sectoral research expenditures and describe some trends and new institutional arrangements in animal research.

Part III has two chapters devoted to public-private collaboration in agricultural research. It begins in Chapter 8 with Kelly Day-Rubenstein and Keith Fuglie's discussion of the Cooperative Research and Development Agreement (CRADA). A CRADA provides a legal means for a federal laboratory and a private company to cooperate in developing and commercializing a technology. It continues with Mary Knudson's case studies of two public-private agricultural research consortia—the Germplasm Enhancement of Maize (GEM) and the Biotechnology Research and Development Corporation (BRDC).

Part III concludes with Chapter 10 by Mary Knudson, Richard Lower, and Richard Jones and is concerned with the use of Intellectual Property Rights (IPRs) in State Agricultural Experiment Stations (SAESs). The use of IPRs by public institutions involves establishing infrastructure (offices, staff, and administrative support) and the institutional learning associated with new legal and administrative arrangements. The authors summarize an earlier 1998 survey of SAESs by Howard Brooks and present the results of a new survey they conducted.

Part IV has four chapters devoted to international spillovers in agricultural research. Chapter 11 by Robert Evenson provides a classification scheme and results from some earlier collaborative and other research with the objective of fostering a better understanding of spillovers and ways to empirically measure them.

In Chapter 12 David Schimmelpfennig and Colin Thurtle analyze and compare agricultural productivity in the US and 10 EC countries.

Their estimates indicated that France and the US have enjoyed the fastest growth rates in total factor productivity and that international flows of technology are very important—especially from the US to European systems, not vice versa. They suggest that these spillovers are a form of aid to the rich allies of the US.

In Chapter 13 Carl Pray and Keith Fuglie consider international transfers of agricultural technologies via the private sector. They attribute these transfers to trade in inputs, licensing, direct investments, and international networks among research units of multinational companies. They indicate that the US is a large importer of agricultural technology and increasingly relies on imported technology for productivity gains. This reviewer has trouble reconciling apparent differences with those of Chapter 12 which suggested that the US benefits little from international spill-ins of technology.

In the last Chapter of Part IV, Nicole Ballenger and Cassandra Klotz-Ingram are concerned with assessing the US benefits of training foreign agricultural scientists. The Land-Grant system has indeed served the US well and provided many attractive places for foreign students to study the agricultural, engineering and other sciences. Since the agricultural sector is declining in relative impor-

tance in most countries, it is not surprising that foreign student enrollments in the agricultural sciences is declining relative to the other sciences. Likewise, a larger proportion of graduate students in agriculture vs. other sciences returning home is not unrelated to the relative importance of the agricultural sectors. This reviewer would point out the US agricultural sector is very competitive in retaining the best and brightest foreign graduates.

It is very difficult, perhaps impossible, to get 22 people to contribute to an effort that results in a book of uniform quality—even with strong editing. It nearly always seems that some contributions are a bit ‘old-hat’ and some remain in process. This book too is a bit uneven, but it makes a contribution. We should all be concerned with whether our agricultural research and educational system continues to provide a basis for an abundant supply of healthful food at reasonable prices at home and abroad. Our public universities and research centers have an important role in helping ensure that the basic information is available to keep total factor productivity in agriculture growing in the future as it has in the past.

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