



AgEcon SEARCH

RESEARCH IN AGRICULTURAL & APPLIED ECONOMICS

The World's Largest Open Access Agricultural & Applied Economics Digital Library

This document is discoverable and free to researchers across the globe due to the work of AgEcon Search.

Help ensure our sustainability.

Give to AgEcon Search

AgEcon Search

<http://ageconsearch.umn.edu>

aesearch@umn.edu

*Papers downloaded from **AgEcon Search** may be used for non-commercial purposes and personal study only. No other use, including posting to another Internet site, is permitted without permission from the copyright owner (not AgEcon Search), or as allowed under the provisions of Fair Use, U.S. Copyright Act, Title 17 U.S.C.*

No endorsement of AgEcon Search or its fundraising activities by the author(s) of the following work or their employer(s) is intended or implied.

IMPACT ASSESSMENT DISCUSSION PAPER NO. 14

**THE PRODUCTION AND DIFFUSION OF
POLICY KNOWLEDGE: A BIBLIOMETRIC
EVALUATION OF THE INTERNATIONAL
FOOD POLICY RESEARCH INSTITUTE**

Philip G. Pardey and Jason E. Christian

Director General's Office

International Food Policy Research Institute

2033 K Street, N.W.

Washington, D.C. 20006

Tel: (202) 862-5600

Fax: (202) 467-4439

Email: IFPRI@cgiar.org

January 2002

Discussion Papers contain preliminary material and research results, and are circulated prior to a full peer review in order to stimulate discussion and critical comments. It is expected that most Discussion Papers will eventually be published in some other form, and that their content may also be revised.

CONTENTS

Abstract	-v-
Acknowledgments	-vii-
Introduction	1
Measuring Science	3
Institutional Context	10
Metrics of Policy Knowledge	18
Flows of Policy Knowledge	27
Summary	49
References	53
Appendix Tables	57

ABSTRACT

The published works of the International Food Policy Research Institute (IFPRI) represent the most immediate and tangible measure of the new policy-related knowledge attributable to the institute, its staff, and research partners. This study provides a quantitative assessment of the number, nature, form, and use of IFPRI's published products since 1979 and compares and contrasts that with the publication performance of several similar agencies, including the economics and social sciences programs of the Centro Internacional de Mejoramiento de Maíz y Trigo (CIMMYT) and the International Rice Research Institute (IRRI) respectively, the Australian Bureau of Agricultural and Resource Economics (ABARE), the Bangladesh Institute for Development Studies (BIDS), and the now defunct Stanford University Food Research Institute (SFRI). Overall, IFPRI's circulated output is extensive, published not only in a broad portfolio of leading scholarly journals, but also in a wide range of books, technical reports, and extension documents. The amount of published output has tended to increase throughout IFPRI's history, and it continues to do so.

Going beyond counting and classifying IFPRI's published record, we report the results of a bibliometric assessment of IFPRI and the comparison institutes for the period 1981–96 using the publication and citation performance details recorded in the Institute for Scientific Information's (ISI) *Science Citation Index* and *Social Science Citation Index* data bases. Citations to published literature are not indicative of an impact on policy or the economy generally but on further research and analysis. An analysis of coauthorship patterns provides an indication of impact too (more directly through the conduct of joint research), as well as indications of the way the research is carried out. Our analysis reveals the role IFPRI plays as a knowledge intermediary between the scholarly community and policy clientele, but that a high proportion of its research collaborations leading to formal publications (and especially publications in the leading journals covered in ISI's data bases) involve researchers in advanced agencies. This partly reflects the limited capacity to perform food policy research in many developing countries—itsself a reflection of local priorities for education and limited, long-term international support to increase scientific capacity in developing countries—and also underscores the role IFPRI could, and arguably should, play in redressing this state of affairs.

ACKNOWLEDGMENTS

Many people gave generously of their time and support and readily provided information to complete this report. We thank the senior management of the agencies mentioned below for their unhesitating willingness to participate in the study. We specifically acknowledge the help we received from Brian Fisher of the Australian Bureau of Agricultural and Resource Economics (ABARE), Abu Abdullah from the Bangladesh Institute of Development Studies (BIDS), George Rothschild formerly of the International Rice Research Institute (IRRI), and Tim Reeves from the Centro Internacional de Mejoramiento de Maíz y Trigo (CIMMYT). Prabhu Pingali from CIMMYT and Mahabub Hossain from IRRI and other staff from both institutes responded quickly to our unreasonable demands for assistance. Jeffrey Williams from the University of California, Davis, and formerly from the Stanford University Food Research Institute, provided information on SFRI. Raisuddin Ahmed and Paul Dorosh from IFPRI supplied additional information on BIDS. Curtis Farrar gave us wise council throughout the work, and we thank him and an anonymous reviewer for helpful comments on earlier drafts of the paper.

Connie Chan-Kang (IFPRI) provided exceptional research assistance, as did Patricia Zambrano and Nienke Beintema. Michael Gjerde and Pete Cervinka from the University of California, Davis, helped tabulate some of the publication count data. Tricia Klosky and the IFPRI publications staff (especially David Gately) helped compile the IFPRI published record, while Stacy Roberts and Chris Schneck provided much useful input on various IFPRI budget and institutional details. CHI Research, under the direction of Francis Narin, was contracted to undertake the bibliometric searches of the citation-index data files developed by the Institute for Scientific Information. We thank Francis Narin, Anthony Breitzman, and other members of the CHI staff for their excellent and creative work.

1. INTRODUCTION

Measuring the output and impact of policy research is a tricky thing to do. Policy research gives rise to new ideas, new data, and new findings that are captured, primarily, in written form. An analysis of this written output and an appreciation of the way it was developed and used provide a partial accounting and assessment of the policy research that brought it about. This report describes a quantitative survey of the published and unpublished writings of professional staff associated with the International Food Policy Research Institute (IFPRI). The survey evidence is interpreted within a science evaluation framework, and the measurable use made of IFPRI's publications by other researchers is compared and contrasted with the publication performance of similar agencies. Much—although certainly not all—of IFPRI's work takes the form of formal written documents. These documents are circulated in various ways, including draft and completed working papers, presentations at seminars and conferences, and published technical reports, monographs, books, chapters in books, and articles in journals. This written work is the object of this study.

IFPRI's mission, and the institutional arrangements in which it carries out its mission, helps to frame the current study. IFPRI's current mission statement, updated in 1997 (IFPRI 1997), is threefold:

- Identify and analyze alternative national and international policies for meeting food security and nutrition needs on a sustainable basis, with particular regard for low-income countries and poor people, and for sound management of the natural resource base that supports agriculture.
- Make results of research available to all those in a position to apply or use them.
- Help strengthen institutions conducting research on food policies and institutions in a position to apply such research results in developing countries.

Earlier versions of IFPRI's mission were variants on these themes. Since 1980, IFPRI has worked as one of the centers of the Consultative Group on International Agricultural Research (the CGIAR).¹ The CGIAR was conceived, and largely continues to operate, as a scientific instrument for economic development. Many government and private volunteer organizations also engage in development efforts. But few, if any other, international agencies use agricultural science as the primary means for effecting this development. Most CGIAR science revolves around the physical and biological disciplines of the agricultural sciences. IFPRI is the only CGIAR center with policy research as the central element of its work.

¹ See Baum (1986), Gryseels and Anderson (1991), and Alston and Pardey (1999) for details of the establishment and subsequent development of the CGIAR.

Any institutional evaluation must include an assessment of the institute's success in achieving its goals, including the effectiveness with which it deploys its resources to meet those goals. The ultimate success of IFPRI's work, and that of its partners, can thus be partly measured by reductions in poverty and improvements in the general well-being of people in poor countries. Yet measuring such changes meaningfully is problematical, and it is inherently difficult to identify which research investment was responsible for a particular improvement (Alston and Pardey 2001). These aspects of evaluation involve the valuation of policy research in general and of IFPRI's role in that research in particular—a topic well beyond our remit here, but one that is beginning to be addressed elsewhere (Pardey and Smith 2002).

Two aspects of IFPRI's program matter most for this study: (a) the institute's efforts to advance food policy analysis as it relates, in particular, to developing countries, and (b) IFPRI's application of analytical advances to concrete problems, again particularly in the developing-country context. However, especially in the case of the first goal, no one-way flow is evident from work to product. Instead, IFPRI, like other institutions supported through the CGIAR, is part of a complex system of science and application that includes scholars and practitioners in developing countries, scientific communities in the industrialized world, and sponsoring agencies. A key function of the CGIAR agronomic and technical institutions is to serve as facilitator and assistant in the development of domestic research capacity. IFPRI, similarly, serves not simply as a performer of policy research and analysis, but as a center for developing a community of policy researchers and analysts oriented toward the problems and challenges facing the developing world. Hence, IFPRI performs three roles in pursuit of its primary goals: (a) as a research center whose members contribute to the growth of knowledge in one or more scientific disciplines; (b) as a policy-analysis agency performing various tasks on behalf of clients, particularly for developing-country governments; and (c) as a center for the transfer of the "technologies" of policy research and analysis to national programs in developing countries. IFPRI's written output reflects all three roles.

In this study, we first we take advantage of publication lists provided by IFPRI and several other organizations active in agricultural, food, and development policy. These sketch an overall picture of publications produced by IFPRI staff and how they compare with those produced elsewhere. Second, we identify articles published in the peer-reviewed journals covered by the Institute of Scientific Information's *Science Citations Index (SCI)* and *Social Science Citations Index (SSCI)* whose authors report affiliation with IFPRI or the other institutions in the study. We then present data describing these publications and, finally, identify all articles in the *SCI* and *SSCI* journals that cite those articles.

2. MEASURING SCIENCE²

2.1 A Framework for Measurement

Economists have long been interested in the inventive process and the role of science in that process. Science plays a pivotal role in the development of new technologies that foster productivity growth and growth of economic output. Sociologists, historians, and scholars from other disciplines are also interested in these issues. How do new inventions come about? How do measured changes in inventive inputs (like R&D spending) map to changes in technologies? And, what are the efficiency and equity consequences of new technologies? These are all key issues for economists trying to understand the long-term economic-development influence of science (as distinct from other influences like increased physical capital or increased human capital brought about by public and private investments in buildings and education). Understanding the economics of science itself is also vital. To what extent do changes in incentives to invent affect investments in R&D? Is the inventive process subject to diminishing returns? Do firms, industries, economic sectors, or even countries benefit from science done elsewhere? Such questions are the subject of considerable economic inquiry.

To advance thinking on these issues, and especially, to begin to quantify some of these aspects, requires a conceptual framework. The simplest model—variants of which underpin much empirical work on this topic—is one that links R&D spending and other inventive inputs to innovations or changes in the stock of useable knowledge. The accumulation of these innovations generates a stock of knowledge that, in conjunction with other factors, gives rise to changes in productivity, output, and other economic consequences of invention.³

A reduced-form relationship linking current and past R&D spending to output or productivity is the approach used most often to assess the economic effects of R&D, including the economic returns to research. Studies of the inventive process itself focus more on the (lagged) relationship between R&D spending and inventive output, or variations on this theme. Some seek to estimate such a function directly, such as Pakes and Griliches (1980) in the case of R&D done by large U.S. corporations and Pardey (1989) in public agricultural R&D in the United States. Such estimates require a meaningful measure of scientific output, so that an empirical equation can be written linking innovations or additions to the stock of knowledge (and other unobserved influences) to observable science metrics such as patent or publication counts.

² The title of this section and some ideas discussed in it borrow from Adams and Griliches (1996). See also Griliches (1990) for a review of the informational content of patent data. Some of these ideas carry over to an assessment of publications in a science evaluation context.

³ Alston, Craig, and Pardey (1998) spell out this model in more detail.

2.2 Science Indicators

Getting meaningful measures of R&D inputs and outputs is difficult; quantifying the relationship between them is doubly so. Most studies use R&D expenditures as a measure of R&D inputs, though some use the number of research personnel instead. Unfortunately, R&D expenditure data are rarely collected for many firms, industries, and sectors. Or, for confidentiality reasons, it may be reported in insufficient detail for a fully satisfactory matching of spending data to the scientific activities being studied. Moreover, spending series are often comparatively short, forcing analysts to truncate the R&D expenditure lags inappropriately. The paucity of R&D deflators is another complicating factor.

Measures of inventive output. Economists and others have long used patent counts as indicators of research output. However, patents have so far been a small part of CGIAR activities (Binenbaum, Pardey, and Wright 2001), and they are inherently unrelated to the written and noncommercial nature of most policy knowledge. Nonetheless, a brief review of the literature in this area is useful because of economists' long experience with patent data as a technology indicator. The relationship of patents to inventions, and of patented inventions to technical change, serves as an analogy to the relationship between publications and research results, and that between published reports of research results and the growth of policy-relevant knowledge.

Patents differ markedly in the magnitude of inventive output they represent. Their technical and economic content varies, and they may reflect improvements that have little if any economic value. Not all innovations are even patentable. The novelty, utility, and other characteristics required to secure a patent for a new idea, process, or product are not uniformly defined or enforced by government patent offices, and patent rules can change over time. Some firms prefer to use secrecy or other means instead of patents to protect their intellectual property.

Notwithstanding these difficulties, Griliches (1990) and others argue that when used with care and creativity, patent counts can be a good indicator of inventive activity and, more specifically, inventive output. A "law of large numbers" argument is often invoked to deal with variations in inventive content among patents. This is essentially the approach of Schmookler (1966) in linking patents to indicators of profitability in the patenting industries (see also Scherer 1980 and Basberg 1982). Royalty payments for patent licensing are used to measure economic value (NSB 1988, OECD 1994). However, except in cases where records are kept describing license payments to specific patents, royalties provide only aggregate information on the value of licensed patents. In particular, they fail to reflect the value of inventions used directly by the patent owner.⁴

⁴ Mandatory licensing laws, which are used by some technology-importing countries, may require reporting license activity as a condition for patent enforcement, as is the case in Indonesia for example. While such a feature might be attractive to a collector of science and technology indicators, it is less clear that the underlying policy of mandatory licensing makes for good science policy. Christian (1996) discusses the harm to the technology importer that may accompany such a policy, reducing profitability to the innovator of the international technology transfer.

In general, the use of patents to measure research *output* relies on the assumption that only inventions with a minimum value are patented because of the nontrivial cost of patenting (including the direct expense of patenting and patent enforcement and the cost of the information made available to competitors in the patent document). While statistics on patents may be used to describe broad trends, one still relies on the novelty requirements of the various patent offices to interpret patenting as an indicator of inventive activity. If invention is costly, then presumably those undertaking the activity are actually receiving, on average, some benefit for their expenditures (Christian 1982). In any case, despite substantial difficulties in the interpretation of patent statistics, economists and others have found enough information within patent information systems to add to the stock of knowledge regarding the functioning of research, development, and innovation processes.

R&D spillovers and quality. Patent records contain valuable information in addition to count data. For example, they carry a citation profile to previous, related patents and to relevant scientific articles. Patents are also assigned a patent class that helps to locate both the technology involved and the industry most likely to use the invention. The U.S. patent office, in particular, has developed a concordance between the patent classification and the Standard Industrial Classification.⁵ These aspects of the data are used to good effect. One line of inquiry uses citation performance to develop "quality weights" as a means of normalizing count data regarding patents' "innovative content." Carpenter and Narin (1983) use citations to patents to measure importance to subsequent technology; however, this says nothing of the direct economic value of the invention covered by the cited patent. Another line of inquiry uses both the citation data and the classification schema to map networks of innovative activity and to assess the spillover effects of R&D, wherein new knowledge generated by one firm or industry benefits others (see, for example, Jaffe 1986). Similarly, Carpenter and Narin use citations in patent documents to the scholarly literature as a means of identifying the progression from fundamental research to technological practice.

Bibliometrics and science indicators. Patent statistics are the science indicators most familiar to economists. Yet much recent work on patent statistics found its inspiration and model in a somewhat older research program. This involved the use of scientific publications, and references to scientific publications, as indicators of the output of, in particular, more fundamental research. Thus, the first of the National Science Board's *Science Indicators* compendia contained a fairly extensive treatment of publication-based data and the preliminary results from a long-term study of patenting (NSB 1973). Carpenter and Narin (1983) built on their prior experience in analyzing citations in the scientific literature when they began their analysis of patent statistics. Indeed, the use of literature-based indicators, or bibliometrics, is well established and increasingly drawn on for science policy formulation

⁵ The U.S. patent classification evolved over nearly two centuries in response to the needs of patent applicants and, in particular, examiners. Its primary function is to aid in the search for prior art. The more modern International Patent Classification is a purely technical classification with fields of application defined at the lowest level of aggregation. In recent years some countries, notably Canada, have included industrial classifications in the patent record.

purposes. The governments of the United States, the United Kingdom, Australia, and many others support work in this area and publish aggregate statistics based on the output of scientific literature (NSB 1997, Katz et al. 1996, Industry Commission 1995, AGPS 1996). Our objective is to apply bibliometric techniques to study the output of social science and policy research.

2.3 The Social Sciences

Although most economic studies of science use patent data, such data is singularly useless for evaluating the output and impact of social science and policy research. Much research in the physical and biological sciences is directed toward, or ultimately affects, the development of new technologies, which are typically embodied in new machines, pharmaceuticals, and other products and processes, many of which may be patented. The situation in the policy-oriented social sciences is different. While new policy knowledge may eventually lead to new laws, new ways of applying old laws, or to other changes in social practice, the direct expression of the new knowledge is almost always in some written form. While social scientists (particularly economists) are perhaps more experienced with the use of patent statistics, the analysis and measurement of social scientists' activities must rest on the less familiar (but at least as well established) techniques of bibliometrics.

Published output, particularly in refereed scientific and technical journals, is a highly visible feature of modern science. In addition to its historic role in communicating results, publications serve a record-keeping function, a quality-control function, and as a device for the discovery, assignment, and recognition of intellectual property. Indeed, the use of publications as the primary vehicle for national, institutional, and in particular, personal evaluation in academia is well known (Moed et al. 1985, May 1997). The relative importance of each of these functions may vary across disciplines and types of activity. In some fields, patents may dominate over the intellectual property function, while in others, professional recognition may dominate over the communication function. For example, while plant breeders publish results of some of their research they also embody and identify their work in the release of new varieties. Breeders may also "communicate" results by actively exchanging seed, such as through the international nursery programs managed by CIMMYT (Centro Internacional de Mejoramiento de Maíz y Trigo) and IRRI (International Rice Research Institute). In such a context, researchers may see the publication of scholarly articles as a distraction from their primary work. In contrast, "progress" in the social sciences is embodied not in improved seeds, but in the written word. In policy-oriented work, in particular, there is less of a role for profit-related property rules. Indeed, work in the social sciences often exists only to the extent that it is written down.⁶

⁶ As McCloskey (1985: 189) observed, "The production function for scholarship [especially in the social sciences] cannot be written as the sum of two subfunctions, one producing 'results' and the other 'writing them up.' The function is not separable." To elaborate, he observed that "...what passed for a truth when floating vaguely in the mind looks a lot like an error when moored to the page."

While written work is central to the social science and policy analysis area, formal publication is not the only or even the dominant form of written output. Publication, particularly in peer-reviewed journals but also in book and monograph series, typically involves the explicit or implicit requirements of both novelty and utility to the profession or discipline. Yet a policy analyst may well perform valuable work that is not, and was never intended to be, either particularly innovative or helpful to subsequent research. It is valuable not to the discipline or profession but to the sponsoring agency or other extra-professional clients. One of IFPRI's functions is, in fact, to perform high-quality, impartial service work on behalf of such clients, with any service to the profession or discipline entirely incidental. An evaluation of the written work of a service institution such as IFPRI must therefore take into account activities outside the realm of academic and scholarly publication.

The "communication" function of scholarly publications should not be overemphasized. Before a paper appears in print as a journal article or book chapter (or, indeed, as a book), it is typically circulated among professionals active in the field. This prepublication circulation is part of the error-catching and correcting process. It is also a primary means of communication. When a result communicated in this way is cited later, it may carry a reference to a formally published work, but the original communication is often verbal (via meetings or conferences) or by informally published work. These less formal forms—often dubbed gray literature—include drafts and working papers and may include materials circulated without formal external peer review.

There is another reason why, particularly in work related to economic development and the problems of poor countries, scholarly publication is a relatively poor medium of communication. Scholarly journals and books are expensive, especially for individuals and institutes in developing countries. And when research funds are tight, subscriptions and acquisitions become vulnerable. Thus, institutions oriented toward developing countries must use other channels if they are to communicate effectively.

The communication function of scholarly publications underlines their intellectual-property and quality-control functions. Publication in a scholarly outlet involves a formal, external peer review. The standards of different publications are generally well known, and acceptance in a peer-reviewed journal brings with it external recognition of quality and originality. The recognition of a citation undoubtedly gives psychological and often professional benefits to the cited author, even though the "property rights" conferred involve no excludability and there is no opportunity to extract monetary rents from subsequent users of the ideas and innovations revealed in the publication (unless, of course, the innovations are patented or otherwise legally protected). Citations may even be an important determinant of professional reputation and salary. Publication, and subsequent citation, *is* important to

individual researchers, even though the activity—apart from its quality-control features—may not seem central to the goals of authors' employers.⁷

Of course, intellectual property rights and recognition of contributions are important for institutions as well. This is illustrated by discussions surrounding an external evaluation of one of IFPRI's sister organizations, the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT). The evaluation panel noted that "evidence is still lacking that ICRISAT's sorghum breeding program has had significant impact in improving sorghum production in the African semi-arid tropical region." Other observers noted the lack of "ICRISAT varieties" in production in the region surrounding the ICRISAT facilities. For their part, ICRISAT managers argued that "a lot of these locally bred Indian varieties have ICRISAT blood in them" (Bangla 1998).⁸ While sorghum plants have genealogies, they don't carry bibliographies, and the contributions of breeders—like ICRISAT—of ancestral varieties may not be recognized.

The dispute over ICRISAT's contributions, or lack thereof, highlights an important issue for the CGIAR centers. One of the centers' primary functions is to facilitate the development of national agricultural research systems (NARS) in developing countries. These include institutes that conduct research specific to local conditions (involving, in the case of IFPRI, national or regional institutes for policy research and analysis). These institutions typically face budget constraints, are required to justify their existence, face external reviews, and have their own need to acquire formal or informal intellectual property rights over work in their respective fields. In some cases, a sensitive CGIAR center may better contribute to its long-term goals by defending its own claims to achievement less vigorously, allowing credit for innovations to be spread widely. But in so doing it accepts costs in terms of its own evaluation and budget review process.

We studied elsewhere the impacts on benefit attribution of different rules for weighting the contributions of different generations of breeders in the development of semi-dwarf wheat and rice varieties (Pardey et al. 1996). As part of the process, we corresponded and interacted with knowledgeable participants in U.S.-based breeding activities. Even in the context of our work, which was far from being an evaluation of their own breeding programs, there was great sensitivity to the sharing of credit: professionals at research agencies in the United States, who are likely to be at least as secure as their counterparts in less-developed countries, are anxious that their contributions (and those of their institutions) are recognized fully.

⁷ The overall publication and citation performance of an agency, however, may have subtle but significant implications of special importance in the case of policy research. It is not just the policy message, but the perceived veracity of the message that matters. Demonstrating that the published output of an agency passes professional muster signals the stature of an institute beyond that of the individual researcher.

⁸ There is credible evaluation evidence to back this claim. See Bantilan and Joshi (1996).

Certainly, publications and citations of publications are not the only indicators of research and analysis output, and any analysis of publication and citation patterns must be sensitive to the contexts in which papers are written, published, and cited. Nonetheless, careful observation of what is written and how it is used can assist in evaluating an organization's performance, particularly if the organization's goals are wider than the production of research results alone. This is our objective. We use IFPRI's publication record, and data on citations of reports and articles written by IFPRI staff and published in peer-reviewed publications, to gain information on how IFPRI performs its various functions. In particular, we are interested in IFPRI's performance of social-science research, its provision of policy research and analysis services to national governments and other clients, and its facilitation of improved food-policy capabilities, particularly within developing countries.

IFPRI has some unique features. But there are other institutions that perform, or might perform, some of IFPRI's functions. We collected similar data from five such organizations to help us understand how IFPRI performs each of its functions. None of these organizations by itself mimics IFPRI's structure or goals; indeed, no such organization exists. We cannot, nor do we wish to, make an invidious comparison between IFPRI and any other organization. Rather, the analysis of these other institutions helps us to highlight and evaluate IFPRI's performance, so we can better understand IFPRI as a performer of research, a provider of policy services, and a facilitator of capacity development in international food policy research and analysis.

3. INSTITUTIONAL CONTEXT

3.1 Research Inputs (IFPRI and the CGIAR)

Carrying through the theme of a research production function introduced above, this section gives a brief indication of IFPRI's expenditures on R&D (and other activities) and relates those to the overall spending patterns of the CGIAR. These expenditures are inputs to the research process. Other inputs are the personnel who do the work and the institutional context within which the research is done and disseminated. Policy research, like research more generally, involves lengthy and unpredictable lags, so the picture we provide of changes in IFPRI's resource base goes back to the institute's inception in the 1970s.⁹

IFPRI was incorporated in the District of Columbia in March 1975 and began operations in August of that year. Canada's International Development and Research Centre (IDRC) and the Ford and Rockefeller foundations provided initial funding. IFPRI operated as an international institute engaged in food policy research formally outside (but affiliated with) the CGIAR until 1980, when it became the twelfth center supported by the consultative group.¹⁰ At that time, IFPRI employed 18 principal research staff and had an annual expenditure of \$2.46 million. The institute organized its research around four themes: food trends analysis, food production policy and development strategies, food consumption and nutrition policy, and international trade and food security.

IFPRI grew over subsequent years. By 2000, it employed 56 principal researchers and 24 research analysts and assistants. It spent a total of \$21.6 million in 2000, provided by a group of 39 donors that included 23 institutions and donor agencies from developed countries, nine from developing countries, and seven international organizations. CGIAR spending grew too, at least in real terms, until the early 1990s, where after its total spending stalled, although IFPRI continued to grow, particularly in the past five years. Figure 1a plots real spending for IFPRI in 1994 U.S. dollars for the period 1976–2000. Figure 1b gives comparative expenditure figures for IFPRI and the CGIAR as a whole. While IFPRI spending grew, both in real terms and relative to that of the CGIAR, it remained a small part of the overall CGIAR effort (6.7 percent of total CGIAR spending in 2000). There was considerable additional investment in policy research (and other policy-related activities) by other

⁹ See Farrar (2000a) for an excellent history of the institution.

¹⁰ The founding chairperson of the CGIAR's Technical Advisory Committee, Sir John Crawford, also chaired IFPRI's initial board of trustees, a post he held until 1979. Farrar (2000a: 12) observes, "...[Crawford] played a strong role in shaping the fledgling institution."

Figure 1a—IFPRI total expenditures, 1976–2000

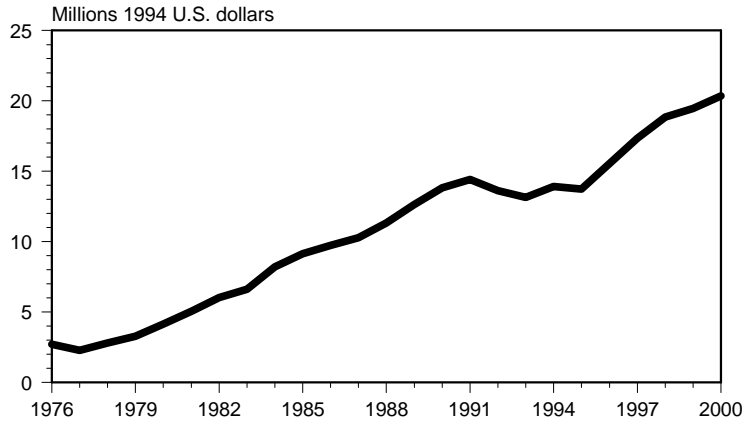


Figure 1b—IFPRI and CGIAR total expenditures, 1976–2000

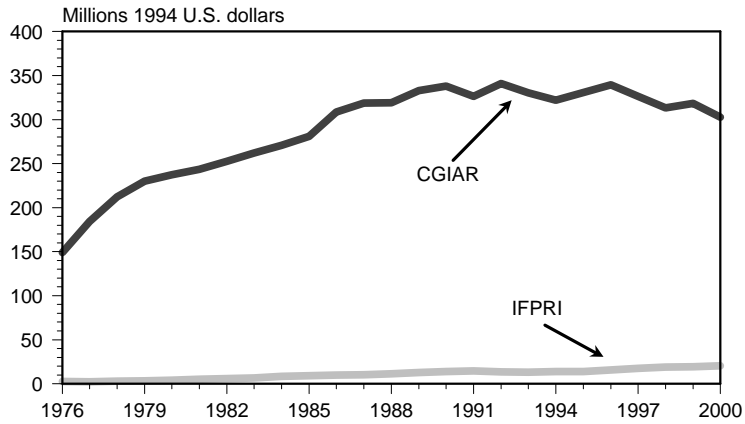
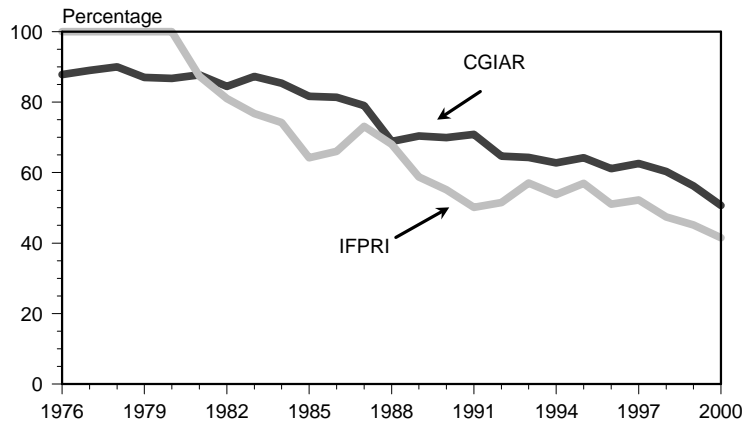


Figure 1c—Unrestricted as a share of total funding, 1976–2000



Source: IFPRI data: 1976–2000 Financial Statements and IFPRI Annual Reports; CG data: Financial reports of the CGIAR Secretariat.

Note: Nominal U.S. dollar series deflated to 1994 prices using the U.S. implicit GDP deflator from BEA (2001). See footnote 12 for additional discussion regarding Figure 1c.

CGIAR centers. In 2000, IFPRI accounted for about 27 percent of the reported total of \$47.3 million spent by the CGIAR on "improving policies."¹¹

Figure 1c shows the significant shifts in types of funding for IFPRI since 1976 along with comparative trends for the CGIAR. In 1981, unrestricted funds (whose deployment is left to the discretion of the recipient) at IFPRI and for the CGIAR as a whole represented 87 percent of total funding. In 2000, unrestricted funds accounted for only 42 percent of IFPRI's total funding and 51 percent for the CGIAR.¹²

Table 1 provides a perspective on the changing pattern of research personnel within IFPRI over the past several decades. The number of principal researchers ("research fellows" in IFPRI parlance) grew from 10 in 1978 to 39 in 1996, peaking at 46 in 1990.¹³ Declines in the number of research fellows in the early to mid-1990s were partly offset by an increased number of postdoctoral fellows and research analysts. Moreover, IFPRI has long maintained an active visiting-fellows program and engaged in various "off-site" modes of collaborative research, with a sizable number of senior researchers outposted to agencies in developing countries (in 2000, seven research fellows and two postdoctoral fellows).

3.2 Aspects of Comparison Agencies

To benchmark IFPRI's publication performance we sought and received assistance and data from five agencies similar to, but in some senses different from, IFPRI. The now closed Stanford University Food Research Institute (SFRI), like IFPRI, conducted considerable social science research, often oriented toward developing-country issues. Yet the organization was essentially academic in nature, performing

¹¹ The \$47.3 million figure was taken from Table 1 in CGIAR Secretariat (2000). It is not really clear what is included in the "improving policies" category of spending reported in this table. Centers are given no specific guidance on how to classify their activities (research or otherwise) and the classification used does not correspond to the international norms used for reporting science and technology indicators as described most recently, for example, in OECD (1994). Moreover, the categories in the table are not mutually exclusive, and the data only includes spending on the "agreed" research agenda (not total CG spending as reflected in the IFPRI figure used to calculate the share reported in the text).

¹² The percentage of "unrestricted funds" for IFPRI reported here represents total revenue minus restricted income (that is, income from grants and contracts earmarked for specific projects and research purposes) expressed as a percentage of total funding. Thus, the numerator of this percentage includes so-called "unrestricted grants" and contract funding, investment income, and a comparatively small amount of income from other sources.

¹³ Notes to Table 1 explain the count nature of these personnel data (as opposed to full-time-equivalent figures).

Table 1—IFPRI research staff by category, 1978–2000

Year	Principal researchers			Research support staff			Total IFPRI	Other ^b	
	Senior researchers ^a	Postdoc and Rockefeller fellows	Total	Research analysts	Research assistants	Total		Research fellow emeritus	Visiting researchers ^c
					(count)				
1978	10		18 ^d		10	10	28		8
1979	11		13 ^d		8	8	21		6
1980	18		18	1	9	10	28		8
1981	24	1	25		12	12	37		
1982	24	4	28		14	14	42		
1983	28	3	31		16	16	47		
1984	25	1	26	1	19	20	46		6
1985	29	3	32	4	20	24	56		22
1986	32	3	35	6	20	26	61	1	19
1987	32	2	34	5	22	27	61	1	14
1988	35	3	38	7	26	33	71	1	19
1989	42	5	47	6	25	31	78	2	13
1990	46	1	47	10	28	38	85	2	21
1991	40	3	43	19	17	36	79	3	29
1992	35	6	41	17	14	31	72	3	19
1993	32	4	36	21	11	32	68	3	19
1994	29	5	34	16	12	28	62	2	14
1995	30	7	37	19	7	26	63	2	22
1996	34	11	45	19	7	26	71	2	27
1997	39	16	55	19	8	27	82	2	32
1998	39	11	50	20	5	25	75	2	35
1999	43	9	52	21	9	30	82	2	34
2000	44	12	56	14	10	24	80	1	28

Source: Compiled by authors from staff listings in IFPRI Annual Reports and unpublished personnel files.

Note: These research personnel series are count data. The count data represent the total number of IFPRI staff in each category present at IFPRI during the course of a year, irrespective of the length of time spent at IFPRI. A full-time equivalent series would be a more appropriate measure for our purposes but data to enable the construction of such a series are not available.

^a Senior researchers include senior scientist, division directors, director general, head of the 2020 vision, head of the training and capacity strengthening program.

^b Excludes a "senior research advisor" who was employed for each of the years 1987-89.

^c Visiting researchers include only individuals who were resident in IFPRI for more than one month.

^d Total includes 8 "research associates" in 1978 and 2 in 1979.

less policy support services than IFPRI and having no formal mandate to support the development of policy research and analysis capabilities in developing countries.

CIMMYT and IRRI, as other members of the CGIAR, share similar overall goals with IFPRI, including orientation toward developing-country problems and an explicit objective of working with partners in less-developed countries. Yet CIMMYT and IRRI both focus on technology generation for specific commodities, while IFPRI is a generalist policy organization, not engaged in technology development as such. Moreover, the social science research conducted at these two centers is primarily an adjunct to their main crop-improvement missions. The focus of their social science research is thus more on technology design and evaluation, especially from a local (often farm-level) perspective, although some broader food and technology policy aspects are featured in the programs of both agencies.

The Australian Bureau of Agricultural and Resource Economics (ABARE), like IFPRI, does significant policy support work, drawing on in-house research capabilities to backstop the policy advice and assessments it provides. However, it is a developed-country organization that places little emphasis on developing-country issues, and it has no mandate to support developing-country capabilities.

From the developing world, the Bangladesh Institute of Development Studies (BIDS) is included. BIDS is not so much similar to IFPRI, but as a policy research and analysis organization in a developing country it represents the type of organization with which IFPRI works extensively. Also, under some configurations of international food policy research it (and similar institutes) might take up some of the roles now performed by IFPRI.

BIDS is an outgrowth two times removed of the Pakistan Institute of Development Economics. The Pakistani institute was created by the Government of Pakistan in 1957, and its headquarters was located in Dhaka when Bangladesh gained its independence in 1971. The institute then reconstituted itself as the Bangladesh Institute of Development Economics. In 1974, it was accorded a parliamentary charter and changed its name to the present one, reflecting a broadened agenda. BIDS is a publicly funded, autonomous research and training organization concerned with problems of development in Bangladesh. Its board of trustees consists primarily of public officials and research fellows and is chaired by the minister for planning. IFPRI's long-running and substantial involvement in Bangladesh dates back to its earliest days and continues at this writing. BIDS is a natural partner for IFPRI, providing competence on the ground that has enabled a breadth and weight of research that would have been impossible for IFPRI alone.

ABARE was founded in July 1945 as the Bureau of Agricultural Economics (BAE) within Australia's Ministry of Postwar Reconstruction (ABARE 1995). Its first director was Sir John Crawford, who, precisely three decades later, became the founding chairperson of IFPRI's board. ABARE's initial research focus was rural (largely broad-acre crop, livestock, and horticultural) sectors.

But the scope of research gradually expanded to incorporate the forest and wood products industries in the 1970s, and fisheries and other natural resources in the 1980s. In 1987, BAE merged with the Bureau of Resource Economics to become ABARE, with a significantly expanded emphasis on natural resources (including mineral and oil sectors as well as land and water conservation). ABARE's research aim is to provide economic assessments of public interests in policies that affect the sectors it studies and to supply policy advice to the Australian government (specifically Agriculture, Fisheries, and Forestry–Australia, the agency that now administers the bureau).

IRRI was established in 1960 and CIMMYT in 1966, but it took some time before the centers began programs of social science and economic research. IRRI led the way in May 1963, after numerous false starts because of recruiting difficulties (Chandler 1992). CIMMYT started social research in 1971, as its board felt such work was necessary to "...blunt criticism from outside the Center [especially regarding the perceived distributional consequences of the Green Revolution technologies], to investigate so-called 'second-generation' problems of the Green Revolution, and to help increase the pace of change in maize production" (CIMMYT 1992: 47). The social science and economic programs of both institutes grew gradually, but not without ups and downs. Both have historically been the largest social science research programs in the commodity centers of the CGIAR, although the programs generally accounted for less than 10 percent of the total spending of each institute.

SFRI was established in 1921, with the strong support of Herbert Hoover, building on his experience coordinating food relief in post-World War I Belgium and directing U.S. wheat production and distribution during that war. It was originally set up as a multidisciplinary research institute, directed by professorial staff in economics, biology, and nutrition. It employed permanent staff to produce often detailed information on individual U.S. commodity markets. A doctoral program developed fairly early, with students serving a research apprenticeship under the guidance of a faculty mentor. Later, that program became standardized, with required coursework and field examinations along the lines of social science doctoral programs in the United States. After the retirement of much of its founding staff, there was a radical change in program, toward agricultural aspects of development. Substantial long-term funding from the Ford Foundation supported this orientation into the 1970s, after which the institute received project funding from a number of sources, supplementing continuing income from its endowment. Throughout the period of this study, SFRI continued to be oriented mainly toward agricultural aspects of development. It increasingly acted as an academic department, training graduate students, although lacking an undergraduate program. It was perhaps hampered in these roles by its continuing interdisciplinary structure, which meant, for example, that noneconomist staff had voting power on such matters as employment and tenure decisions regarding economics faculty, or coursework and examination requirements for economics students. SFRI's problem orientation led it to publish volumes of studies from many disciplinary perspectives related to individual countries and commodities. While such studies may serve policymakers well, they often have less impact on individual disciplines than specialist work oriented specifically to progress within an academic discipline.

SFRI's policy orientation may have contributed to its downfall in the mid-1990s. A review of the program, directed by members of traditional disciplinary departments, found a lack of publication in major scholarly journals, at least relative to the institute's size. Furthermore, while the institute was actually making money from a one-year master of arts program oriented in part to mid-career government officials in developing countries, such programs were far from the traditions and scholarly pursuits of the disciplinary programs, especially the elite program in Stanford's economics department. The last year of the institute as a full-scale research organization was 1995, when it employed 13 faculty, five support staff, and 15 funded Ph.D. students as research assistants.

Table 2 presents summary statistics of these five agencies, along with comparable data for IFPRI, to help calibrate the discussion in the rest of the paper.

Table 2—Research personnel and expenditures of IFPRI and benchmark institutes

Institution		Year established	Research personnel		Expenditures	
Name	Acronym		Senior	Support	Total	Per senior researcher
			(count)		(US\$ in millions)	(US\$ in thousands)
International Food Research Policy Institute ^a	IFPRI	1975	49	25	16.20	219
Australian Bureau of Agricultural and Resource Economics ^b	ABARE	1945	152	55	16.30	79
Bangladesh Institute of Development Studies ^c	BIDS	1971	40	13	0.58	11
Centro Internacional de Mejoramiento de Maíz y Trigo (economics program) ^d	CIMMYT	1971 ^g	9	9	1.92	107
International Rice Research Institute (social science program) ^e	IRRI	1963 ^g	9	28	1.55	42
Stanford University Food Research Institute ^f	SFRI	1921	13	15	1.33	102

^a Personnel data for 1998 from Table 1. Expenditure data for 1998.

^b Personnel and expenditure data for 1997.

^c Personnel and expenditure data for 1994 from Reza and Yunns (1995).

^d Expenditure data for budget year 1998 from Smale (personal communication).

^e Personnel and expenditure data for 1997 from IRRI's social science program.

^f Personnel and expenditure data for 1995, last year of full operation of the institute. Research support personnel includes funded PhD students.

^g Establishment dates for economics and social science programs respectively.

4. METRICS OF POLICY KNOWLEDGE

The institutions included in this study produce a wide range of written and published material, some intended mainly for research sponsors or other specific clientele. For policy-oriented work, such documents are often the formal embodiment of the supported research. Other publications, such as scholarly articles, books, and monographs, also serve the traditional functions of scholarly publications in other fields, such as the transmission of knowledge to other researchers, establishment of claims of intellectual priority, and so on. Still others, particularly working papers and papers presented at conferences and meetings, may be works in progress, although such less formal documents may be a central means to communicate knowledge and ideas among researchers.

The institutions in the study provided us with lists of their published or circulated written output. We grouped this output into six categories—journal articles, books and monographs, collections, technical reports, working papers, and others—using the following criteria:

- **Journal articles** are publications in scholarly, peer-reviewed journals. IFPRI staff publish in a wide range of journals. These include general agricultural and development economics periodicals such as the *American Journal of Agricultural Economics* and the *Journal of Development Economics*, a large number of regional journals, including many published in developing countries such as the *Pakistan Development Review* and the *Philippine Economic Journal*, and highly specialized journals often devoted to specific commodities, classes of commodities, or natural resources. In all, we identified 134 journals in the publication lists obtained from the Institute for Scientific Information (ISI). These are listed in Appendix Table 2.
- **Books and monographs** are bound volumes by a single author or group of authors, as distinct from an edited collection of contributions from a number of authors. Many books and monographs are works at the same stage of development, originality, and overall quality as journal articles, although they may also summarize and recap elements that may have appeared separately in several such articles.
- **Collections** are distinguished from journal articles in that they only appear once, and typically carry the names of an editor and publisher. Contributions to such collections are also "finished" works, like journal articles and books and monographs, and have generally passed a formal review process. Requirements for an "inventive step" are often less for these sorts of publications, and they may include a high proportion of work that, while useful and successful, offers no particular service to other researchers.

- **Technical reports** are publications under the imprint of a research organization. These typically pass an administrative review process, including in some cases external review. Typically a technical report contains the collected results of a study. Some technical reports may eventually appear as scholarly publications.
- **Working papers** are reports circulated prior to formal external peer review. These include many works intended for eventual publication, particularly as journal articles or as contributions to collections. But they may also serve simply to share ideas and never appear in the form of reviewed publications.
- **Other** includes outlets that vary substantially from institution to institution, often reflecting the organization's mission. For example, for ABARE it includes a large number of annual compilations and situation and outlook reports reflecting ABARE's role as a provider of nonresearch services. For IFPRI, it comprises a variety of series for the delivery of policy information to nonspecialist users, often in developing-country governments. Similar in some ways to extension (although serving officials rather than farmers), series like the various "2020 Vision" publications are included in this category.

4.1 Overview of IFPRI's Written Output

IFPRI staff produce a wide variety of written works. A primary outlet for publication has been the institute's Research Report series, which consists of substantial, externally peer-reviewed documents bringing together the technical details of IFPRI projects. Research Reports function in part as archives for other specialist researchers working in related fields. They also serve as a medium to communicate results to policy clientele, although given the technical sophistication and detail of the series (which is often comparable to that in a scholarly journal), this presupposes a high degree of technical expertise on the part of such clientele. Each research report is the subject of a separately distributed abstract intended to inform a broader audience and advertise both the report and its conclusions.

In addition to the Research Report series, IFPRI staff contribute chapters to books, particularly to the volumes published by IFPRI in collaboration with Johns Hopkins University Press (JHUP). These books typically include authors from outside the institute and bring together studies that deal with broadly similar topics. By serving other researchers, the JHUP books (and other publications in "collections") are a form of scholarly publication whose primary intent is not simply to report the research at hand and communicate results to sponsors, but rather, to contribute to progress in the field as a whole.

Such scholarly intent is the explicit function of the third major publication outlet for IFPRI researchers, the professional journal, which typically requires methodological innovation or policy or other impact of professional interest. In addition to these research publications, IFPRI staff circulate a

large number of working papers and contribute to a more diffuse outlet structure for communication to nonspecialist audiences. This includes formal documents, such as the IFPRI Food Policy Statements or its 2020 Vision series reports, as well as reports to project sponsors and participants, letters and memoranda, and so on, which are in general not countable.

Outlets for research outputs. Table 3 lists IFPRI staff publications in various outlets. From the standpoint of the individual IFPRI author, there are two reasons why the scholarly journal may prove more attractive than inclusion in a JHUP book or IFPRI Research Report. First, the circulation of a journal may be substantially higher. More recent IFPRI Research Reports have an average print run of about 3,000 and an up-front circulation of about 1,300, while the JHUP series have print runs in the range of 1,000 to 2,000. By comparison, the circulation of the *American Journal of Agricultural Economics (AJAE)* is about 4,000, with more specialized journals generally having a lower circulation than the *AJAE*. Authors often write articles in the hope of publication in a widely circulated (and typically more heavily cited) journal, then publish elsewhere if necessary. Second, both the Research Report and the JHUP series entail considerable editorial responsibilities for the IFPRI author, while for journal articles the author's work essentially ends when the article is accepted for publication. The JHUP series is almost a sequence of one-number journals, with IFPRI staff acting as editor. While this is a valuable function and it carries professional recognition, as a means of publishing research results the editorial duties are an additional cost. IFPRI research staff also edit, or coedit special issues of journals on particular topics with articles contributed by IFPRI staff and others.

The role of the IFPRI Research Report series as the flagship research outlet for the institute throughout the 1980s is clear. More than six reports appeared in most of the years from 1979 to 1991. Output of these documents diminished during the 1990s, with only two reports appearing in 1996, one in 1997, and two in 1998 and 1999. The number increased to five in 2000 and nine in 2001. The apparent structural shift in the use of the Research Report series may simply be due to fluctuations in the research cycle, or, alternatively, IFPRI staff may be choosing to publish less of their work through the Research Report series.

The data describing the use by IFPRI staff of other sorts of publication outlets suggests this latter conclusion. The other primary publication outlets for IFPRI researchers are the JHUP series and articles in scholarly journals. Both use formal peer review and are approximately equal in terms of the quality required. On the other hand, their target audiences vary considerably. JHUP books more closely target practitioners and policymakers in IFPRI's target areas, while scholarly journals typically serve a broader readership of professional researchers. During the 1990s, when publication of Research Reports dropped sharply, the publication of JHUP books remained steady, while publication of journal articles grew substantially. There is not, therefore, evidence of a decrease in research output. Indeed, there is an increase in research output as seen by the professional research community as a whole.

Table 3—IFPRI written output by type, 1979–2000

Year	Technical reports ^a		Books and monographs ^b		Journal articles ^c		Working papers ^d			Contributions to collections ^e		Other ^f		
	Research reports	Other	JHUP	Other	Peer reviewed	Other	2020	IFPRI	Other	Discussion papers	In proceedings	Other	General	2020
Annual Output														
	(count)													
1979	9	0	–	2	7	0	–	–	2	–	0	1	1	–
1980	8	2	–	0	3	2	–	–	0	–	1	5	0	–
1981	8	1	–	2	5	0	–	–	2	–	0	6	0	–
1982	7	1	–	2	12	5	–	6	0	–	0	13	3	–
1983	6	2	–	2	10	3	–	2	2	–	0	9	1	–
1984	5	5	–	4	23	7	–	0	3	–	3	3	0	–
1985	4	2	1	1	19	4	–	3	4	–	2	7	4	–
1986	6	5	1	1	25	2	–	2	3	–	6	9	3	–
1987	7	3	1	1	32	2	–	1	2	–	4	16	7	–
1988	7	4	2	1	41	12	–	4	2	–	6	16	6	–
1989	7	5	2	6	24	6	–	5	7	–	3	25	5	–
1990	6	5	0	5	28	3	–	1	2	–	5	18	3	–
1991	5	3	1	2	22	2	–	11	3	–	0	11	3	–
1992	3	2	0	0	51	3	–	9	4	–	3	12	7	–
1993	4	2	1	2	28	2	–	5	2	–	2	27	7	–
1994	4	1	1	1	41	2	1	2	0	13	3	8	14	8
1995	3	1	1	0	28	0	8	4	0	28	1	2	6	25
1996	2	0	0	2	47	5	9	2	0	37	2	15	5	12
1997	1	3	2	1	54	4	4	2	4	56	2	16	10	6
1998	2	6	1	4	57	9	4	0	7	39	0	26	8	11
1999	2	8	2	1	60	3	3	0	5	75	9	17	18	14
2000	5	4	2	8	54	12	4	0	1	53	7	28	25	18
Output by subperiod														
1979–1989	74	30	7	22	201	43	0	23	27	0	25	110	30	0
1990–2000	37	35	11	26	470	45	33	36	28	301	34	180	106	0
1979–2000	111	65	18	48	671	88	33	59	55	301	59	290	136	94

Source: Compiled by authors. Hand tallied from various unpublished IFPRI documents and IFPRI annual reports.

Note: Every effort was made to avoid double counting publications when compiling the listings made available to us. Time and resources limited us to a hand tallying exercise. A preferred method would have been to compile a database of the publications.

^a Includes IFPRI research reports and various other reports of an obvious technical nature (principally publications in the IFPRI special report series).

^b JHUP refers to books published in the IFPRI-Johns Hopkins University Press series. Other refers to books published elsewhere.

^c Includes articles published in refereed journals by IFPRI staff and those acknowledging IFPRI affiliation in the publication.

^d Includes working papers published as part of the 2020 Vision program, as well as IFPRI working papers and Impact Assessment papers. This compilation excludes reports to donors.

^e Includes papers published in edited volumes.

^f Includes papers that have more of an outreach orientation. Other publications are generally Food Policy reports, Food Policy Statements, IFPRI Lecture series, technical guides, microcomputers in policy research. 2020 Vision material includes 2020 briefs, synthesis reports, *News and Views*, and newsletters.

Given the importance of the journal article to academics in agricultural and development economics and in other social science subfields, the increase in journal-article output is likely seen as a strength. Furthermore, active participation in the journal literature may well make collaboration between IFPRI staff and developed-country academic researchers more attractive to the academic collaborator. On the other hand, if IFPRI researchers give more emphasis to the requirements of journal publication, they may be steered away from other goals, such as communicating policy results to the organization's primary policy clientele.

Of the other IFPRI publication outlets, there is less to say. IFPRI staff publish in a variety of technical report series besides the IFPRI Research Report series. Many of these have functions similar to the research reports and contain integrated reports of a project. Working papers may be thought of as works preliminary to more formal publications, such as chapters in JHUP books or articles in journals. In recent years, IFPRI has de-emphasized its Working Paper series in favor of divisional discussion papers, which were initiated as a series in 1994. Forty six divisional discussion papers were published in 2000, and, as of November 2001, 16 of these had been published or accepted for publication in referred journals. Table 3 lists 2020 Vision working papers separately, as these are policy-oriented discussion papers intended to move forward policy application and are not preliminary versions of research-reporting articles. Under the "other" category, which also contains mostly research-summarizing or policy-discussing publications, we include other 2020 Vision materials. These outputs are perhaps better thought of as "extension and outreach". We have no information about the large flow of IFPRI research in the form of "deliverables" provided to the donors that support projects. These products meet the direct needs of the donors and other participants, and often—though not always—lead to later publication of results.

Table 3 provides evidence of considerable change in IFPRI's publication patterns, involving a de-emphasis of the Research Report series and of other technical reports, with increased output of shorter pieces, contributions to collections, and journal articles. Over half the journal articles published by IFPRI staff since 1979 appeared in the last seven years of our series (1994–2000); more than half of the Research Reports appeared in the first nine years (1979–87). At the same time, since 1994, there has been a substantial increase in the output of the Food Policy Statements and the 2020 Vision materials, whose function is more information diffusion and outreach than to record research results. Nearly three-quarters of IFPRI's output in these categories appeared after 1994. Yet there are tradeoffs, with increases in the latter two categories (shorter descriptions of research results and information and outreach documents) coinciding with a decreased output of comprehensive and integrated reports of research results.

Our emphasis here is on peer-reviewed reports of research. The use of peer-reviewed media offers some initial evaluation by experts as to the correctness of procedures and conclusions. IFPRI's sponsorship of peer-reviewed outlets, through the Research Report and JHUP series, helps insure that the use of external peer review does not unduly bias IFPRI research in favor of the professionally

interesting and away from the policy-relevant. Nonetheless, both these outlets impose costs on authors, which may outweigh their benefits.

Diffusion of nonspecialist information. Researchers and academics may underemphasize the diffusion and practical application of the fruits of their labors. Yet ultimately, the real test of any social investment in research is the extent to which it contributes to the way people live, which in some social sciences involves policy application. Those who make policy are seldom professional researchers. The ability to communicate research results outside the research community is, therefore, vital to the ultimate success of much policy research. This nonspecialist communication function is certainly well recognized in IFPRI, as demonstrated by the significant resources devoted to it and by the prominence of the 2020 Vision publications and other policy-directed titles (the last three columns of Table 3).

In addition to the formal documentary transfer of policy knowledge through such channels, there is a substantial informal flow, both through the policy gray literature and through face-to-face collaborations, typically taking place within client countries. Two cases illustrate these mechanisms. An early project to study food subsidies in Egypt relied on formal documentary channels to transfer policy knowledge, while a more recent project to provide research and technical assistance in Bangladesh used face-to-face interactions and extensive informal written communication.¹⁴

4.2 Publication Performance of Comparison Organizations

It is difficult to directly compare the published outputs of different research organizations, given their different sizes, missions, and management styles, as well as differences in the formats of their publication lists. Indeed, indicators-based reports traditionally bemoan the lack of generally accepted standards for the collection and diffusion of information. In the science indicators domain this should usually be accompanied by a laudatory mention of the OECD's Frascati Manual, which established international standards for the collection of research expenditure and personnel data and later was extended to various measures of "output" (OECD 1994). The development of institutional publication lists would benefit from such standards, as we learned to our chagrin in the construction of publication lists for the several institutions in the study. It would be useful to have a few standard facts attached to each record in a publication database, including whether there was formal internal or external peer review, the number of pages of text and of tabular information, and the number of internal and external authors. Nonetheless, the raw publication data do help us to describe the institutions in the study. Table 4 presents these data.

First, most of the institutions use journal articles and, except for IRRI, technical reports as their primary means of publication. ABARE, as the policy-analysis arm of a sizeable government, produces

¹⁴ Farrar (2000b) provides more detail on the Egypt work, and Chowdhury and Haggblade (2001) describe the food policy change processes in Bangladesh during the post-1970 period.

a large number of regular information documents, many of which have little research content, but provide important information to government and other clienteles. In developing our list of ABARE publications, we placed ABARE's in-house quarterly (now called *Australian Commodities* following several title changes) in the "other" category, as it fit better with the *Situation and Outlook* reports and other outreach and extension-style publications than with articles in scholarly publications. Indeed, the large number in the "other" column for ABARE reflects its role as a provider and distributor of data and other systematic information to the Australian government and the farm/resource sectors. The category includes annual reports on prices and other data, situation and outlook reports, and a variety of other reports and analyses.

To develop the publication data for BIDS, we combined data from a publication list that ran through 1987, with a list of publications by researchers affiliated with the institute. The latter list includes a great number of publications in *Bangladesh Development Studies*, a journal published by BIDS but open to authors regardless of institutional affiliation. Submissions to the journal are externally reviewed so we included BIDS articles in that journal in the journal article category. Articles in *Bangladesh Development Studies* accounted for 129 of the 203 journal articles reported. There was also a large number of publications in the *Bangladesh Journal of Political Economy*, as well as in journals published elsewhere. Further, there is a Bangla-language research annual, which we included in "other."

Because the main function of BIDS is to apply policy research to the problems facing Bangladesh, we hesitated to include it in our study, since it does not aim to provide research results to the rest of the scholarly community and must emphasize its domestic policy constituency. Nonetheless, the tension between "service to policy constituency" and "participation in scholarly community" that exists for IFPRI exists for BIDS as well, in an even sharper form, since IFPRI does play a role in directing developed-country research interest toward the issues and challenges facing the developing world. This role, which BIDS neither performs nor is intended to perform, gives IFPRI its comparative advantage in some areas: not as a developed-country academic research performer, not as a substitute for policy research and analysis in developing countries, but as a link between the two sorts of institutions. IFPRI cannot supply the large volume of Bangla-language reports that are needed by the government of Bangladesh. However, IFPRI staff can, and do, work closely with BIDS staff, as well as with researchers elsewhere, to provide a link between the Bangladesh policy research community and their professional colleagues elsewhere.

In many ways SFRI and the three CGIAR centers included in our study (CIMMYT, IFPRI, and IRRI) have the most in common. All employ (or have employed) substantial staffs of doctorate-holding economists, sociologists, and other social scientists, producing work that is regularly published in leading journals. All have concentrations in food policy, particularly with respect to less-developed countries. We are unconvinced by the low number of technical reports reported by IRRI; IRRI provided us with publication lists drawn from the curriculum vitae of their current staff, plus lists of journal publications for the history of IRRI's social sciences division. Many technical reports,

especially those bearing the names of former staff members, are likely missing. This is a consequence of publication lists being based on individuals rather than the organization. At the other end of the spectrum is the publication list provided by CIMMYT, which included large numbers of publications by authors now affiliated with CIMMYT, written prior to that affiliation, including some that may be included in the publication lists for IFPRI and IRRI.

For IFPRI and IRRI, this is a problem arising from an information system designed for one use (documenting the research expertise of staff) being used for another (documenting the research output of past projects). We are conscious, of course, of the tradeoffs between documenting and performing research. While it may be possible to identify many of the entries in the CIMMYT list that relate to authors' non-CIMMYT work, it is not generally possible to identify IRRI-related work by authors no longer at IRRI. In a well-documented world, each completed project would generate a list of publications written under it.

The lists for SFRI, CIMMYT, and IFPRI appear to be more complete. Although CIMMYT has produced a very large number of technical reports, we cannot tell how many of these are policy-relevant; some are certainly information series, often with agronomic content and no aim of influencing policy. Again, formal methods for reporting different sorts of publications would be useful here. The relatively modest number of journal articles reported by SFRI was somewhat of a surprise.¹⁵ The organization employed prominent scholars and encouraged journal publication. We learned that in fact a controversial literature-based evaluation of SFRI contributed to Stanford University's decision to close SFRI (Williams 1998).

While a close (and, probably, costly) examination of the written output of the organization is impossible in the context of the present evaluation, it appears that an appropriate mix of media is being used by IFPRI staff, although some may have concerns about the apparent depreciation of the Research Report series in favor of publication in scholarly journals. This need not imply a bias in the research that is performed toward the journal-publishable and away from the policy-applicable. It may simply be part of the changing funding mix, in which the assembly of integrated summary reports receives less support.

¹⁵ The smaller publication totals partly reflect SFRI's smaller size (especially compared with ABARE and IFPRI); partly it reflects the shorter period for which journal counts could be compiled for the institute (1979–91). A rough normalization of the data can be achieved by combining the personnel data in Table 2 with the journal-count totals in Table 4. On this basis, SFRI published 0.81 journal articles per senior researcher per year, IFPRI 0.70 articles, CIMMYT 0.61 articles, IRRI 0.52 articles, and ABARE 0.06 articles.

Table 4—Written output, by institution and type

Institution	Time period	Journal articles	Books and monographs	Technical reports	Working papers	Other publications
(count)						
Time period provided by each institution						
ABARE ^a	1979–97	175	7	159	46	1,003
BIDS ^b	1973–97	209	25	162	20	102
CIMMYT ^c	1968–97	165	13	105	109	232
IRRI	1976–97	103	15	15	6	14
SFRI ^e	1970–91	74	19	102	na	38
IFPRI	1979–2000	759	66	176	448	579
Standardized time period						
ABARE	1979–96	175	7	155	46	987
BIDS	1979–96	187	23	162 ^d	20	102
CIMMYT	1979–96	160	12	100	106	224
IRRI	1979–96	89	14	15	6	14
SFRI ^e	1979–91	73	18	186	na	na
IFPRI	1979–96	244	29	104	50	165

Source: Compiled by authors. Hand tallied from publication lists provided by the respective institutions.

Note: Where papers and chapters published in edited volumes and proceedings were listed, they are included in "other publications." Policy summaries, pamphlets, brochures, and other outreach-oriented documents, when available, are also included in "other publications."

^a Articles published in the in-house *Situation and Outlook* reports and Price Index tabulations are included in "other publications." Submissions to inquiries, keynote addresses, and closing addresses are excluded.

^b Publications in *Bangladesh Unnayan Samikkha* are included in "other publications."

^c Conferences and workshops provided by CIMMYT are not included unless they appeared in published proceedings. Technical reports include the *World Wheat Facts and Trends* series. In addition, a substantial number of entries are for CIMMYT (affiliated authors written prior to their affiliation with CIMMYT).

^d The number of technical reports includes a few undated studies that may have been published prior to 1979.

^e Counts of journal articles, books and monographs, and other publications for 1985-91 period only.

5. FLOWS OF POLICY KNOWLEDGE

The previous section considered the published output of staff at IFPRI and the comparison institutions, as reported by those institutions. These data provide valuable information about the sorts of work performed and help to illustrate the way these institutions fulfill their various mandates. However, a key question that cannot be addressed by simple publication counts is how the written output is used. We are concerned, in particular, with flows of knowledge, especially between developed-country institutions, including IFPRI, and other policy institutions, particularly in developing countries. In this sense, IFPRI is a hybrid organization. Sometimes it acts as a member of its surrounding research community, with especially close ties to other research groups based in the United States and developed countries. At other times it acts as a direct provider of research and analysis services to developing-country governments and to other agencies involved in development issues, such as donors and nongovernmental organizations. In addition, IFPRI, like the other internationally oriented organizations in the study (SFRI, CIMMYT, and IRRI), collaborates with agencies providing direct research and analysis services. In this sense, IFPRI may serve a mediating function, helping to pass policy knowledge and policy problems back and forth between developing-country clientele and the research community.

Some information about knowledge flows may come from interviews with government officials and representatives of other client groups. Indeed, such interviews are a feature of this and other evaluation exercises.¹⁶ However, such techniques are useful only to the extent that one can identify client groups (and appropriate representatives). This is straightforward for some users of IFPRI services. However, IFPRI (and other performers of policy research on international and development issues) serves a variety of clientele. These include not only government policymakers, but also the policy-research community itself, with an emphasis on policy researchers and policy analysts in the developing countries themselves. It is infeasible to sample all of these clientele through surveys or other means. Other information sources on the uses of policy research and analysis are necessary.

This section uses two sources of information on flows of policy knowledge. First are coauthorship patterns. Collaboration on a research project involves immediate and detailed communication of information. While data on collaborative funding and performance of research would be useful, it is not always accessible. However, collaborative research typically results in the publication of works that list authors from the various institutions. We use data on the institutional affiliations of authors of IFPRI research reports, chapters in JHUP books, and articles published in the journals in the ISI databases, to describe collaborative activity. A second set of information on flows of

¹⁶ For example, IFPRI commissioned a readership survey of its published 2020 Vision materials, and the results of that survey were reported elsewhere (The Beresford Group 1997).

policy knowledge is found in the bibliographies and reference lists of policy-related documents. While citation practices vary considerably according to discipline, type of document, institutional affiliation of author, and so on, the practice of citing work remains widespread, particularly in scholarly publications. The appearance of a citation is direct evidence of use of the cited literature. While the citation may appear because the citing author wishes to point out an error, it is far more common for the citation to acknowledge intellectual debt to prior work, denote the domain of the citing (and cited) work, or otherwise recognize use of the previously published work.

There is a temptation to use citations as an indicator of quality. Certainly the publications cited most are likely to be highly influential. While we do not resist this temptation too strenuously, we are above all concerned with the citation simply as an indicator of use—an indicator, moreover, that carries some information about the location of the user and can provide information about the international policy and analysis network in which IFPRI and the other institutions operate. One evaluates, in fact, not simply the institution generating the new policy knowledge, but also how well it fits into its environment.

Before turning to the analysis of the actual flows of data, we introduce the databases used for this section's discussion of journal article coauthorship and the analysis of citation patterns. These are the ISI's Science Citations Index (SCI) and Social Science Citations Index (SSCI), which contain data from title pages and bibliographies of articles, reviews, and notes published by major scholarly journals in the natural and social sciences.

5.1 The Journal Article Databases

The first step in the analysis was the construction of the set of publications in the database that was authored by IFPRI (or comparison-institution) staff. This involved primarily a search of the ISI databases, conducted by a subcontractor, CHI Research, looking for *institutional addresses* of authors that correspond to the name or abbreviation of the target institutions. A set of name variants was developed. For example, for IFPRI the following names were used in the search: *International Food Policy Research Institute, IFPRI, Inter* Food Pol* Inst*, Intl. Food Pol* Rs* Ins**. The database records for these articles were retrieved and tabulated. A brief analysis of this publication set is reported below. Since that set's primary purpose in this report is to serve as the basis for an analysis of the journal literature that cites the work of authors affiliated with the target institutions, this set is called the **cited-article set** or **cited literature**.

The institutional address is a key element of the ISI database records. When an article is recorded in the *SCI* or *SSCI*, title-page information on the authors is recorded. In general this identifies the institution(s) where the author(s) work. Title-page information reflects the author affiliation(s) when the article is accepted for final publication, which may or may not be the same as when the reported work was actually completed. Thus, a new IFPRI researcher (for example) may list the IFPRI affiliation for work that was completed prior to the researcher's arrival at IFPRI. By the same token,

some work conducted at IFPRI may be reported in articles listing another organization, if the article is accepted for publication after the author leaves IFPRI. To some extent the incorrect attributions associated with new staff members is balanced by uncounted articles by departing authors. We found that overall the cited-article sets were of similar size to the journal article sets reported to us by the various institutions, so misattribution of authorship is an unavoidable but not critical inconvenience.

Against this misattribution may be set a significant advantage of the machine-generated institutional affiliation data: it enables us to identify and analyze coauthorship patterns. The institutional affiliation fields include all institutions listed by any of the authors. Collaboration among researchers from different institutions (and particularly from different countries) is the most direct form of information, with policy ideas, problems, and solutions exchanged seamlessly among authors. Of course, the flow of information is not one-way, as we might understand it to be in the case of citations to literature. Collaborations generally enrich all parties involved.

In addition to information on institutional affiliation of authors, each record in the cited-literature set contains information about the number of authors. We present this as well, noting that it may convey some specifics about how the institution's work is actually carried out, although its use as an instrument of evaluation is limited.

Each record further identifies the journal in which the publication appeared. The journals covered by ISI are grouped into the *SCI* and *SSCI* based on ISI's judgment of the journal's disciplinary emphasis. Thus, general economics journals, including those emphasizing development economics, are carried in the *SSCI*, along with journals in anthropology, political science, public policy, sociology, and so on. Agricultural sciences, including agronomy, crop sciences, veterinary medicine, and so forth, are carried in the *SCI*. Agricultural economics falls neatly between the two stools, as both a social science and an agricultural science. It is therefore carried in both indices. CHI Research used a journal-name-to-(sub)discipline concordance to group articles into fields of science, based on the journal in which each article appeared.

The journal identification was also used to resolve another problem: that of identification of social science and policy research and analysis articles from CIMMYT and IRRI. Both of these organizations have substantial crop-research programs, with large numbers of publications unrelated to the social science and policy fields that are the focus of this study. The institutional-affiliation field does not distinguish between, for example, the economics program at CIMMYT and the wheat or maize programs. Thus, a simple search for CIMMYT (and its variants) returned a very large number of publications completely unrelated to the economics program. To correct for this, a list was assembled of all journals in which authors affiliated with BIDS, IFPRI, and SFRI published. We assumed that all publications found in the *SSCI* were in fact from the social sciences programs at CIMMYT and IRRI and included those in the cited-literature set. Next, we retrieved the records of all *SCI* journals that had published work by authors affiliated with BIDS, IFPRI, or SFRI. This list was then checked manually. *Science* magazine, as well as various technical journals in agronomy and crop sciences, were included

in this set of journals, and carried economics and policy-related articles as well as those outside the boundaries of the social science programs. In future bibliographic analysis, it might be appropriate to ask both social science and nonsocial science researchers at these institutions to review the included and excluded titles.

The cited-article set was then used by CHI Research to construct a **citing article set**. Each article in the ISI system carries a unique identification code. When bibliographies are entered into the system the code for each cited article is attached to the record for the citing article. Given a list of codes for papers authored by IFPRI or other target-institution staff, ISI can retrieve records for all articles in the ISI databases that cite those papers. This citing-literature dataset was then analyzed, using, in particular, information from the institutional-affiliation field, the publication year, and the link to the cited-literature set.

This approach has two important limitations. The method we used to construct the cited-article set means publications in outlets not covered by ISI (which includes many journals from developing countries, books, and monographs) are excluded from the analysis.¹⁷ Moreover, while the *SCI* contains all the citations in the covered citing papers, if a paper is in a publication that is not in an *SCI* covered journal, then the citations to it captured by *SCI* will be less complete than if it were in a *SCI* journal since there is a tendency for disproportionate journal self-citation within any journal. Citations to many journals produced in less-developed countries that are not covered by *SCI* (and likewise to books and monographs) are likely to reflect this self-citation bias. For both these reasons, unreviewed publications are missed, at both ends. If a governmental use of IFPRI research is recognized by a citation in a ministerial document, for example, that citation will not be picked up. Thus, while a citation-based analysis may be quite useful, particularly for evaluating contributions to further scholarly policy research and analysis, other techniques are needed for the evaluation of other elements of the institute's program.

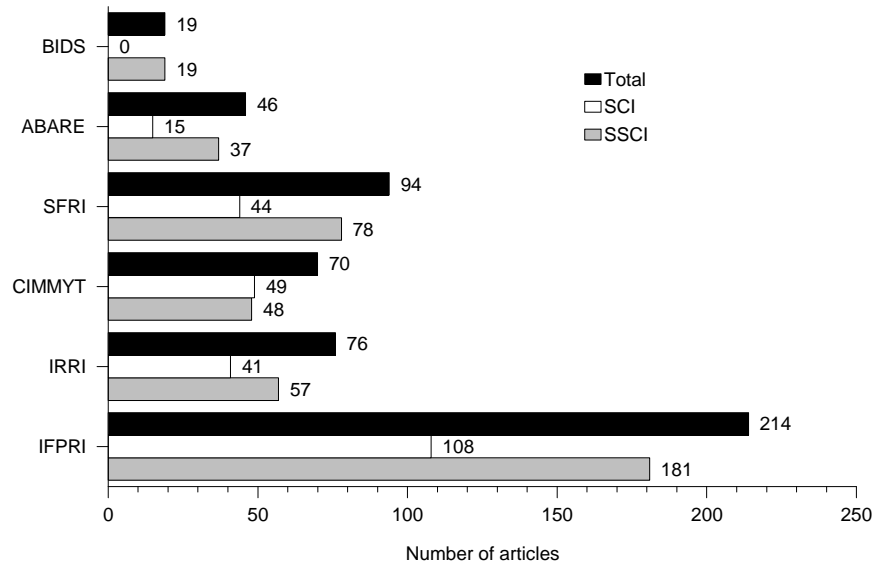
5.2 Journal Article Counts

Our search of the ISI databases recovered 453 articles between 1980 and 1996 listing authors from at least one of the six target institutions. Most articles were in *SSCI* journals, including the journals that appear in both sets. Figure 2 shows the number of articles by authors from each institution. Note that some articles have authors from two or more of the target institutions. If an article has one or more authors from an institution, it appears in the institutional list once. There is therefore no double-counting in computing the number of articles from each institution. However, one cannot derive the total number

¹⁷ One way to skirt this problem is to construct the cited-article set by hand tallying publication lists provided by the respective institutes. However, this method would typically introduce other discrepancies. Publication records are generally less than ideal as we discovered and describe in this report, so while comparing institutions based on the ISI sets is incomplete, it is not affected by variations in institutional bookkeeping.

of articles by summing across the institutional totals. Section 5.3 discusses institutional coauthorship in greater detail.

Figure 2—Number of SCI and SSCI journal articles, by institution and journal set



Source: CHI Research, from Institute of Scientific Information (January 1998).

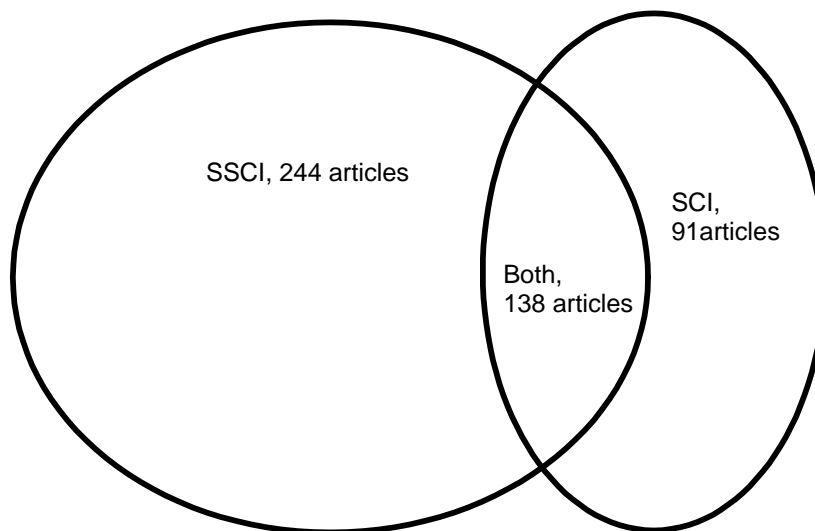
The data provided by the various institutions—discussed in section 5.3—indicates that of the six institutions in the study, IFPRI staff produced the largest number of journal articles (269). The ISI databases yielded 214 journal articles listing IFPRI as at least one author's affiliation. IRRI and CIMMYT were the two next largest journal-article producers in the ISI-extracted lists. However, the ISI publication lists are significantly shorter than the institution-provided lists. There are three likely reasons for this difference. First, as noted above, some discrepancies may be due to articles being published after the authors end their employment at the studied institution. Second, articles may be published in journals not covered by ISI. Third, our procedure, described in section 5.1, for separating social science publications from the larger body of articles in the biological and production sciences at these institutions probably excluded some articles by the social science staff. In a study where these institutes' programs are the focus of analysis, additional procedures, such as allowing individual authors to check a list of proposed-for-exclusion articles, would correct at least this third source of discrepancy.

SFRI was the next largest source of journal articles in both the ISI and institution-provided lists. SFRI publication lists contained 74 journal articles, while the ISI-extracted list counted 88. There was thus some difficulty in identifying SFRI publications, as some articles simply list "Stanford University" as the institutional address. The problem, however, is not severe: we looked up all Stanford University articles in the *American Journal of Agricultural Economics* and found 15 articles; 12 were in the

dataset extracted using the SFRI search strategy. We then examined the author names for the other three and found that they worked in the department of economics and so were unaffiliated with SFRI. Nonetheless, the possibility remains that some SFRI affiliates might have listed another Stanford department, leading to exclusion of some SFRI articles from the dataset.

The records in the databases include the title of the journals in which each article appeared. For journals that are currently covered by ISI, the records also includes whether the journal is in the *SCI*, the *SSCI*, or both. A number of journals are no longer indexed by ISI (mostly because they have ceased publication or changed titles). Those journals, which ISI describes as "unknown," were assigned to *SCI* and/or *SSCI* based on their classification when they were covered.¹⁸ Thus, the 453 articles by authors affiliated with the six target institutions can be divided into those appearing in *SCI* journals, those in *SSCI* journals, and those in both (such as agricultural economics journals) (Figure 3). The universe of journals includes 52 that are no longer covered by ISI, although records from the period when they were in the ISI databases are included. The largest number of articles was, as expected, in the *SSCI*: 224 were in only the *SSCI*, with an additional 138 appearing in the *SCI* as well.

Figure 3—Overlap between SSCI and SCI journal sets



Source: CHI Research, from Institute of Scientific Information (January 1998).

¹⁸ CHI Research, which did the database work, has worked with the ISI databases since the early 1970s and has excellent records of the changing coverage of the *SCI* and *SSCI*.

The subfield assignments of the journals in which authors from the target institutions appear reflects the disciplinary breadth of the published research. Table 5 presents numbers of articles categorized according to journal subfields. All of the institutions except BIDS share an emphasis on economics in general and particularly agricultural economics, including agricultural economics as applied to development. ABARE, IFPRI, and, to a lesser extent, IRRI have substantial numbers of publications in economics journals oriented neither toward agriculture nor to economic development as such. These are fairly generalist journals covering a variety of subdisciplines. Notable for IFPRI is the substantial number of publications in nutrition and dietetics and the food science and technology subfields. These are nonsocial science fields with significant policy content in which IFPRI and, to a lesser extent, CIMMYT and SFRI have a sizeable presence. IFPRI's significant presence in policy studies related to the natural resource base for food production is also evident, with a substantial number of publications in the environment and earth science subfields. IFPRI staff publish in a significantly wider range of journals than staff at the other institutions, as is to be expected from an organization oriented toward a broad spectrum of policy issues related to food production, distribution, and consumption.

The publication records provided by ISI include the year in which each article was published. This makes analysis of time trends in journal publication relatively straightforward. Figure 4 plots publication counts for each organization. These counts are the numbers of articles in the ISI cited-literature set with at least one author stating an affiliation with the organization. An article with an author from IFPRI and another from CIMMYT, for example, is included in the counts for each organization. The reported counts are in fact three-year moving averages. Use of straight publication counts makes for an unreadable graph because small absolute fluctuations for the smaller institutions are large in percentage terms.

In general, IFPRI publication in *SCI* and *SSCI* journals increased substantially over 1980–96. Starting in 1984, IFPRI accounted for more—usually substantially more—journal articles than any of the other institutes studied. This is expected given IFPRI's significantly larger size (except for ABARE, whose publications are unlikely to be as completely indexed by ISI as IFPRI's). The sharp drop in 1991 is noteworthy, as it followed a period of considerable disruption in IFPRI activities, with high turnover of key staff and turbulence in funding. It serves to show that research and knowledge production depend on many institutional details, and individuals matter in terms of the productivity of a research organization. Output of journal articles did recover, however, along with the resources flowing to the organization. In 1996, more than twice as many IFPRI-authored articles appeared in the ISI-indexed journals than in 1991.

The publications of the comparison institutions reflect reasonably well their changing roles through the years. IRRI was active in development-oriented policy research and analysis during the first half of the period under study. It was also the institution with either the most or, starting in 1985, the second most (after IFPRI) journal articles in the cited-literature set. However, IRRI's program later receded in importance, a reflection, in part, of cutbacks in funding and staff at the institute, and while the

Table 5—ISI journal articles by organization and by journal field-of-science, 1980–96

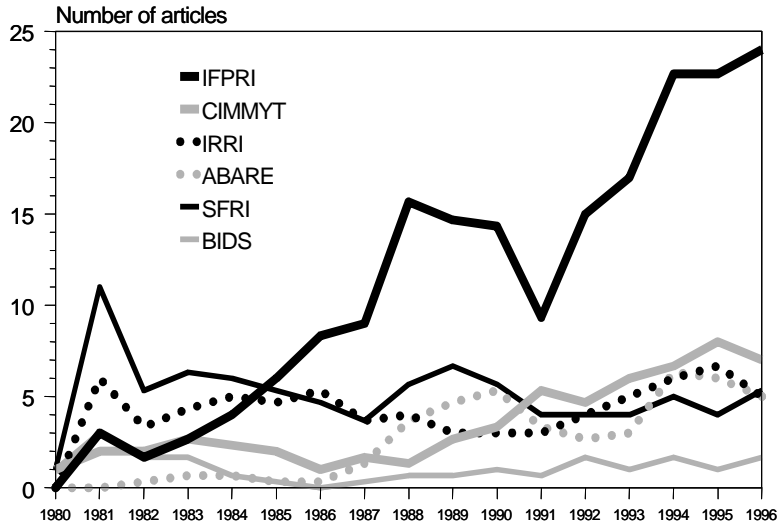
Field of science	IFPRI	ABARE	BIDS	CIMMYT	IRRI	SFRI
			(percent)			
Agricultural Economics and Policy	14.6	8.1	0.0	15.8	17.2	12.5
Agriculture	0.2	3.2	0.0	7.5	7.0	0.0
Agriculture, Dairy, and Animal Science	0.2	0.0	0.0	0.8	2.3	1.0
Anthropology	0.4	0.0	3.8	1.5	0.8	5.2
Area Studies	3.1	0.0	15.4	3.8	4.7	7.3
Business and Finance	2.0	1.6	0.0	0.0	0.0	2.1
Economics	31.6	40.3	15.4	21.8	26.6	29.2
Engineering:	0.0	0.0	0.0	0.0	0.0	0.0
Chemical	0.2	0.0	0.0	0.0	0.0	0.0
Industrial	0.2	0.0	0.0	0.0	0.0	0.0
Environmental Sciences	1.5	0.0	0.0	0.8	0.0	0.0
Environmental Studies	0.4	8.1	0.0	0.0	0.0	2.1
Food Science and Technology	9.1	1.6	0.0	6.8	2.3	2.1
Geography	0.7	0.0	0.0	0.0	0.0	0.0
Health and Policy Services	0.4	0.0	0.0	0.0	0.0	0.0
Industrial Relations and Labor	0.2	0.0	0.0	0.0	0.0	0.0
International Relations	1.1	0.0	0.0	0.0	0.8	0.0
Limnology	0.2	0.0	0.0	0.0	0.0	0.0
Mathematical Methods and Social Sciences	0.7	0.0	0.0	0.0	0.0	0.0
Multidisciplinary Sciences	1.1	0.0	0.0	0.8	3.9	0.0
Nutrition and Dietetics	11.3	1.6	0.0	7.5	1.6	5.2
Pediatrics	0.2	0.0	0.0	0.8	0.0	1.0
Planning and Development	11.7	6.5	30.8	8.3	14.1	5.2
Political Science	0.2	0.0	0.0	0.8	0.8	2.1
Public, Environmental, and Occupational Health	0.4	0.0	0.0	0.0	0.0	0.0
Social Issues	0.2	0.0	0.0	0.0	1.0	0.0
Social Sciences:	0.0	0.0	0.0	0.0	0.0	0.0
Biomedical	0.4	0.0	3.8	0.0	0.0	0.0
Interdisciplinary	0.2	0.0	0.0	0.8	3.1	3.1
Mathematical Methods	0.9	0.0	0.0	0.0	0.0	0.0
Statistics and Probability	0.9	6.5	0.0	0.0	0.0	0.0
Water Resources	0.2	0.0	0.0	0.0	0.0	1.0
No Category	5.1	11.3	3.8	18.8	10.2	0.0
Other	0.0	11.3	26.9	3.8	3.9	20.8
Total	100.0	100.0	100.0	100.0	100.0	100.0
Total publication counts	452	62	26	133	128	96

Source: CHI Research, from Institute of Scientific Information (January 1998).

Note: Articles are included in each field of science in which the journal is identified.

number of papers grew steadily during the first half of the 1990s, it remained smaller than that of the CIMMYT program. Again, this is consistent with the information presented in section 5.4.

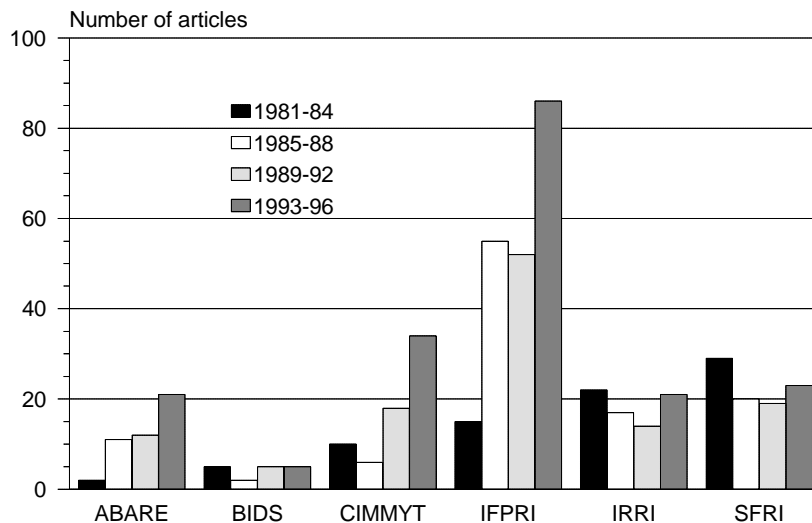
Figure 4—Number of journal articles in ISI by institution, 1980–96



Source: CHI Research, from Institute of Scientific Information (January 1998).
 Note: Series are presented as three-year moving averages.

Figure 5 groups each institution's output of articles in ISI-listed journals into four-year periods according to publication date. It shows publication trends without the short-run fluctuations of even the three-year moving average in Figure 4. Again, the recent high output of IFRPI authors is striking, with authors from CIMMYT and ABARE also significantly increasing their publication in journals in the ISI databases.

Figure 5—Summary of ISI journal articles by institution, four-year periods



Source: CHI Research, from Institute of Scientific Information (January 1998).

A cautionary note is in order here, given the comparative and evaluative uses to which publication counts (and citation analysis) may be put and the importance of decisions that may be based on them. ISI citation indices do not list all journals. ISI is a profit-making business. It must cover the costs of processing and storing publication and citation data by selling services, primarily by downloading bibliographic information on cited papers. If ISI does not expect a journal to contain enough articles with information that will be downloaded (hence sold), it does not index that journal. For example, neither the *Review of Marketing and Agricultural Economics (RMAE)*, the *Food Research Institute Studies (FRIS)*, nor the *Bangladesh Development Studies (BDS)* is indexed. *RMAE* was an Australian journal with a serious peer-review requirement, and it served as an important outlet for ABARE authors.¹⁹ *FRIS* was published by SFRI. It too was open to outside authors and accepted articles based on peer review, often using in-house reviewers. *BDS*, published by BIDS, has an external peer review requirement and is an important journal for Bangladeshi policy researchers and analysts.

Many other journals are excluded from the ISI indices as well. So any conclusion that a publication rate is "too low" (a judgment neither made nor implied in this report) depends in part on whether the outlets used by an institution's authors are in the ISI databases. Section 5.4 discussed the use made by BIDS researchers of *Bangladesh Development Studies*; it is their primary outlet of scholarly research. It would thus be inappropriate to use a database that excludes this journal in an evaluation of BIDS research, which in any case is not the point of this report. In the case of SFRI, research staff published extensively outside *FRIS*, which was generally used as a vehicle for fairly specific case studies of importance to policy sponsors (and meriting and receiving peer review), but of less interest to the broader research community.

Our primary emphasis in this section is international flows of policy knowledge. The primary agents of that flow in this report are the three CGIAR centers and SFRI. The remainder of this section often treats these four institutes as a group, the *internationally oriented* organizations, which we consider to be the main focus of our use of the ISI database.

Counts of journal articles should also be used with circumspection as indicators of the value or importance of research output. A myopic focus on publication counts to measure research productivity may have a number of unfortunate consequences. For example, it might lead to "bologna-slicer" publication practices, in which research is broken into its lowest publishable component and possibly placed in less-read and lower quality journals in the hopes of boosting the indicator. In the short run, this tendency can be counteracted by examining citations. In the longer term, norms can be developed, perhaps at the level of the subfield, to describe average citation practices. While recognizing that publication-based data can give useful indicators of research output, particularly in combination with

¹⁹ It ceased publication in December 1996 and subsequently merged with the *Australian Journal of Agricultural Economics* to be published as the *Australian Journal of Agricultural and Resource Economics*, which had its first issue in March 1997.

data on citations, our primary use of these data is to help describe the functioning of IFPRI and to evaluate the organization's contribution to various aspects of the publication-mediated information dissemination systems.

5.3 Coauthorship

This section returns first to a discussion of coauthorship of the main IFPRI research-reporting publications: the IFPRI Research Report series and the JHUP books. It then extends the analysis to coauthorship in ISI-listed journals.

Research Reports. Table 6 lists the institutional affiliations of authors of the 104 IFPRI reports published between 1979 and 1998. In the first column of the table we see that of the 82 reports listing an IFPRI affiliation, two have a coauthor from another international organization, 10 have coauthors from developed-country institutions, and 10 have coauthors from institutions in less-developed countries. That column alone gives a good picture of the patterns of IFPRI research collaboration. However, other forms of "knowledge flow" are also apparent in the table.

Table 6—Coauthorship of IFPRI research reports, 1979–98

	IFPRI	World Bank	Other international organizations	Developed countries	Less-developed countries
IFPRI	82				
World Bank	0	1			
Other international organizations	2	0	3		
Developed countries	10	0	1	21	
Less-developed countries	10	1	0	3	22

Source: Compiled by authors.

Note: Institutional affiliation of authors taken from notes in the respective Research Reports.

Consider the last two rows. As noted, 10 reports list authors from both IFPRI and a developed-country or developing-country institution. However, 21 Research Reports list at least one developed-country author, and 22 list at least one author from a less-developed country. Thus, 11 Research Reports (21 minus 10, from the developed-country row) list a developed-country author and no IFPRI author, and 12 (22 minus 10) list a developing-country author and no IFPRI author. These include cases where the author was an IFPRI visiting researcher who, by the time the report was published, had moved, or returned, to another research institution, and where the author collaborated closely with IFPRI but never joined the staff. Such movement of people, whether for visits or through permanent job changes, implies a very direct transfer of policy knowledge.

Taking into account both collaborative research and the flow of people, IFPRI's primary role—with one foot in a developed country and the other outside—is clearly revealed. A substantial number of Research Reports (10–20 percent) includes authors from outside the organization. These are divided more or less evenly between developed and less-developed countries. A slightly higher number of Research Reports, again about evenly divided between developed and less-developed countries, involves former IFPRI staff.

Chapters in JHUP books. We made a similar set of computations for contributors of chapters in the books published in the IFPRI/JHUP series. Table 7 presents these data.

Table 7—Coauthorship of chapters of IFPRI/JHUP books, 1985–98

	IFPRI	World Bank	Other international organizations	Developed countries	Less-developed countries
IFPRI	85				
World Bank	8	29			
Other international organization	4	0	36		
Developed countries	19	4	5	113	
Less-developed countries	15	7	3	11	52

Source: Compiled by authors.

Note: Institutional affiliation of chapter authors taken from biographical details included in the respective books.

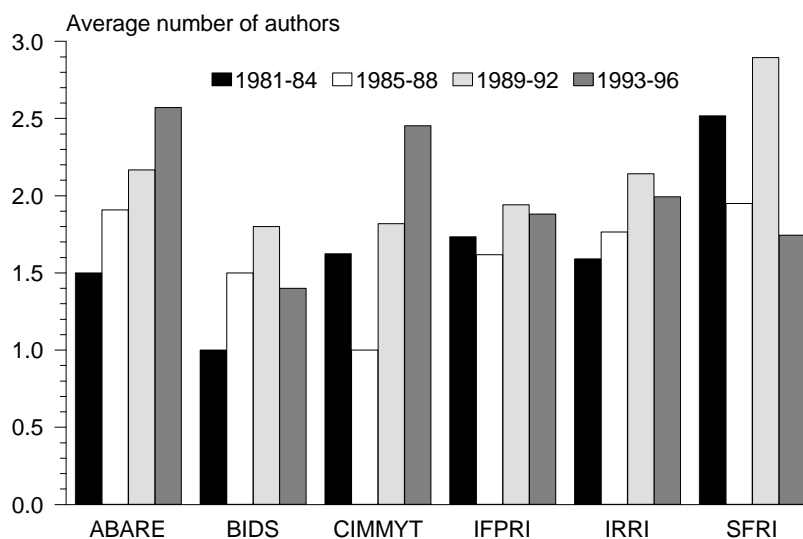
Authorship of these chapters is much more widely distributed than authorship of IFPRI Research Reports. This is expected, since there is no requirement that the books describe research performed by IFPRI. Rather, the requirement is that the research relate to IFPRI's mission. In these publications, IFPRI's roles are three: as a performer of research, indicated by the first column of the table; as a research collaborator, indicated by the off-diagonal cells of the first column; and as a "convener" of researchers, indicated by the difference between the diagonal element and the first column of each row. This difference is the number of chapters from each type of institution with no IFPRI coauthor.

Again a picture emerges of substantial interaction between IFPRI authors and colleagues from institutions in both developed and less-developed countries. In contrast to the Research Report series, there are substantially more non-IFPRI chapters with developed-country authors than non-IFPRI chapters with developing-country authors. In other words, the JHUP series acts as an outlet for developed-country research (and, perhaps, to attract developed-country researchers to work on the IFPRI program). At the same time, the books are a substantial outlet for collaborative research involving both developed-country and developing-country authors.

Journal articles. Our study uses two fields in the ISI publication record: the first is the field listing the authors of each publication; the second is the field containing the names of each distinct institution affiliated with one or more of the authors. When several such institutional affiliations are identified the article is said to be *institutionally coauthored*.

Institutional coauthorship is part of broader collaboration that involves considerable direct communication of many forms of policy knowledge. It also reflects changing practices in the writing and publication of scholarly articles in the social sciences and policy analysis fields. In Figure 6, each bar shows the average number of institutions listed in the publication records of articles published during four-year periods. Where two institutions are shown, there are at least two individual authors. For IFPRI and the other CGIAR centers in the study, institutional coauthorship is a primary form of publication. Throughout the study period, among all articles with at least one author from either IFPRI or IRRI, an average of 1.6 institutional affiliations were listed. A similar pattern is observed for CIMMYT, except that there was no institutional coauthorship involving CIMMYT authors between 1985 and 1988.²⁰ More recently CIMMYT practice has more closely mirrored that of the other CGIAR centers, although coauthorship within the institution is substantially higher than that observed in the other institutions in the study.

Figure 6—Average number of authors per ISI journal article by institution, four-year periods



Source: CHI Research, from Institute of Scientific Information (January 1998).

Note: The number of institutions includes the institution of the author, therefore one is the minimum possible value.

²⁰ In a few cases the number of institutions exceeds the number of authors. This occurs when authors list multiple institutional affiliations. For example, between 1993 and 1996, articles from SFRI averaged 2.2 institutional affiliations, but only 1.8 authors.

We understand coauthorship to be an important element of the flow of ideas, which in turn is a key element of the IFPRI program. IFPRI should act not only as an originator of policy knowledge, but also as an agent of knowledge diffusion, aiding communication among developed-country researchers (often in academia), researchers at the various CGIAR centers and other international institutions, and researchers at developing-country organizations. To examine the geographical and institutional distribution of institutional coauthorship involving IFPRI and the other organizations in this study, we grouped the coauthoring organizations into classes reflecting their location and type. We then tabulated the number of coauthored papers according to this classification. Table 8 presents these data. There is some double-counting in the table, since a paper enters the table once for each institutional affiliation.

Table 8—Institutional coauthorship of ISI journal articles by class of institution, 1980–96

	IFPRI	CIMMYT	IRRI	ABARE	SFRI
Developed-country institutions	116	33	50	46	65
CGIAR centers	22	8	22	na	16
Other international organizations	24	6	4	1	3
Less-developed country institutions	19	15	6	2	13
Unknown	9	12	10	na	4

Source: Compiled by authors from tabulations provided by CHI Research.

Note: Coauthorship pattern for relevant journal articles included in ISI database.

IFPRI authors collaborate actively with authors in all four classes. Like the other institutions studied here, most of these collaborations involve developed-country organizations. If the large number of IFPRI collaborations (18) with World Bank staff are included in the developed-country total, these collaborations account for over two-thirds of the total institutional collaborations. This is expected; with its primary location in Washington, D.C., U.S.-based researchers in particular are highly accessible to IFPRI staff, and collaborations are relatively easy to arrange. Twenty-one collaborations involve staff at the University of Minnesota and Cornell University, more than all the collaborations with colleagues based in developing countries.²¹

Table 3 in the appendix shows the entire list of institutions appearing in coauthorship with IFPRI staff. This list provides a snapshot of the range of institutions with which IFPRI collaborates (or at least those collaborations leading to journal articles in the ISI set). It illustrates, first, IFPRI's strength in working with other U.S.-based institutions and, second, the very broad range of developing-country

²¹ At the time of writing this paper, Pardey held a joint, adjunct appointment at Minnesota along with his position at IFPRI. However, he did not identify Minnesota on a significant number of journal articles during the last three years of the study series. Minnesota accounts for 11 of the coauthorships and, while Pardey would like to take credit for them, honesty (and the ISI data) forbid it.

organizations with which IFPRI works. Furthermore, collaboration with colleagues at other CGIAR centers is quite high. On the other hand, most of the collaborations with developing-country colleagues involve only one or two articles. We identified only one non-CGIAR center with four listed collaborations, and two with three. Thus, while IFPRI seems to perform very well as a participant in the developed-country food policy research community, its participation in the scholarly aspects of policy research in developing countries, which is one of its primary targets, has been broad but comparatively shallow. Again this may reflect the forms of funding available to IFPRI (and, perhaps, a lack of senior collaborators with whom to coauthor policy research products). Or it may be part of a conscious choice to work in a multicountry setting to broaden the geographical impact of its research. It is worth noting that SFRI, with a much lower rate of journal publication, accounts for 13 developing-country coauthorships, compared with IFPRI's 19. SFRI's disappearance represents both a challenge to the development-oriented food policy community and an opportunity for IFPRI, which could take up a substantial part of the services and activities SFRI left behind.

5.4 Citations and the Intertemporal Flow of Knowledge

Our study is concerned with IFPRI's contributions to the development, distribution, and use of policy knowledge. Publication counts are primarily oriented toward the development or production of such knowledge. Yet this new knowledge, wherever developed, is of limited use unless and until it is learned by those in a position to make or influence policy. IFPRI's role as a communicator and transmitter of information is central to the success of its mission. Journal (and other) publications are primary vehicles of this process, and citations serve as "scorecards" of the success of such outputs.

The focus on information flows leads us to consider two largely independent elements of the publication system. First is research collaboration, which is a direct and effective medium of research communication that often leads to the publication of multiple-author journal articles, as discussed in the previous section. Second is the ability to search the ISI databases for articles that cite another article or list of articles, such as the cited-article set described in sections 5.1 and 5.2. We can construct a variety of indicators to shed light on aspects of the journal-mediated transfer of policy knowledge.

The reference in one publication to statements or results in another is a key element of scholarly communication. Citation is not simply courtesy, rather it is recognition and statement of a common problem or solution, part of the transmittal and reuse of knowledge that characterizes the scholarly endeavor. Research results are important if they are used, whether by policymakers or by other researchers. IFPRI and other providers of policy knowledge make a continual effort to gauge policymakers' use of results, through questionnaires, interviews, project advisory committees, and other means. In the case of scholarly communication, whose aim is mainly service to the professional research community, citations are the primary indicator of use and intellectual influence (Stigler and Friedland 1979). That "service" undoubtedly includes the occasional publication of errors and mistaken interpretations, which when corrected will generate citations. Yet even such citation reflects use, contribution to debate, a movement in the body of knowledge. Some results have tremendous

repercussions and generate hundreds of citations. As scholars pay more attention to such papers, so do observers and analysts of scholarly activity. Table 1 in the appendix lists the most cited articles for the institutions in the study. This is not to assert a simple relationship between "quality" or "impact," however measured, and the number of citations. Rather, the existence of citations suggests greater impact, and citation in general indicates that research is influencing somewhere: effective scientific communication is taking place.

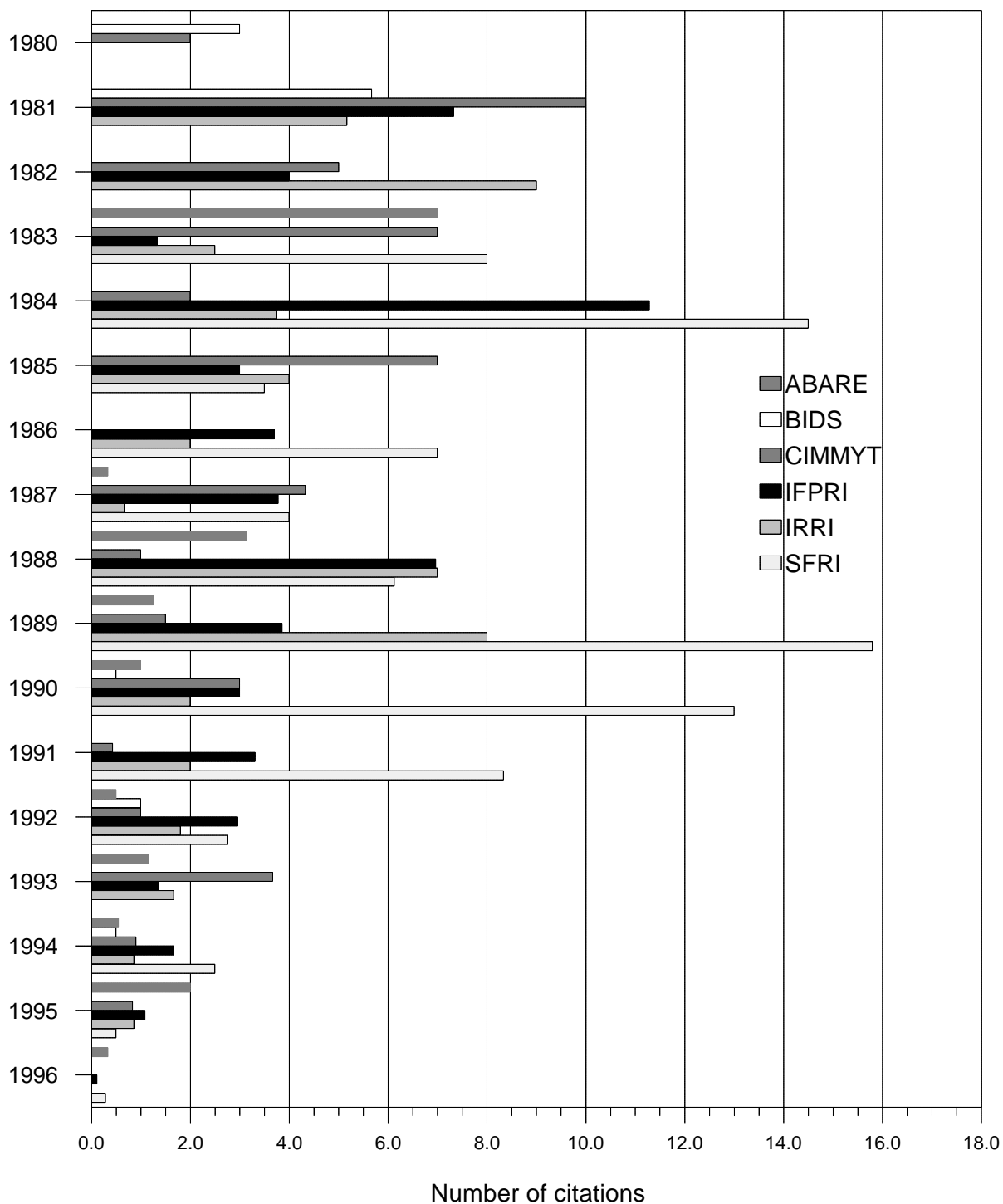
Our procedure for assembling and analyzing citations was relatively straightforward. The ISI databases were searched for every article that included citations to the cited-article set discussed above, whose authors identify affiliations with IFPRI or the other institutions in the study. There is for each target institution, then, a citing-article set, which may overlap both with the cited-literature set and with the citing sets for other institutions. We then analyzed these literature sets using information on the institutional affiliations of the author(s), year of publication, subfield, the number of citations in each article, and so on.

We paid particular attention to three elements. First, we made some overall comparisons of the size of the citing dataset and its linkages with the cited-literature set. Second, we looked at the institutional identity of the citing literature, using scholarly citation as an indicator of interorganizational and international flows of policy knowledge. Third, we considered the time profile of citation behavior, the speed with which published literature finds its way into subsequent reference lists. This draws attention to how IFPRI, in particular, works within the formal and informal channels of communication with the surrounding scholarly community.

Diffusion rates. Papers written by authors affiliated with IFPRI have tended to receive fairly substantial recognition in the subsequent literature, with each publication receiving on average at least two citations, and usually significantly more, during 11 of the first 13 years of the study. For the last years of the series, citation rates are not particularly meaningful, as it may take several years for an article to be recognized and cited. There are no obvious differences between citation patterns for IFPRI and the other CGIAR centers in this study. Some years, articles by IFPRI staff were highly cited (the average 1984 article received 11 cites, compared with 1.3 cites for the previous year's publications). In other years the most highly cited articles come from another organization (Figure 7). If there is one constant, it is the prominence of articles from SFRI through most of the period, especially in the late 1980s and early 1990s and 1994.

Comparisons with the citation patterns of other institutions are not terribly satisfactory, in part because of the lumpy nature of highly cited literature. When using citation-based data to evaluate quality or impact, it is helpful to have norms based on usual citation patterns and the average number of citations received by papers in a particular field. Citation indices, where citation rates are expressed as a percentage of average citation rates for a field, country, or other subset of the total published literature, are used extensively in the science policy literature, such as in the U.S. National Science

Figure 7—Average cites per year to ISI journal articles, by year of publication and institution



Source: CHI Research, from Institute of Scientific Information (January 1998).

Note: A 1982 ABARE paper with 223 citations is not shown.

Foundation's *Science and Engineer Indicators* series (NSB 1997: 89). Unfortunately, almost all the literature on aggregate citation behavior has been in the physical and life sciences. However, Glänzel (1996) published norms for several social science fields, including economics, both for the entire set and for individual countries based on the location of the affiliated institution. Thus, within the first three years after publication, all economics articles in the *SSCI* are cited, on average, 1.08 times; articles published by authors affiliated with institutions in the United States are cited 1.35 times. While citation norms are not available for all social sciences, nor for citation more than three years after publication, the indication is that the articles in this study are cited substantially more than economics papers in general.

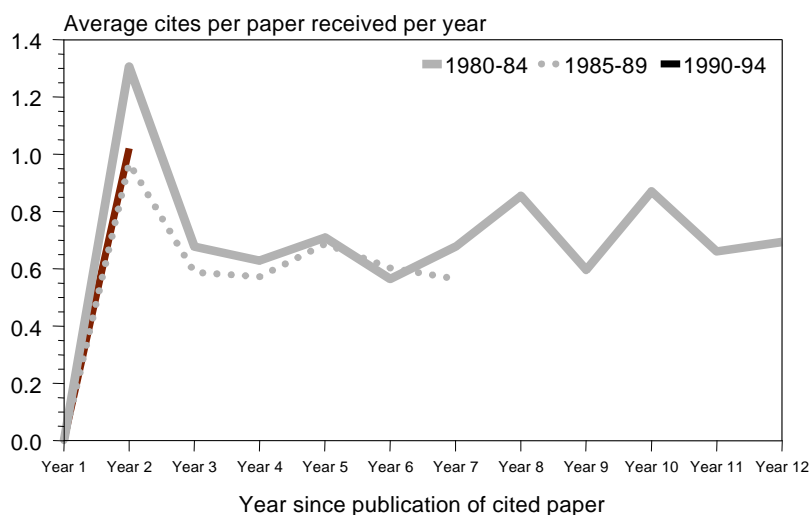
In the discussion of coauthorship, we noted the gap left in the development-oriented food policy research community by the disappearance of SFRI. This gap is also evident in the citation data: SFRI researchers regularly published journal articles that were subsequently highly cited. An organization can take steps to encourage, for example, ongoing collaborations with researchers at other institutions and in other countries. It cannot, by fiat, instruct authors to publish articles that will be highly cited, although hiring practices can influence this outcome somewhat. In any case, while service to the research community is part of IFPRI's mission, it is likely less important to IFPRI than to an organization affiliated with a major research university. Furthermore, SFRI's disappearance does not, fortunately, imply the disappearance of former SFRI staff, most of whom probably continue to contribute to the food policy and development literature.

Diffusion lags. Citation is primarily an indication of communication and perhaps use. Its main function is not to confer recognition or indicate quality of the cited literature. For IFPRI, and other institutions actively involved in the international diffusion of policy knowledge, this primary communication function deserves emphasis. Whatever IFPRI produces, it is more valuable if it is taken up, and taken up quickly. Bibliometric analyses of scholarly articles fail to measure the flow of research results to policymakers, no matter what the country. However, the scholarly literature does give information about awareness of results, especially if local policy researchers mediate the flow of information to local policymakers. If knowledge flow through local researchers is an important path for the transfer and implementation of IFPRI results, and if local researchers publish their results in journals covered by the ISI citation indices, then the geographical and temporal profiles of the citing literature give information about the effectiveness of the channels of international diffusion of food policy knowledge. More generally, citation measures are useful indicators of the impact IFPRI and others have on the general corpus of policy knowledge. They thereby shed light on how IFPRI and others help to shape and inform the policy questions being posed and the responses to those questions: a metric of the international public goods aspect of knowledge production.

Our analysis here has two aspects. First is the comparison of the publication years of the citing literature to the dates of the cited literature, which reveals the diffusion lags. Second is our examination of institutional coauthorship patterns to identify the geographical patterns of diffusion through citation and differential patterns of diffusion.

Figure 8 shows the average number of citations to each paper in the cited-literature set, broken down by the number of years since the appearance of the cited article. For the first five publication years (1980–84) we constructed a time series for 12 subsequent citing years; for later publication years the series must be truncated. The lag structure clearly indicates that this literature is cited frequently relative to the economics literature. Furthermore, following the high average citation rate one year after publication, citation rates do not steadily taper, as is the typical pattern in the physical and biological science literature. Two interpretations are possible. First, the knowledge diffusion lags may be longer for social science research than for other forms of research. This, in turn, would reflect the differences between the physical and social sciences in their review, publication, and citation practices: the physical sciences commonly publish shorter articles and their journals are published more frequently. Another explanation is that the science of food policy research moves comparatively slower, so results do not become obsolete for many years after publication.

Figure 8—Citation lag structure



Source: CHI Research, from Institute of Scientific Information (January 1998).

Diffusion patterns. The lag structure of citations to the food policy literature has a strong geographical aspect. Figure 9a shows citations to articles with at least one author affiliated with IFPRI, CIMMYT, IRRI, or SFRI, the four institutions in the study that are significant international mediators of the flow of policy knowledge. Figure 9b describes citations to articles with at least one IFPRI-affiliated author. The citing regions are Asia/Pacific (AP), developed countries (DC), Latin America and the Caribbean (LAC), Sub-Saharan Africa (SSA), and West Asia and North Africa (WANA). Total citations are accumulated by the number of years between publication of the cited and citing articles. Thus, the first bar in Figure 9a shows the number of citations from articles with at least one author whose institution is located in the Asia-Pacific region, published in the same year as the cited article, to articles with at least one author listing an affiliation with one of the four internationally oriented

institutions in the study. The second bar describes citing articles published during the year following the cited article's publication, and so on.

Figure 9a—Total citations to international institutes' journal articles, by region and citation window

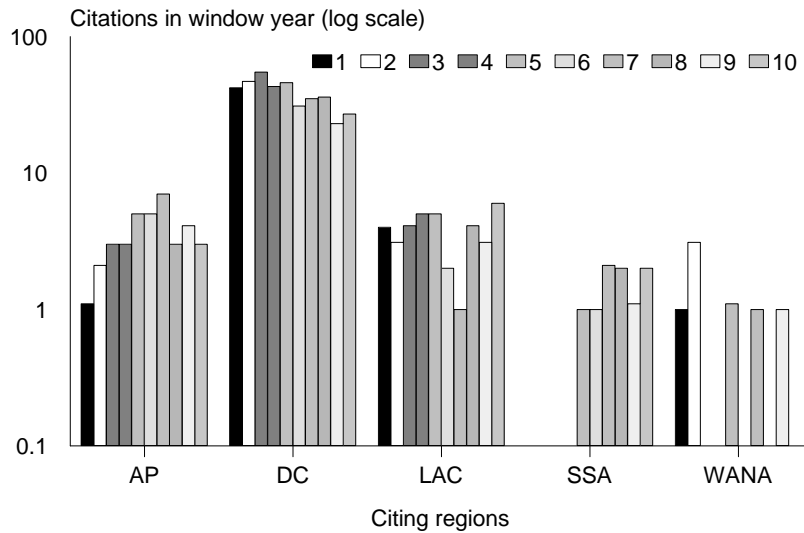
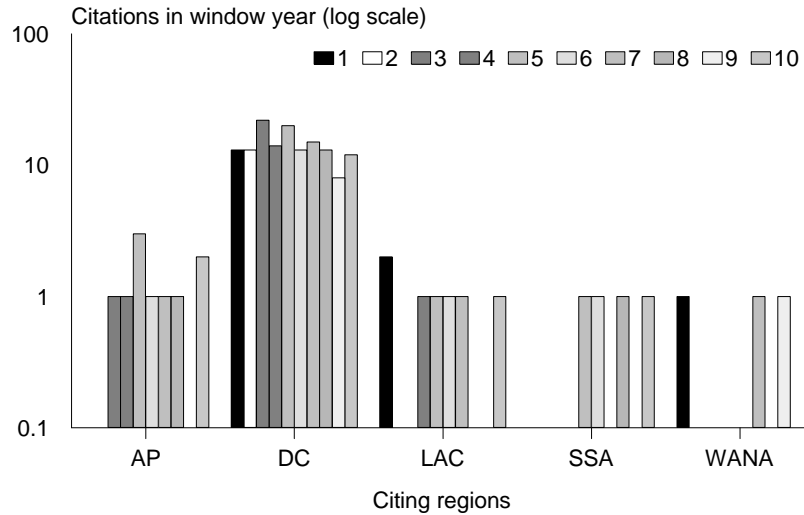


Figure 9b—Total citations to IFPRI journal articles, by region and citation window



Source: CHI Research, from Institute of Scientific Information (January 1998).
 Note: Includes citations to CIMMYT, IRRI, and SFRI publications.

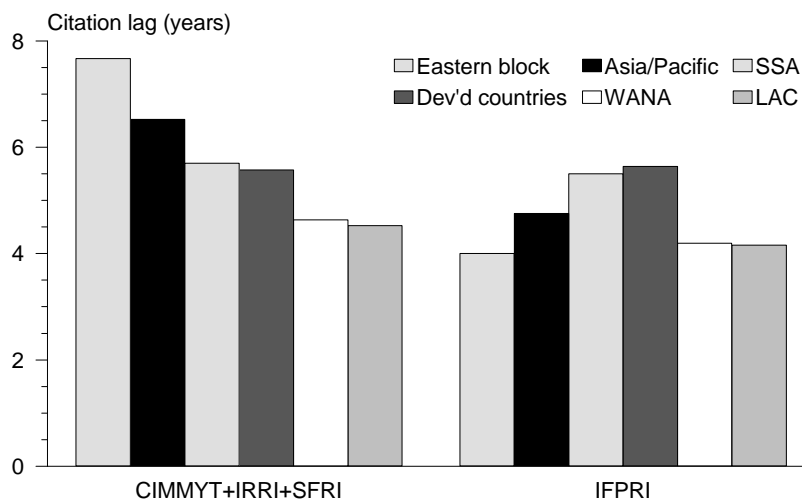
For the internationally oriented institutions as a whole (Figure 9a), differential citation patterns and lag structure are clear. Most citations (like most coauthors) are from developed-country

organizations. Furthermore, the developed-country citation profile diminishes with time, characteristic of a situation of scholarly progress, with citations highest in the first years following publication. In contrast, the much lower rates of citation by developing-country authors start low, but tend to increase for at least several years following publication of the cited article. Authors in the Asia-Pacific region and Latin America cite the international institutions' literature regularly. Citations from the other developing-country regions are rare.

Figure 9b shows IFPRI's citation profile separately from the other international institutions. The use of IFPRI's published output is more concentrated in developed countries than the output of the full set of international institutions, with developed-country cites exhibiting the decline characteristic of citations within a progressive field of science. Citations from developing countries are relatively few, and IFPRI-specific information concerning citation lags cannot be established. The appendix lists institutional affiliations of authors citing IFPRI literature. Overall, the citation data tends to reinforce the view of IFPRI's role that emerged, sketchily, from the analysis of coauthorship data. For the scholarly part of its portfolio at least, IFPRI has solid ties to policy-oriented research communities in the United States and in other developed countries. But its ties to researchers in developing countries are comparatively weaker, although many institutions are represented.

Figure 10 shows the average age of articles citing works by authors at IFPRI and the other internationally oriented institutions in the study. In a rapidly moving scholarly dialogue, one expects this average lag to be relatively short: results are picked up and cited rapidly, though some very important results may be cited for years. A long average lag may reflect slow progress. The regional pattern of this lag shows differential speeds of adoption (and citation) of research results. This may be based, in part, on authors' lack of access in slow-citing regions to the relevant literature. Indeed, to some degree we also evaluate here the system of scholarly communication in which IFPRI takes part.

Figure 10—Average citation lag, IFPRI and other international institutions, by citing region



Source: CHI Research, from Institute of Scientific Information (January 1998).

Citation lags for articles written by IFPRI-affiliated staff are generally shorter than for authors affiliated with the other international institutions, although the short average lag for citations by authors in the (former) Eastern bloc is probably due to the small number of citations. Citations by authors from Latin America tend to occur quickly, demonstrating generally high awareness of recent policy research. On the other hand, linkages between researchers in the Asia-Pacific region and IFPRI are weaker, or at least take longer to manifest.

The relatively long lags between publication by an IFPRI-affiliated author and citation by authors in the Asia-Pacific region (for example) is not necessarily a criticism of IFPRI. The same can be said of the other international institutions in the study. The suggestion is that some, perhaps much, of the weakness is in the ability of researchers working in developing-country institutions to acquire and cite knowledge developed elsewhere (no doubt a reflection of restricted access to well-stocked libraries, the Internet, and so on). IFPRI alone cannot solve this state of affairs.²² Nonetheless, the evaluation of an institution that is in part charged to work with and strengthen a system must address the strengths and weaknesses of that system. Working with national research and policy communities and designing structures to improve the flow of IFPRI results (and those of other policy researchers), especially to developing countries, seems an appropriate role for IFPRI, and for others concerned with the execution of effective food policy in the developing world.

²² Beintema, Pardey, and Roseboom (1998), for example, document the sorry state of agricultural universities throughout Africa.

6. SUMMARY

The output of a policy research organization such as IFPRI largely takes the form of documents, published more or less formally, circulated to various sets of users, and having greater or lesser influence on policy. Evaluating such an organization involves identifying changes in policy due in part to its policy research and analysis. Identifying such changes is often difficult, and attributing them to the efforts of a single agency is especially so. A study of the channels through which research results and analyses flow prior to their ultimate impact on policy is a valuable complement to an evaluation of research outputs and productivity. Such a study should examine various aspects of an institution's written output: what is written, how it is circulated, and how it is used. The study of such documentation to provide information on the conduct and performance of research is called bibliometrics.

A bibliometric evaluation of IFPRI (or of any other institution) must take into account the various roles the institution plays, with an understanding of how these roles influence what is written and how it is communicated. IFPRI plays at least two roles in its mission to improve the quality of food policy, especially in developing countries. First, it is a direct provider of research and analyses to policy groups located in developing and developed countries. As such, it draws upon and builds links with leading researchers and analysts working in areas of food policy. Second, like other CGIAR centers, it strengthens policy research capabilities within national agricultural policy research systems.

Overall, IFPRI's circulated output is large and broad, published not only in leading scholarly journals, but also in a wide range of books, technical reports, and extension documents. The amount of published output has tended to increase throughout IFPRI's history, and it continues to do so. During the past five years, IFPRI staff published more articles in scholarly journals than during any other similar period in the organization's history. These articles appear in a variety of journals, including both leading journals of agricultural and development economics, regional journals, and publications devoted to specific commodities, industries, and problems. This picture of relative optimism is supported by continued high rates of working-paper circulation—an activity which is likely preliminary to journal and other forms of scholarly publication. Historically most of these documents were drawn from the IFPRI Research Report series, which included technical, externally reviewed reports of the organization's main research projects. Output of these reports has generally fallen over the past decade (although it has picked up in the past two years covered by our study). This may not represent a fall-off in research performance, but rather researchers' decision to bypass the Research Report series in favor of earlier external publication, and an increasing emphasis of IFPRI management on outreach and extension publications, consistent with its role as a direct provider of policy knowledge to governments and others.

To help understand the relationship of IFPRI's written output to its size and roles, we developed similar publication lists for five other institutions working in roughly the same domain as IFPRI. IFPRI is bigger than most of the other institutions in the study, and it shares program elements with all of them. It acts, in many ways, like a general-purpose policy research agency, like the U.S. Department of Agriculture's Economic Research Service (ERS) or ABARE, the latter of which was included in this study. Like ABARE, IFPRI publishes a substantial number of highly policy-oriented studies and outreach and extension-type publications. Like CIMMYT and IRRI, IFPRI is a member of the CGIAR and, as such, provides research specifically oriented to the needs of developing countries with no particular regional focus. Also, IFPRI, like SFRI, is a U.S.-based performer of research in the food policy area. As a performer of research and publisher of scholarly articles, IFPRI most resembles SFRI. With its substantial outreach function, it more resembles CIMMYT and IRRI. In addition, data for BIDS provided an example of a developing-country institution active in food policy research. BIDS is far smaller than the other organizations in the study, and it cannot now perform the range of studies, particularly with general application, undertaken by the other organizations. The bibliometric evidence suggests that IFPRI plays a unique role. Without it, the food policy research system would be significantly different.

For a closer look at IFPRI's role in the research part of that system, we identified articles with authors stating an affiliation with the study organizations in the ISI's *SCI* and *SSCI* databases. This is a subset of the scholarly journal literature that contains the world's more heavily cited journals, which are the most influential in research circles. Publication by IFPRI-affiliated staff in the ISI-indexed journals was lower than the total journal article count reported by the organization, a pattern that held true for the other organizations in the study as well (although to a lesser extent for SFRI). IFPRI staff also publish in regional and specialty journals, an activity that may be understood in part as outreach.

An organization interested in strengthening policy research capabilities in developing countries must be concerned with collaborative research, particularly that involving researchers from developing countries. Such collaborations often lead to publications carrying the names of multiple institutions. We looked at coauthorship of three sets of literature: the IFPRI Research Report series, chapters in the books published by IFPRI and JHUP, and articles in ISI-listed journals. Treating coauthorship as an indicator of scientific communication, IFPRI appears to have been involved in a large number of collaborative research projects around the globe. The nature of this collaboration varies somewhat according to the publication outlet. In the case of the two IFPRI-sponsored outlets, collaborations involving IFPRI and developing-country institutions were most common. However, IFPRI's strongest scholarly ties, by far, as indicated by publications in the ISI-listed journals, are with the World Bank and with the top echelon of U.S. academic research institutions in its field.

This observation fits with an emerging picture of IFPRI's dual role in the international research and policy analysis system as a member of and collaborator with both the developed-world scholarly community and the application-oriented policy communities. IFPRI maintains strong links with scholarly communities in the United States and other developed countries, collaborating in the

publication of journal articles that are vital to workers in that community. At the same time, by carrying out immediately applicable policy research and analysis, often in collaboration with researchers and policy professionals in the target countries, IFPRI contributes to a more rapid transfer into practice of new policy knowledge. There may be a related benefit of IFPRI's sponsored publications. Particularly in the case of the JHUP books, IFPRI's sponsored publications offer a peer-reviewed and professionally respectable outlet, frequently used, for non-IFPRI researchers to publish development-oriented results. While these might not be sufficiently general for a scholarly journal, they may still contain valuable results for policy clientele.

Our coauthorship analysis of journal articles also encompassed the other institutions in the study. In contrast to IFPRI's experience, which was weighted toward collaboration with authors from the World Bank and other U.S.-based institutions, the two other CGIAR centers in the study had relatively more collaborations within their respective regions (Asia for IRRI and Latin America for CIMMYT). SFRI, perhaps due to a continual flow of graduate students to and from developing countries, had the strongest emphasis on collaboration between the United States and developing countries. IFPRI's position in the U.S. agricultural policy research system is a strength. Extending and deepening ties with researchers in developing countries may be an area for future, additional emphasis (especially given the recent closure of SFRI).

Finally, citations to published literature, in this case in the ISI-indexed journals, denote an impact of research, not on policy or on economic activity, but on further research and analysis. Our analysis here concentrated on IFPRI and institutions that resemble it: CIMMYT, IRRI, and SFRI. All these institutes appear to have greater than average impact on further research, as measured by citations. This impact, however, is concentrated in developed countries: the great majority of citations to these institutions' articles was by authors affiliated with developed-country research organizations. In addition to the low rate of citation by authors from developing countries, there were long and persistent lags. This indicates either relatively weak links between the study institutions and developing-country users, or that the relatively prestigious journals in the ISI databases are not well adapted to communicate research to developing-country colleagues. This problem is probably distinct from the classic outreach problem, which IFPRI's 2020 Vision initiative addresses. 2020 Vision is oriented toward users of policy research, while the issue here is the effectiveness of channels of scholarly communication with developing-country researchers. Here, IFPRI's high level of publication in journals outside the mainstream (viewed, at least, from a research institution based in a developed country) may in fact be a strength. Active publication in scholarly journals in countries immediately affected by a research issue may contribute little to the developed-country research community, yet perform an important service for the research communities in those countries.

IFPRI is unique in that it is not an academic institute. It places a premium on the applied work that is typically given less emphasis in the university-based research community with which it interacts most extensively. IFPRI has extensive connections with a wide variety of developing-country policymakers and an institutional familiarity with policy issues in those countries. It also has strong ties

with colleagues in the various research institutions of the CGIAR and other leading research institutions in its field around the world. A simple review of IFPRI's publication record suggests that it has been, and continues to be, an important producer of policy research and analysis "output." This result is important and ought not to be neglected. However, we argue for a different, although related, point: IFPRI's role as a research "producer" enables it to act as an intermediary between the scholarly community and policy clientele.

Our focus is on policy clientele in developing countries, although the process is not limited to these. As a knowledge intermediary, IFPRI acts as a channel through which policy issues and research questions flow to help guide research. As a participant in research (often directly guided by contacts with policy clientele), IFPRI is well placed to help translate research results, wherever produced, into terms useful to policymakers. Technology transfer generally requires technical sophistication among the technology recipients. Serving both as a collaborator with policy communities and, in some cases, a de facto member of those communities, IFPRI contributes to that sophistication, promoting and participating in valuable links between the international research community and policy clientele around the world.

REFERENCES

- ABARE (Australian Bureau of Agricultural and Resource Economics). 1995. *ABARE: Fifty years of applied economic research*. Canberra: Australian Government Publishing Service.
- Adams, J., and Z. Griliches. 1996. *Measuring science: An exploration*. Discussion Paper No. 1749, February. Cambridge: Harvard Institute of Economic Research, Harvard University.
- Alston, J. M., and P. G. Pardey. 2001. Attribution and other problems in assessing the returns to agricultural R&D. *Agricultural Economics* 25 (2–3) (September): 141–152.
- _____. 1999. International approaches to agricultural R&D: The CGIAR. Paper prepared for Office of Science and Technology Policy, Executive Office of the President of the United States.
- Alston, J. M., B. J. Craig, and P. G. Pardey. 1998. Dynamics in the creation and depreciation of knowledge, and the returns to research. EPTD Discussion Paper 35. Washington, D.C.: International Food Policy Research Institute.
- AGPS (Australian Government Publishing Service). 1996. *Australian science: Performance from published papers*. Canberra: Australian Government Publishing Service.
- Bagla, P. 1998. Midlife crisis threatens center for semiarid crops. *Science* 279 (1) (January): 26–27.
- Basberg, B. L. 1982. Technological change in the Norwegian whaling industry: A case study in the use of patent statistics as a technology indicator. *Research Policy* 11: 163–171.
- Bantilan, M. C. S., and P. K. Joshi. 1996. *Returns to research and diffusion investments on wilt resistance in pigeon pea*. ICRISAT Impact Series 1. Pantancheru: International Crop Research Institute for the Semi-Arid Tropics.
- Baum, W.C. 1986. *Partners against hunger: Consultative Group on International Agricultural Research*. Washington, D.C.: World Bank.
- Beintema, N. M., P. G. Pardey, and J. Roseboom. 1998. Educating agricultural researchers: A review of the role of African researchers. EPTD Discussion Paper 36. Washington, D.C.: International Food Policy Research Institute.

- Binenbaum, E., P. G. Pardey, and B. D. Wright. 2001. Public-private R&D relationships: The Consultative Group on International Agricultural Research. *American Journal of Agricultural Economics* 83 (3) (August): 748–753.
- Carpenter, M. P., and F. Narin. 1983. Validation study: Patent citations as indicators of science and foreign dependence. *World Patent Information* 5 (3): 180–185.
- Chandler, R. F., Jr. 1992. *An adventure in applied science: A history of the International Rice Research Institute*. Los Baños: International Rice Research Institute.
- Chowdhury, T-e-E., and S. Haggblade. 2000. Dynamics and politics of policy change. In *Out of the shadow of famine: Evolving food markets and food policy in Bangladesh*, edited by R. Ahmed, S. Haggblade, and T. Chowdhury. Baltimore: The Johns Hopkins University Press.
- CGIAR Secretariat. 2001. *CGIAR annual report 2000*. Washington, D.C.: Consultative Group on International Agricultural Research.
- Christian, J. E. 1982. Patent data as an indicator of invention: The firm's decision to patent. OECD Secretariat Note DSTI/SPR/82.30. Paper presented to OECD Workshop on Patent and Innovation Statistics, June.
- _____. 1996. Endogenous process innovation under piracy and multinational enterprise. Davis: University of California (Draft).
- CIMMYT (Centro Internacional de Mejoramiento de Maíz y Trigo). 1992. *Enduring designs for change: An account of CIMMYT's research, its impact, and future direction*. Mexico City: CIMMYT.
- European Commission. 1994. *European report on science and technology indicators 1994*. Luxembourg: European Commission Publications.
- Farrar, C. 2000a. *IFPRI's First 10 Years*. Washington, D.C.: International Food Policy Research Institute.
- Farrar, C. 2000b. A review of food subsidy research at IFPRI. Impact Assessment Discussion Paper 12. Washington, D.C.: International Food Policy Research Institute
- Glänzel, W. 1996. A bibliometric approach to social sciences, national research performances in 6 selected social science areas, 1990–1992. *Scientometrics* 35 (3): 291–307.

- Griliches, Z. 1990. Patent statistics as economic indicators: A survey. *Journal of Economic Literature* 28 (4) (December): 1661–1707.
- Gryseels, G., and J. R. Anderson. 1991. International agricultural research. In *Agricultural research policy: International quantitative perspectives*, edited by P. G. Pardey, J. Roseboom, and J. R. Anderson. Cambridge: Cambridge University Press.
- IFPRI (International Food Policy Research Institute). 1997. *Medium-term plan 1998–2000*. Washington, D.C.: IFPRI.
- Industry Commission. 1995. *Research and development*, vols. I, II, and III. Canberra: Australian Government Publishing Service.
- Jaffe, A. 1986. Technological opportunity and spillovers of R&D: Evidence from firms' patents, profits, and market value. *American Economic Review* 76 (5): 984–1001.
- Katz, J. M., D. Hicks, M. Sharp, and B. Martin. 1996. *The changing shape of British science*. Brighton: Science Policy Research Unit, University of Sussex.
- May, R. M. 1997. The scientific wealth of nations. *Science* 275 (February): 793–796.
- McCloskey, D. 1985. Economical writing. *Economic Inquiry* 23 (2) (April): 187–222.
- Moed, H. F., W. J. M. Burger, J. G. Frankfort, and A. F. J. van Raan. 1985. The use of bibliometrics data for the measurement of university research performance. *Research Policy* 14: 131–149.
- NSB (National Science Board). 1973. *Science Indicators 1972*. Washington, D.C.: U.S. Government Publishing Office.
- _____. 1988. *Science and engineering indicators 1987*. Washington, D.C.: U.S. Government Publishing Office.
- _____. 1997. *Science and engineering Indicators 1997*. Washington, D.C.: U.S. Government Publishing Office.
- OECD (Organization for Economic Cooperation and Development). 1994. *Frascati manual 1993: Proposed standard practice for surveys of research and experimental development*. Paris: OECD.
- Pakes, A., and Z. Griliches. 1980. Patents and R&D at the firm level: A first report. *Economics Letters* 5: 377–381.

- Pardey, P. G. 1989. The agricultural knowledge production function: An empirical look. *Review of Economics and Statistics* 71 (33) (August): 453–461.
- Pardey, P. G., J. M. Alston, J. E. Christian, and S. Fan. 1996. *Hidden harvest: U.S. benefits from international research aid*. Food Policy Report, September. Washington, D.C.: International Food Policy Research Institute.
- Pardey, P. G., and V. H. Smith, eds. 2002. *What's economics worth?—Valuing policy research*. Washington, D.C.: International Food Policy Research Institute (in preparation).
- Reza, S., and M. Yunus, eds. 1995. *BIDS report, 1992 to 1994*. Dhaka: Bangladesh Institute of Development Studies.
- Scherer, F. M. 1980. *Industrial market structure and economic performance*, 2nd ed. Boston: Houghton Mifflin.
- Schmookler, J. 1966. *Invention and economic growth*. Cambridge: Harvard University Press.
- Stigler, G. J., and C. Friedland. 1979. The pattern of citation practices in economics. *History of Political Economy* 11 (Spring): 1–20.
- The Beresford Group. 1997. Results of 'how are we doing': An IFPRI survey of 2020 vision readers. Connecticut: The Beresford Group.
- Williams, J. C. 1998. Personal communication, University of California, Davis, December.
- World Bank. 1997. *World development indicators*, CD-ROM version. Washington, D.C.: World Bank.

Appendix Table 1—Most cited ISI journal articles by institution, 1980–96

Organization	First author	Journal	Year published	Total citations	Title of article
ABARE	Quiggin, J.	Journal of Economic Behavior and Organization	1982	223	A Theory of Anticipated Utility
	Menz, K. M.	American Journal of Agricultural Economics	1983	7	Technology and United States Corn Yields: Plateaus and Price Responsiveness
	Brewer, K. R. W.	Journal of the American Statistics Association	1988	7	How Nearly Can Model-Based Prediction and Design-Based Estimation Be Reconciled
	Chambers, R. L.	Journal of the Royal Statistics Society Series B-methodological	1993	6	Log-linear Models for Survey Data with Non-ignorable Nonresponse
	Hinchy, M.	American Journal of Agricultural Economics	1988	5	Benefits From Price Stabilization to Producers and Processors: The Australian Buffer-Stock Scheme For Wool
	Breckling, J.	Biometrika	1988	5	M-quantiles
BIDS	Ahmed, N. R.	Studies in Family Planning	1981	17	Family-Size and Sex Preferences among Women in Rural Bangladesh
CIMMYT	Borlaug, N. E.	Science	1983	20	Contributions of Conventional Plant-Breeding to Food-Production
	Tripp, R. B.	Journal of Tropical Pediatrics	1981	16	Farmers and Traders: Some Economic Determinants of Nutritional Status in Northern Ghana
	Tripp, R.	Human Organization	1985	14	Anthropology and On-Farm Research
	Singh, A. J.	Journal of Agricultural Economics	1990	10	Relative Variability in Wheat Yields Across Countries and Over Time
	Collinson, M. P.	Experimental Agriculture	1987	8	Farming Systems Research: Procedures for Technology Development
	Tripp, R. B.	Journal of Developing Areas	1982	7	Time Allocation in Northern Ghana: An Example of the Random Visit Method
	Dubin, H. J.	Plant Disease	1982	7	The CIMMYT's International Maize and Wheat Improvement Center International Approach to Breeding Disease-Resistant Wheat
	Byerlee, D.	Population Studies/CA Journal of Demography	1981	4	Factors Affecting Reliability in Age Estimation in Rural West-Africa: A Statistical Analysis
IFPRI	Krueger, A. O.	The World Bank Economic Review	1988	58	Agricultural Incentives in Developing Countries: Measuring the Effect of Sectoral and Economy-Wide Policies
	Mellor, J. W.	Journal of Economic Literature	1984	31	The World Food Equation: Interrelations Among Development, Employment, and Food Consumption
	Reardon, T.	World Development	1988	26	Coping with Household-Level Food Insecurity in Drought-Affected Areas of Burkina Faso
	Hazell, P. B. R.	American Journal of Agricultural Economics	1984	23	Sources of Increased Instability in Indian and United States Cereal Production
	Kennedy, E. T.	American Journal of Clinical Nutrition	1984	19	The Effect of Wic Supplemental Feeding on Birth Weight: A Case-Control Analysis
	Sahn, D.R.	Journal of Development Economics	1988	18	The Effects of Human Capital on Wages, and the Determinants of Labor Supply in a Developing Country

Appendix Table 1—Most cited ISI journal articles by institution, 1980–96 (continued)

Organization	First author	Journal	Year published	Total citations	Title of article
	Reardon, T.	Journal of Development Studies	1992	17	Determinants and Effects of Income Diversification Amongst Farm Households in Burkina Faso
	Gelb, A.	Economic Journal	1991	15	Public-Sector Employment, Rent Seeking, and Economic Growth
	Senauer, B.	American Journal of Agricultural Economics	1988	13	Determinants of the Intra-Household Allocation of Food in the Rural Philippines
	Rosegrant, M. W.	American Journal of Agricultural Economics	1981	13	Simulating the Impacts of Credit Policy and Fertilizer Subsidy on Central Luzon Rice Farms, the Philippines
	von Braun, J.	Economic Development and Cultural Change	1989	12	The Impact of New Crop Technology on the Agricultural Division of Labor in a West-African Setting
	Mellor, J. W.	Environment	1988	11	The Intertwining of Environmental Problems and Poverty
	Mellor, J. W.	Science	1987	11	Famine: Causes, Prevention, and Relief
	Lipton, M.	World Development	1988	10	The Place of Agricultural Research in the Development of Sub-Saharan Africa
	Bouis, H. E.	Journal of Development Economics	1992	10	Are Estimates of Calorie Income Elasticities Too High: A Recalibration of the Plausible Range
	von Braun, J.	World Development	1988	10	Effects of Technological Change in Agriculture on Food Consumption and Nutrition — Rice in a West-African Setting
	Alderman, H.	World Bank Research Observer	1995	9	Unitary Versus Collective Models of the Household: Is it Time to Shift the Burden of Proof
	Kennedy, E.	World Development	1992	9	Household Food Security and Child Nutrition: The Interaction of Income and Gender of Household Head
	Sahn, D. E.	World Development	1987	9	Changes in the Living Standards of the Poor in Sri Lanka during a Period of Macroeconomic Restructuring
	Lele, U.	Oxford Economic Papers-New Series	1981	9	Technological-Change, Distributive Bias and Labor Transfer in a Two-Sector Economy
	Valdes, A.	The World Bank Economic Review	1987	8	Agriculture in the Uruguay Round — Interests of Developing-countries
	Haddad, L. J.	Oxford Bulletin of Econ. and Statistics	1991	8	The Impact of Nutritional-Status on Agricultural Productivity — Wage Evidence from the Philippines
	Hazell, P. B. R.	Journal of Agricultural Economics	1985	8	Sources of Increased Variability in World Cereal Production Since the 1960s
	Delgado, C. L.	American Journal of Agricultural Economics	1982	8	Constraints on Oxen Cultivation in the Sahel
	Senauer, B.	American Journal of Agricultural Economics	1986	7	The Effect of the Value of Time on Food-Consumption Patterns in Developing-Countries — Evidence from Sri-lanka
	Sanders, J. H.	Economic Development and Cultural Change	1990	7	Developing New Agricultural Technologies for the Sahelian Countries: The Burkina Faso Case
	Mellor, J. W.	World Development	1988	7	Global Food Balances and Food Security

Appendix Table 1—Most cited ISI journal articles by institution, 1980–96 (continued)

Organization	First author	Journal	Year published	Total citations	Title of article
	Oram, P. A.	Environment	1988	7	Moving Toward Sustainability: Building the Agroecological Framework
	Sahn, D. E.	Economic Development and Cultural Change	1988	6	The Effect of Price and Income Changes on Food-Energy Intake in Sri-lanka
	Senauer, B.	American Journal of Agricultural Economics	1986	6	The Impact of Food Stamps on Food Expenditures: Rejection of the Traditional Model
	Delgado, C. L.	American Journal of Agricultural Economics	1986	6	A Variance-Components Approach to Food Grain Market Integration in Northern Nigeria
	Alderman, H.	Economic Development and Cultural Change	1994	6	Food Security and Health Security: Explaining the Levels of Nutritional-Status in Pakistan
	Alderman, H.	Journal of Development Economics	1987	6	Allocation of Goods Through Non-Price Mechanisms: Evidence on Distribution by Willingness to Wait
	Schiff, M.	Economic Development and Cultural Change	1990	5	Nutrition: Alternative Definitions and Policy Implications
	Haddad, L.	World Development	1994	5	Women's Income and Boy-Girl Anthropometric Status in the Côte d'Ivoire
	Lipton, M.	World Development	1989	5	Agriculture, Rural People, the State, and the Surplus in Some Asian Countries: Thoughts on Some Implications of Three Recent Approaches in Social Science
	Haddad, L.	Food Policy	1994	5	Choice of Indicators for Food Security and Nutrition Monitoring
	Rosegrant, M. W.	Australian Journal of Agricultural Economics	1985	5	The Effect of Fertilizer on Risk — A Heteroscedastic Production Function with Measurable Stochastic Inputs
	Kumar, S. K.	World Development	1988	5	Effect of Seasonal Food Shortage on Agricultural Production in Zambia
	Bouis, H. E.	Journal of Development Economics	1994	4	The Effect of Income on Demand for Food in Poor Countries — Are Our Food-Consumption Databases Giving Us Reliable Estimates
	Mellor, J. W.	Food Policy	1988	4	Food Policy, Food Aid, and Structural Adjustment Programs — The Context of Agricultural Development
	Babu, S. C.	Food Policy	1994	4	Household Food Security and Nutrition Monitoring: The Malawi Approach to Development Planning and Policy Interventions
	Mundlak, Y.	The World Bank Economic Review	1992	4	On the Transmission of World Agricultural Prices
	Koester, U.	Food Policy	1989	4	External Demand Constraints for Agricultural Exports — An Impediment to Structural Adjustment Policies in Sub-Saharan African Countries
	Imminck, M. D. C.	European Journal of Clinical Nutrition	1992	4	Body-Mass Index, Body-Composition and the Chronic Energy Deficiency Classification of Rural Adult Populations in Guatemala
	Stone, B.	China Quarterly	1988	4	Developments in Agricultural Technology
	Sabot, R.	Journal of Economics Perspectives	1991	4	Grade Inflation and Course Choice
	von Braun, J.	Food Policy	1990	4	Food in Sub-Saharan Africa: Trends and Policy Challenges for the 1990s
	Vosti, S. A.	Social Science and Medicine	1990	4	Malaria Among Gold Miners in Southern Para, Brazil: Estimates of Determinants and Individual Costs

Appendix Table 1—Most cited ISI journal articles by institution, 1980–96 (continued)

Organization	First author	Journal	Year published	Total citations	Title of article
	Mellor, J. W.	Food Policy	1986	4	The New Political-Economy of Food and Agricultural Development
	Adams, R. H.	World Development	1985	4	Development and Structural Change in Rural Egypt, 1952 to 1982
	Webb, P.	Disasters	1993	4	Coping with Drought and Food Insecurity in Ethiopia
IRRI	Swaminathan, M. S.	Science	1982	33	Biotechnology Research and Third-World Agriculture
	Otsuka, K.	Economic Development and Cultural Change	1988	25	Theories of Share Tenancy: A Critical Survey
	Chang, T. T.	Science	1984	18	Conservation of Rice Genetic-Resources: Luxury or Necessity
	Herd, R. W.	Economic Development and Cultural Change	1981	16	Modern Technology and Economic Efficiency of Philippine Rice Farmers
	Unnevehr, L. J.	American Journal of Agricultural Economics	1986	13	Consumer Demand for Rice Grain Quality and Returns to Research for Quality Improvement in Southeast Asia
	Ali, M.	American Journal of Agricultural Economics	1989	11	Profit Efficiency among Basmati Rice Producers in Pakistan Punjab
	Kalirajan, K.	Canadian Journal of Agricultural Economics	1981	8	An Econometric Analysis of Yield Variability in Paddy Production
	Lingard, J.	Journal of Agricultural Economics	1983	7	Comparative Efficiency of Rice Farms in Central Luzon, the Philippines
	Smith, J.	American Journal of Agricultural Economics	1985	6	Production Risk and Optimal Fertilizer Rates: A Random Coefficient Model
	Kalirajan, K.	American Journal of Agricultural Economics	1981	6	The Economic Efficiency of Farmers Growing High-Yielding, Irrigated Rice in India
	Fujisaka, S.	Agroforestry Systems	1989	5	The Need to Build on Farmer Practice and Knowledge: Reminders from Selected Upland Conservation Projects and Policies
	Shakya, P. B.	Journal of Agricultural Economics	1985	5	Adoption of Modern Varieties and Fertilizer Use on Rice in the Eastern Tarai of Nepal
	Otsuka, K.	Journal of Agricultural Economics	1991	4	Determinants and Consequences of Land Reform Implementation in the Philippines
	David, C. C.	Australian Journal of Agricultural Economics	1990	4	The Modern Seed-Fertilizer Technology and Adoption of Labor-Saving Technologies: The Philippine Case
	Ahammed, C. S.	Journal of Development Studies	1984	4	Measuring the Impact of Consumption Linkages on the Employment Effects of Mechanization in Philippine Rice Production
	Martorell, R.	Human Biology	1981	22	Maternal Stature, Fertility, and Infant Mortality
SFRI	Villar, J.	Pediatrics	1984	102	Heterogeneous Growth and Mental Development of Intrauterine Growth-Retarded Infants During the First Three Years of Life
	Ashton, B.	Population and Development Review	1984	43	Famine in China, 1958-61

Appendix Table 1—Most cited ISI journal articles by institution, 1980–96 (continued)

Organization	First author	Journal	Year published	Total citations	Title of article
	Kendall, C.	Social Science and Medicine	1984	36	Ethnomedicine and Oral Rehydration Therapy: A Case Study of Ethnomedical Investigation and Program Planning
	Mellor, J. W.	Journal of Economic Literature	1984	31	The World Food Equation: Interrelations Among Development, Employment, and Food Consumption
	Martorell, R.	Human Organization	1989	28	Body Size, Adaptation and Function
	Martorell, R.	American Journal of Clinical Nutrition	1984	28	Characteristics and Determinants of Child Nutritional Status in Nepal
	Kendall, C.	Human Organization	1983	22	Anthropology, Communications, and Health: The Mass Media and Health Practices Program in Honduras
	Mendoza, F. S.	JAMA Journal of American Medical Association	1991	21	Selected Measures of Health Status for Mexican-American, Mainland Puerto-Rican, and Cuban-American Children
	McCorkindale, C.	Journal of the American Dietetic Association	1990	19	Nutritional-Status of HIV-Infected Patients During the Early Disease Stages
	Murphy, S. P.	Journal of the American Dietetic Association	1990	18	An Evaluation of Food Group Intakes by Mexican-American Children
	Martorel, L. R.	Pediatrics	1989	18	Genetic and Environmental Determinants of Growth in Mexican Americans
	Wright, B. D.	Journal of Futures Markets	1989	17	A Theory of Negative Prices for Storage
	Merchant, K.	Progress in Food And Nutrition Science	1988	17	Frequent Reproductive Cycling: Does It Lead to Nutritional Depletion of Mothers
	Martorell, R.	Human Biology	1988	17	Body Proportions in Three Ethnic Groups: Children and Youths 2-17 Years in Nhanes-ii and Hhanes
	Martorell, R.	Yearbook of Physical Anthropology	1987	17	Maternal Nutrition and Birth-Weight
	Merchant, K.	American Journal of Clinical Nutrition	1990	16	Maternal and Fetal Responses to the Stresses of Lactation Concurrent with Pregnancy and of Short Recuperative Intervals
	John, A. M.	Population Studies: A Journal of Demography	1987	15	The Effects of Breastfeeding and Nutrition on Fecundability in Rural Bangladesh: A Hazards-Model Analysis
	Malina, R. M.	Yearbook of Physical Anthropology	1986	14	Growth Status of Mexican-American Children and Youths: Historical Trends and Contemporary Issues
	Delgado, H.	Nutrition Research	1982	14	Nutrition and Length of Gestation
	Valverde, V.	Ecology of Food and Nutrition	1981	11	Income and Growth Retardation in Poor Families with Similar Living Conditions in Rural Guatemala
	Merchant, K.	American Journal of Clinical Nutrition	1990	10	Consequences for Maternal Nutrition of Reproductive Stress Across Consecutive Pregnancies
	John, A. M.	American Journal of Clinical Nutrition	1989	10	Incidence and Duration of Breast-Feeding in Mexican-American Infants, 1970-1982
	Goldman, N.	Demography	1981	10	Dissolution of the First Unions in Colombia, Panama, and Peru

Appendix Table 1—Most cited ISI journal articles by institution, 1980–96 (continued)

Organization	First author	Journal	Year published	Total citations	Title of article
	Fafchamps, M.	Econometrica	1993	9	Sequential Labor Decisions Under Uncertainty — An Estimable Household Model of West-African Farmers
	Fafchamps, M.	American Journal of Agricultural Economics	1992	9	Cash Crop Production, Food Price Volatility, and Rural Market Integration in the Third World
	Zemanian, A. H.	IEEE Transactions on Electron Devices	1988	8	A Finite-Difference Procedure for the Exterior Problem Inherent in Capacitance Computations for Vlsi Interconnections
	Mears, L. A.	Bulletin of Indonesian Economic Studies	1984	8	Rice and Food Self Sufficiency in Indonesia
	Falcon, W. P.	American Journal of Agricultural Economics	1984	7	Recent Food Policy Lessons from Developing Countries
	Coale, A. J.	Demography	1985	7	Calculation of Age-Specific Fertility Schedules from Tabulations of Parity in Two Censuses
	John, A. M.	Population Studies: A Journal of Demography	1988	7	Estimating the Distribution of Interval Length: Current Status and Retrospective History Data
	John, A. M.	Human Biology	1988	6	Lactation and the Waiting Time to Conception: An Application of Hazard Models
	Scherr, S. J.	World Development	1989	6	Agriculture in an Export Boom Economy: a Comparative Analysis of Policy and Performance in Indonesia, Mexico, and Nigeria
	Arthur, W. B.	Demography	1982	6	The Ergodic Theorems of Demography: A Simple Proof
	Goldman, N.	Social Biology	1981	6	Legalization of Consensual Unions in Latin America
	Arthur, W. B.	Population and Development Review	1988	5	Immigration Policy and Immigrants Ages
	Tangermann, S.	World Economy	1987	5	Multilateral Negotiations on Farm-Support Levels
	Ewbank, D. C.	Population Studies: A Journal of Demography	1982	5	The Sources of Error in Brass Method for Estimating Child Survival: The Case of Bangladesh
	Rozelle, S.	Journal of Comparative Economics	1994	4	Rural Industrialization and Increasing Inequality: Emerging Patterns in China Reforming Economy
	Ye, Q. L.	Canadian Journal of Agricultural Economics	1994	4	Fertilizer Demand in China Reforming Economy
	Jones, W. O.	Journal of Modern African Studies	1987	4	Food-Crop Marketing Boards in Tropical Africa
	Nelson, K. J.	Journal of the American Dietetic Association	1993	4	Prevalence of Malnutrition in the Elderly Admitted to Long-term Care Facilities
	Hobcraft, J. N.	Population Studies: A Journal of Demography	1982	4	Advances in the P F Ratio Method for the Analysis of Birth Histories
	Lau, L. J.	Journal of Policy Modeling	1981	4	The Microeconomics of Distribution: a Simulation of the Farm Economy
	Chinn, D. L.	China Quarterly	1980	4	Basic Commodity Distribution in the Peoples Republic of China

Source: Compiled by authors using tabulations from CHI Research (January 1998).

Note: Table includes ISI journals receiving a total of four or more citations.

Appendix Table 2—Number of IFPRI publications in ISI journals by field of science

Journals by field of science	Publications (count)
Agricultural economics and policy	
Food Policy	52
American Journal of Agricultural Economics	42
Journal of Agricultural Economics	15
Canadian Journal of Agricultural Economics	6
Agricultural Administration and Extension	3
Agricultural Administration	3
Agriculture	
Agricultural System	11
Outlook on Agriculture	5
Experimental Agriculture	3
Agronomy Journal	3
Agriculture, dairy and animal science	
Outlook on Agriculture	5
Agriculture, soil science	
Journal of Soil and Water Conservation	1
Anthropology	
Human Organization	5
Journal of Peasant Studies	2
American Journal of Human Biology	2
Yearbook of Physical Anthropology	1
Anthropological Quarterly	1
Archaeology	
International Journal of Nautical Archaeology	1
AREA studies	
Economic Development and Cultural Change	19
Journal of Developing Areas	4
China Quarterly	4
Journal of Contemporary Asia	3
IDS Bulletin-Institute of Development Studies	3
Journal of Southeast Asian Studies	1
China Journal	1
Journal of Modern African Studies	1
Biology	
Human Biology	2
Biology, miscellaneous	
Yearbook of Physical Anthropology	1
Business	
Journal of Environmental Economics and Management	3

Journals by field of science	Publications (count)
Technological Forecasting and Social Change	1
Business, finance	
World Bank Economic Review	5
World Economy	5
International Monetary Fund Staff Papers	1
Journal of Futures Markets	1
Population Studies: A Journal of Demography	6
Demography	
Population and Development Review	2
International Migration	2
Demography	2
Social Biology	1
Studies in Family Planning	1
Ecology	
Wildlife Research	1
Journal of Soil and Water Conservation	1
Economics	
Food Policy	52
American Journal of Agricultural Economics	42
World Development	38
Economic Development and Cultural Change	19
Journal of Agricultural Economics	15
Australian Journal of Agricultural Economics	13
Journal of Development Economics	13
Developing Economies	6
Canadian Journal of Agricultural Economics/Revue Canadienne D'Economie Rurale	6
World Bank Economic Review	5
World Economy	5
Journal of Comparative Economics	4
Journal of Developing Areas	4
Journal of Environmental Economics and Management	3
Oxford Bulletin of Economics and Statistics	3
World Bank Research Observer	3
Journal of Economic Perspectives	2
Journal of Policy Modeling	2
Oxford Economic Papers - New Series	2
Bulletin of Indonesian Economic Studies	2
Weltwirtschaftliches Archiv/Review of World Economics	2
Economic Journal	1
Journal of Economic Literature	1
Journal of Health Economics	1

Journals by field of science	Publications (count)
Trimestre Economico	1
Singapore Economic Review	1
Journal of the Japanese and International Economies	1
Journal of Economic Behavior and Organization	1
Hitosubashi Journal of Economics	1
Economic Record	1
Economic Geography	1
China Economic Review	1
Journal of Business and Economic Statistics	1
Applied Economics	1
Energy Economics	1
Engineering, chemical	
Chemical and Engineering News	1
Engineering, electrical and electronic	
IEEE Transactions on Electron Devices	1
Engineering, industrial	
Issues in Science and Technology	1
Environmental science	
Environment	4
Water Resources Research	1
Journal of Environmental Management	1
Environmental Conservation	1
Environmental studies	
Energy Policy	3
Journal of Environmental Economics And Management	3
Journal of Regional Science	1
Land Use Policy	1
Resources Policy	1
Family studies	
Studies in Family Planning	1
Food science and technology	
Food Policy	52
Food Technology	1
Food Reviews International	1
Genetics and heredity	
Human Biology	2
Geography	
Geographical Journal	2
Economic Geography	1
Health policy and services	
Journal of Health Economics	1

Journals by field of science	Publications (count)
Health Policy and Planning	1
History	
Journal of Southeast Asian Studies	1
Industrial relations and labor	
International Labour Review	1
Information science and library science	
Journal of Documentation	1
Bulletin of the Medical Library Association	1
Journal of Documentation	1
Scholarly Publishing	1
International relations	
Weltwirtschaftliches Archiv/Review of World Economics	2
Foreign Affairs	1
Journal of the Japanese and International Economies	1
Security Dialogue	1
Studies in Comparative International Development	1
Limnology	
Water Resources Research	1
Management	
Journal of Forecasting	1
Mathematical methods, biology and medicine	
Current Contents/Agriculture Biology and Environmental Science	2
Biometrika	1
Mathematical methods, social science	
Oxford Bulletin of Economics and Statistics	3
Medicine, general and internal	
JAMA - Journal of the American Medical Association	1
Multidisciplinary science	
Impact of Science on Society	1
Science	4
Research and Exploration	3
Current Contente/Agriculture Biology and Environmental Science	2
Issues in Science and Technology	1
Nutrition and dietetics	
Food Policy	52
American Journal of Clinical Nutrition	6
Ecology of Food and Nutrition	3
European Journal of Clinical Nutrition	2
Food Reviews International	1
Journal of Nutrition	1
Nutrition Reviews	1

Journals by field of science	Publications (count)
Journal of the American Dietetic Association	1
Pediatrics	
Pediatrics	2
Journal of Tropical Pediatrics	1
Physics, applied	
IEEE Transactions on Electron Devices	1
Planning and development	
World Development	38
Economic Development and Cultural Change	19
Journal of Development Studies	14
Developing Economies	6
Journal of Developing Areas	4
Disasters	4
IDS Bulletin - Institute of Development Studies	3
World Bank Research Observer	3
Development and Change	2
Journal of Forecasting	1
Journal of Regional Science	1
Technological Forecasting and Social Change	1
Third World Quarterly	1
Futures	1
Plant science	
Plant Disease	1
Political science	
Journal of Developing Areas	4
Studies in Comparative International Development	1
Public, environmental and occupational health	
Social Science and Medicine	2
Social issues	
Issues in Science and Technology	1
Impact of Science on Society	1
Social science, biomedical	
Social Science and Medicine	2
Social Biology	1
Social science, interdisciplinary	
Human Organization	5
Current Contents/Agriculture Biology and Environmental Science	2
Interdisciplinary Science Reviews	1
Jahrbuch Fur Sozial Wissenschaft	1
Social science, mathematical methods	
Oxford Bulletin of Economics and Statistics	3

Journals by field of science	Publications (count)
Journal of Business and Economic Statistics	1
Sociology	
Rural Sociology	1
Statistics and probability	
Journal of the Royal Statistical Society Series B-Methodological	4
Oxford Bulletin of Economics and Statistics	3
Journal of the American Statistical Association	2
Statistics in Medicine	1
Biometrika	1
Tropical medicine	
Journal of Tropical Pediatrics	1
Water resources	
Water Resources Research	1
Journal of Soil and Water Conservation	1
Zoology	
Wildlife Research	1
No category	
Diversity	
Agricultural Economics	
CGIAR Study Papers	
System Approaches for Sustainable Agricultural Development	
Agro-Forestry System	
Current Plant Science and Biotechnology in Agriculture	
Journal of Sustainable Agriculture	
Agricultural Policy Proceedings	
Wool Technology and Sheep Breeding	
Water International	
Small Ruminants Research	
Illinois Research	
UNESCO Courier	
Oleagineux	
International Environmental Affairs	
Geo Journal Library	
Environment and Policy	
Development Oriented Research in Agriculture	
Annual World Bank Conference on Development Economics	
ASA Special Publication	

Source: CHI Research, Institute of Scientific Information (January 1998).

Note: Fields of science are assigned by the Institute for Scientific Information to each journal. A journal may appear in more than one field. For example, the American Journal of Agricultural Economics is listed in both "agricultural economics and policy" and "economics." The fields are assigned by ISI to aid searches based on subject matter.

Appendix Table 3—Institutional coauthorship in ISI journals, 1980–96

	IFPRI	CIMMYT	IRRI	SFRI
	(count)			
World Bank	18	2	2	1
University of Minnesota	11	–	1	–
Cornell University	10	2	–	4
Oxford University	8	–	–	–
IRRI	7	–	–	–
SFRI	5	–	–	–
Michigan State University	5	–	2	–
Virginia Polytechnic Institute and State	4	–	–	–
University of Chicago	4	–	–	–
Williams College	4	–	–	–
University California, Davis	4	–	–	–
Institute of Nutrition in Central America and Panama	4	–	–	1
International Monetary Fund	4	–	–	–
University of Malawi	3	–	–	–
China National Rice Research Institute	3	–	–	4
CIMMYT	3	–	–	–
Tokyo Metropolitan University	3	–	8	–
University of Warwick	3	–	–	–
Consortium International of Earth Science Information	2	–	–	–
North Carolina State University	2	–	–	–
Northwestern University	2	–	–	–
Ew Resource System Institute	2	–	–	–
Mississippi State University	2	–	–	–
Christian Albrechts University Kiel	2	–	–	–
Tokyo Gakugei University	2	–	–	–
Iowa State University of Science and Technology	2	5	–	–
Department of Agricultural Economics	2	–	–	–
International Livestock Central Africa	2	–	–	–
University of California, Berkeley	2	–	–	3
Planning Commission	2	–	–	–
Swiss Federation Institutes of Technology	2	–	–	–
GATT	2	–	–	–
Colorado State University	2	–	1	–
Purdue University	2	–	–	–
Yale University	2	–	–	–

	IFPRI	CIMMYT	IRRI	SFRI
		(count)		
University of New England	2	-	3	-
Stewart Associates	2	-	-	-
George Washington University	2	-	-	-
Inter-American Institute of Agricultural Sciences	2	-	-	-
International Crop Research Institute Semi Arid Tropic	2	-	-	-
University of Detroit	2	-	-	-
University of Wisconsin	2	-	-	-
Gilmore International Consulting	2	-	-	-
University of Maryland	2	3	-	-
University of Kiel	2	-	-	-
National Public Health Institute	2	-	-	-
Harvard University	2	-	-	1
Tufts University	1	-	-	-
Emory University	1	-	-	-
Bunda College of Agriculture	1	1	-	-
Duke University	1	-	-	-
Department and Lab Economic Theory and Application	1	-	-	-
Kiel Institute of World Economy	1	-	-	-
University of Colorado	1	-	-	-
University of Hawaii	1	1	-	-
Zagazig University	1	-	-	-
International Service for National Agricultural Research	1	-	-	-
International Crops Research Institute Semi-Arid Tropics	1	-	-	-
National Bureau of Economic Research	1	-	-	-
Jomo Kenyatta University	1	-	-	-
Stanford University	1	-	-	9
Howard Darby and Levin	1	-	-	-
Food Research Institute	1	-	-	-
University of the Philippines	1	-	-	-
PAHO	1	-	-	-
University of Massachusetts	1	-	-	-
U.S. Agency for International Development	1	-	-	-
National Institute of Public Health	1	-	-	-
International Potato Center	1	-	-	-
Ohio State University	1	-	1	-
University of Houston	1	-	-	-
West Africa Rice Development Association	1	-	-	-

	IFPRI	CIMMYT	IRRI	SFRI
		(count)		
Institute of Weltwirtschaft	1	-	-	-
University of Alberta	1	-	-	-
Other	2	30	37	39

Source: Compiled by authors with data from CHI Research, Institute of Scientific Information (January 1998).

Philip Pardey is a senior research fellow at IFPRI, and a professor in the Department of Applied Economics, University of Minnesota. At the time of writing this report, Jason Christian was a research agricultural economist in the Department of Agricultural and Resource Economics at the University of California, Davis.

