

International Conference on Impacts of
Agricultural Research and Development:

Why has Impact Assessment Research not Made More of a Difference?

Proceedings of a conference organized by the

Standing Panel on Impact Assessment (SPIA) of
the Interim Science Council, Consultative Group
on International Agricultural Research (CGIAR)

and

The Economics Program, The International Maize
and Wheat Improvement Center (CIMMYT)

4-7 February 2002
Tryp Corobici Hotel, San José,
Costa Rica

David J. Watson, editor



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CIMMYT® (www.cimmyt.org) is an internationally funded, nonprofit, scientific research and training organization. Headquartered in Mexico, CIMMYT works with agricultural research institutions worldwide to improve the productivity, profitability, and sustainability of maize and wheat systems for poor farmers in developing countries. It is one of 16 food and environmental organizations known as the Future Harvest Centers. Located around the world, the Future Harvest Centers conduct research in partnership with farmers, scientists, and policymakers to help alleviate poverty and increase food security while protecting natural resources. The centers are supported by the Consultative Group on International Agricultural Research (CGIAR) (www.cgiar.org), whose members include nearly 60 countries, private foundations, and regional and international organizations. Financial support for CIMMYT's research agenda also comes from many other sources, including foundations, development banks, and public and private agencies.

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Abstract: This document contains the proceedings of an international conference on impact assessment research held in San José, Costa Rica, from 4-7 February 2002. Co-organized by the Economics Program of the International Maize and Wheat Improvement Center (CIMMYT) and the Standing Panel on Impact Assessment (SPIA) of the Consultative Group on International Agricultural Research (CGIAR), the conference was attended by approximately 150 impact assessment practitioners and users. Participants included representatives from CGIAR Centers, national agricultural research organizations, public and private universities, multilateral lending organizations, development assistance agencies, non-governmental organizations (NGOs), philanthropic foundations, private corporations, and the media. The goal of the conference was to examine why many impact assessment studies have had limited influence on the way that agricultural research is conducted and have failed to ensure adequate and sustainable financial support for research. Participants concluded that the success of future impact assessment studies could be improved by: (1) better matching impact assessment results to the needs of decision makers; (2) making impact assessments more credible and more understandable, without losing rigor; and (3) improving methods for assessing a broader array of impacts, beyond traditional economic measures.

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Foreword

This document reports on the outcome of an international conference on impact assessment in agricultural research. The conference, which took place in Costa Rica in February of 2002, was co-organized by the Standing Panel on Impact Assessment (SPIA), which is part of the interim Science Council of the Consultative Group on International Agricultural Research (CGIAR), in collaboration with the Economics Program of the International Maize and Wheat Improvement Center (CIMMYT).

In recent years, the CGIAR and other agricultural research organizations have confronted two closely related problems. First, concern is growing within the donor community relating to the effectiveness of existing impact assessment research in guiding international agricultural research and technology transfer. Second, donor support for agricultural research is declining, despite the credible assessments showing that investment in this area indeed has had high returns. In response to these problems, SPIA convened a workshop in Rome in May, 2000, on the theme “The future of impact assessment in the CGIAR: Needs, constraints and options” (for a summary proceedings from the Rome workshop, see TAC 2001). The objective of the workshop, which was attended by representatives of all 16 CGIAR centers, was to improve the efficiency and effectiveness of impact assessment research within the CGIAR.

The idea for the 2002 Costa Rica conference emerged from the 2000 Rome workshop. In addition to scientists from the CGIAR centers, the Rome workshop was attended by key representatives from the donor community, a number of whom suggested that the CGIAR needed to spend more time and effort addressing the question, “Why has the great volume of

credible, positive impact assessment research not made more of a difference in terms of decision making—both at the center level in terms of program reformulation and at the donor level in terms of bolstering support/resources for agricultural research?” A follow-up conference on that theme subsequently was proposed by the then head of the CIMMYT Economics Program, Prabhu Pingali.

The Costa Rica conference was attended by 145 persons, including a variety of experts in impact assessment and evaluation research, representatives from 15 CGIAR centers, many national research organizations, public and private universities, multilateral lending organizations, development assistance agencies, NGOs, philanthropic foundations, private corporations, and the media. The interactions and debates among the participants were productive and at times heated, reflecting the different perspectives, backgrounds, and experiences of those in attendance.

Progress in designing and implementing impact assessment research, and in increasing the usefulness of such research, requires close and sustained interaction between the professionals who do the research and those who use the results as an input into decision making. It is the belief of the co-organizers of the Costa Rica conference that the conference succeeded in fostering such interaction. However, what was achieved in Costa Rica was only a beginning. SPIA, CIMMYT and the rest of the CGIAR centers believe that the CGIAR system – its sponsors, management, scientific advisors and clients – must continue the interaction and the debate. In that regard, the organizers would welcome any comments or suggestions from conference attendees and those others who read these proceedings.

*Hans Gregersen, Chair
SPIA, interim Science Council*

*Michael Morris
Director, CIMMYT Economics Program*

Abbreviations and Acronyms

ADB	Asian Development Bank
ASARECA	Association for Strengthening Agricultural Research in Eastern and Central Africa
AVRDC	Asian Vegetable Research and Development Center
BGMV	Bean golden mosaic virus
CGIAR	Consultative Group for International Agricultural Research
CIAT	Centro Internacional de Agricultura Tropical
CIFOR	Center for International Forestry Research
CIMMYT	International Maize and Wheat Improvement Center
CIP	Centro Internacional de la Papa
CONICET	National Research Council of Science and Technology of Argentina
CRSP	Collaborative Research Support Project
DICTA	Dirección de Ciencia y Tecnología Agropecuaria, Honduras
EMBRAPA	Empresa Brasileira de Pesquisa Agropecuaria
GIS	Geographic information system
GMO	Genetically modified organism
GRENEWECA	Genetic Resources Network of West and Central Africa
GTZ	Deutsche Gesellschaft Fur Technische Zusammenarbeit
HYV	High-yielding variety
IBSRAM	International Board for Soil Research and Management
ICAR	Indian Council of Agricultural Research
ICARDA	International Center for Agricultural Research in the Dry Areas
ICLARM	International Center for Living Aquatic Resources Management
ICRAF	International Centre for Research in Agroforestry
ICRISAT	International Crops Research Institute for the Semi-Arid Tropics
IDRC	International Development Research Centre
IDS	Institute of Development Studies, UK
IFAD	International Fund for Agricultural Development
IFDC	International Fertilizer Development Center, USA
IFPRI	International Food Policy Research Institute
IITA	International Institute of Tropical Agriculture
ILRI	International Livestock Research Institute
INRM	Integrated Natural Resource Management
INTA	Instituto Nacional de Tecnología Agrícola (Argentina)
IPGRI	International Plant Genetic Resources Institute
IPM	Integrated pest management
IRRI	International Rice Research Institute
iSC	interim Science Council of the CGIAR
ISNAR	International Service for National Agricultural Research
IWMI	International Water Management Institute
KARI	Kenyan Agricultural Research Institute
MV	Modern variety
NARS	National agricultural research system
NCAP	National Centre for Agricultural Economics & Policy Research, ICAR, India
OPV	Open pollinated variety
PCARRD	Philippine Council for Agriculture, Forestry and Natural Resources Research and Development
PGRC	Plant Genetic Resources Center, Ghana
PRM	Programa Regional de Maíz para Centroamérica y el Caribe
PROFRIJOL	The Central American Bean Network (supported by SDC)
SDC	Swiss Agency for Development and Cooperation
USAID	United States Agency for International Development
USDA/ARS	United States Department of Agriculture / Agricultural Research Service
WARDA	West Africa Rice Development Association

Executive Summary

The CGIAR is an informal association of 58 public and private sector members that supports 16 international agricultural research centers known as Future Harvest Centers. CIMMYT is a Future Harvest Center. The Future Harvest Centers share a mandate to increase agricultural productivity in developing countries, alleviate poverty, and enhance the sustainability of the natural resource base. Successful achievement of this mandate depends on the ability of the Centers to identify appropriate research priorities, effectively manage ongoing research, account for resources invested in research and development activities, and build and maintain public support for international agricultural research. Effective impact assessment should play a key role in achieving the above. The conference reported herein was organized to enhance the effectiveness of CGIAR impact assessment efforts. Specific objectives included:

1. Providing a forum for publicizing “best practices” in impact assessment research and for disseminating results of recent impact assessment research.
2. Fostering dialogue between impact assessment practitioners, both within the CGIAR and throughout the larger research and development communities.
3. Demonstrating to donors that Future Harvest Centers are committed to organizational learning.

The program included invited and contributed papers sessions, panel presentations, free discussion sessions, and poster sessions. Participants highlighted experiences and case studies of impact measurement in agricultural productivity; equity, poverty, social health, and nutrition; the environment; and institutions and human capital. Participants also described novel approaches for assessing hard-to-measure impacts in such areas as training and capacity-building, institutional strengthening, networking, participatory research, and policy research. Many presentations, focusing principally on non-conventional approaches, analyzed the factors constraining the effective use of impact assessments research. Critical insights were gained regarding the design, process and use of impact assessment studies. Discussion also took place between those practitioners conducting impacts research and the

potential users of such information. This included representatives from the donor community, the media, national research systems, NGOs and those involved in research prioritization in the CGIAR. Insights were gained regarding how to improve the effectiveness of impact assessment results, particularly applying those results to research priority setting. Extensive discussions took place between impact assessment practitioners and representatives of the media and donor communities regarding the most appropriate ways to build and maintain public support for international agricultural research.

Major ideas for improving the success of future impact assessment studies included the following points: (1) better matching impact assessment results to the needs of decision makers; (2) making impact assessments more credible and more understandable, without losing rigor; and (3) improving methods for assessing a broader array of impacts, beyond traditional economic measures. To achieve the above, participants suggested diverse actions, among them: interacting more frequently with the impact assessment users; communicating with decision makers about findings and their possible implications; going beyond a cost-benefit framework to provide richer information on the factors influencing impacts; effectively publicizing and disseminating results; recognizing that attribution may not always be important; not limiting studies to success stories; establishing credible counterfactuals for transparency and plausibility purposes; fully institutionalizing impact assessment; and formulating a set of principles and strategic guidelines for future, ex-post impact assessment in the CGIAR.

To sustain the momentum generated during the conference, SPIA and CIMMYT planned to pursue the following activities. Work on several aspects is already under way:

Conference website. The conference website would be maintained through the end of 2002, and would be updated with additional abstracts and links to all papers received. The complete list of conference participants will be posted, including names, institutional affiliations, and contact information.

Publications. The conference program committee concluded that a conventional proceedings volume containing all 75 papers presented at the conference would not attract a great deal of attention. Therefore, efforts have been made to publish several themed collections of conference papers targeted at specific groups of users. The program committee has reviewed all conference papers and assembled several sets grouped around four themes: (1) assessing the impacts of agricultural research; (2) impacts of agricultural research—theory and evidence; (3) learning by doing—innovative approaches to evaluating agricultural research; (4) returns to investment in plant genetic resource conservation and crop improvement research. The themed collections have been submitted to professional journals for publication as special issues. A list of those published to date follows this summary.

Impact assessment website. An impact assessment website is being created. The aim is to provide a user-friendly portal to an extensive collection of information of potential interest to the impact assessment community worldwide. It will include a bibliographic database of impact assessment literature; links to the full text of selected impact assessment documents; capsule summaries containing non-technical information about impact assessment concepts, methods and results that could be used for public awareness messages; a searchable database containing a range of research impacts indicators; information about how to access other on-line databases containing information of relevance to impact assessment research; a photo gallery of downloadable images related to impact assessment case studies; and facilities for electronic conferencing and on-line discussions. Much initial work has been done on several of the above components. Completion and full implementation of the website will depend on the availability of additional resources.

Conference Papers Published to Date

Quarterly Journal of International Agriculture, vol. 42 (2003), No. 2 Assessing the Impact of Agricultural Research: Theory and Evidence

Assessing the impact of agriculture research: An introduction

Prabhu Pingali and Michael Morris

Assessing the impact of agriculture research: An overview

Michael Morris, Prabhu Pingali, Hans Gregersen, and Tim Kelley

Assessing the impact of agricultural research on poverty and livelihoods

Michelle Adato and Ruth Meinzen-Dick

Enhancing the role of spatial analysis in strategic impact assessment: Improving data resolution for regional studies

Stanley Wood and Jordan Chamberlin

The tradeoff approach: Lessons from Ecuador and Peru

John Antle Bozeman, Jetse Stoorvogel, Water Bowen, Charles Crissman, and David Yanggen

Measuring the benefits of international agricultural economics research

David E. Schimmelpfennig and George W. Norton

Special issue of Agricultural Economics, forthcoming in 2003

Returns to investment in plant genetic resource conservation and crop improvement research

Part 1. Concepts and methods

Estimating the benefits of plant breeding research: Methodological issues and practical challenges

Michael Morris and Paul Heisey

The economic impact of productivity maintenance research: Breeding for leaf rust resistance in modern wheat

Carissa Marasas, Melinda Smale, and Ravi Singh

Part 2. Economics of genetic resource conservation

The economic costs and benefits of a participatory project to conserve maize landraces on farms in Oaxaca, Mexico

Melinda Smale, Mauricio Bellon, Javier Aguirre, Jorge Mendoza, Ana Maria Solano, Rafael Martinez, and Alejandro Ramirez

The distribution of benefits from public international germplasm banks: The case of beans in Latin America

Nancy Johnson, Doug Pachico, and Osvaldo Voysest

Saving seeds: The cost of conserving genetic resources at the CGIAR centres

Bonwoo Koo, Philip Pardey, and Brian Wright

Part 3. Factors affecting the adoption of modern varieties

Adoption of improved maize varieties in the hills of Nepal

Joel Ransom, Kamal Paudyal, and Krishna Adhikari

Variety characteristics and maize adoption in Honduras

Hernando Hintze, Mitch Renkow, and Gustavo Saín

The roles of public sector vs. private sector in R&D and technology generation: the case of maize in Asia

Roberta Gerpacio

Part 4. Distributional impacts of plant breeding research

Welfare effects of maize technologies in marginal and high potential regions of Kenya

Daniel Karanja, Mitch Renkow, and Eric Crawford

The economic impact of bean disease resistance research in Honduras

David Mather, Richard Bernsten, Juan Carlos Rosas, Aberlardo Viana, Danilo Escoto, and Julio Martinez

Is research on marginal lands catching up? The case of unfavourable wheat growing environments

Maximina Lantican, Prabhu Pingali, and Sanjaya Rajaram

Special issue of Agricultural Systems, forthcoming in 2003
Learning for the Future: Innovative Approaches to Evaluating Agricultural Research

Foreword *Peter Matlon*

Learning for the future: Using evaluation to enhance organizational learning and improve performance

Douglas Horton and Ronald Mackay

Expanding the use of impact assessment and evaluation in agricultural research and development

Ronald Mackay and Douglas Horton

Why impact analysis should not be used for research evaluation and what the alternatives are

Javier Ekboir

Disciplines, institutions and organizations: Impact assessments in context

Rajeswari S. Raina

From measuring impact to learning institutional lessons: an innovation systems perspective on improving the management of international agricultural research

A.J. Hall, V. Rasheed Sulaiman, N.G. Clark, and B. Yoganand

Impact pathway evaluation: an approach for achieving and attributing impact in complex systems

Boru Douthwaite, Thomas Kuby, Elske van de Fliert, and Steffen Schulz

Using impact pathway analysis to strengthen the impact orientation of agricultural research

Andreas Springer-Heinze, Frank Hartwich, J. Simon Henderson, Douglas Horton and Isaac Minde

Measuring the impact of user participation in agricultural and natural resource management research

Nancy Johnson, Nina Lilja, and Jacqueline A. Ashby

An analysis of IPGRI's influence on the International Treaty on Plant Genetic Resources for Food and Agriculture

Raphaël Sauvé and Jamie Watts

EIARD views on impact assessment and evaluation in agricultural research for development

European Initiative For Agricultural Research For Development (EIARD)

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Conference Program



“Why has impact assessment research not made more of a difference?”

Monday, February 4, 2002

Opening Session

Chairperson: Hans Gregersen (SPIA)

Opening address

New science brings hope for people and the environment
Timothy Reeves (CIMMYT)

Keynote speech

Impact assessment: Why should we care?
Alex McCalla (University of California at Davis)

Plenary Paper Session 1

Impact Assessment in the CGIAR: The Road Traveled

Chairperson: Edgardo Moscardi (IADB)

PI 1.1 Milestones in CGIAR impact assessment research

Prabhu Pingali (CIMMYT)

PI 1.2 Assessing the impacts of international crop genetic improvement research: Some lessons learned

Robert Evenson (Yale University) and Douglas Gollin (Williams College)

Contributed Papers Session 1

Measuring Research Impacts: Quantitative Methods

Chairperson: Richard Bernsten (Michigan State University)

C1.1 The simple econometrics of impact assessment: Theory with an application to milk-market participation in the Ethiopian highlands

Garth Holloway (ILRI) and Simeon Ehui (ILRI)

C1.2 Measurement and source of efficiency in Argentina's agricultural science research system: A stochastic frontier analysis

Daniel Lema (INTA), Susana Mirassou (INTA), and Martin Guppy (INTA)

C1.3 The Tradeoff Analysis Approach: Lessons from the tradeoffs project in Ecuador and Peru

John Antle (Montana State University), Jetse Stoorvogel (University of Wageningen), Walter Bowen (CIP, IFDC), Charles Crissman (CIP), and David Yanggen (CIP, Montana State University)

Contributed Papers Session 2

Factors Affecting Adoption of Modern Varieties

Chairperson: Erika Meng (CIMMYT)

C2.1 Factors affecting the adoption of maize technologies in the hills of Nepal

Joel Ransom, Kamal Paudyal, and Krishna Adhikari (CIMMYT)

C2.2 Variety characteristics, transaction costs and maize adoption in Honduras

Hernando Hintze and Mitch Renkow (North Carolina State University); and Gustavo Saín (CIMMYT)

C2.3 Factors affecting the adoption of selected wheat production technologies by farmers in Njoro and Rongai divisions of Nakuru District, Kenya

Alice Ndiema and M.G. Kinyua (NPBRC); and W.N. Ongo'ndo (Egerton University)

Contributed Papers Session 3 Increasing Impacts of Agricultural R&D: Institutional and Political Considerations

Chairperson: Patricia Kristjanson (ILRI)

- C3.1 Expanding the use of impact assessment and other evaluation research evidence
Ron Mackay (Concordia University) and Doug Horton (ISNAR)
- C3.2 Why does impact assessment continue to neglect institutional sustainability?
Daniel Ticehurst, Simon Henderson, and Alistair Sutherland (NRI)

- C3.3 Demand driven technological change and the traditional cereals in sub-Saharan Africa: The Malian case
Jeff Vitale (Purdue University) and John Sanders (Texas A&M University)

- C3.4 An assessment of IPGRI's impact on international policy-making: A case study of the international undertaking on plant genetic resource (1996-2001)
Raphaël Sauvé and Jamie Watts (IPGRI)

Discussion Session 1: Donor Perspectives

One important group of users of impact assessment studies are the people who make decisions about the allocation of research funding. Funding agencies increasingly demand accountability from researchers, usually including concrete evidence that investments in research are paying off. In this session, a panel of donor agency representatives describes the types of information that funding agencies need to make research-funding decisions. The panel will then engage the audience in a discussion designed to explore how results of impacts studies can be more effectively communicated to inform the various constituencies that influence funding for research and development.

Chairperson: Jim Ryan (Australian National University)
Panelists: Stephan Krall (GTZ), Rodney Cooke (IFAD), Dana Dalrymple (USAID)

Tuesday, February 5, 2002

Plenary Paper Session 2 Measuring Returns to Research Investment

Chairperson: Mahabub Hossain (IRRI)

- PI 2.1 Under investment in agricultural R&D revisited
Johannes Roseboom (ISNAR)
- PI 2.2 The impact of agricultural research in Bangladesh: Productivity, economic returns and varietal replacement issues
Joseph Nagy (Consultant) and Ferdous Alam (Bangladesh Agricultural University)
- PI 2.3 Herding cats: Is impact assessment the ultimate exercise in futility?
Patricia Kristjanson and Philip Thornton (ILRI)

- PI 2.3 Herding cats: Is impact assessment the ultimate exercise in futility?
Patricia Kristjanson (ILRI) and Philip Thornton (ILRI)

Panel Session 1 Crop Genetic Improvement Research

Chairperson: Robert Evenson (Yale University)

- PA1.1 Estimating the benefits of plant breeding research: Methodological issues and practical challenges
Michael Morris (CIMMYT) and Paul Heisey (USDA/ERS)
- PA1.2 Returns to investment in maintenance research: The case of leaf rust resistance breeding in CIMMYT-related spring bread wheat
Carissa Marasas (CIMMYT), Melinda Smale (IFPRI), and Ravi Singh (CIMMYT)

- PA1.3 Economic impacts of post-harvest research for potato and sweetpotato in developing countries
Keith Fuglie and Tom Walker (CIP)

Panel Session 2

Natural Resource Management Research

Chairperson: Peter Hazell (IFPRI)

- PA2.1 Impact assessment in natural resource management research
John Poulsen (INRM), Boru Douthwaite (IITA), and Douglas White (CIAT)
- PA2.2 Environmental impacts of productivity-enhancing crop research: A critical review
Mywish Maredia (Michigan State University), Prabhu Pingali (CIMMYT), and Michael Nelson (former World Bank)
- PA2.3 Measuring the impact of user participation in natural resource management research
Nancy Johnson and Jacqueline Ashby (CIAT); and Nina Lilja (CGIAR)

Contributed Papers Session 4

Impacts of Research Investment on Productivity Growth

Chairperson: Mitch Renkow (North Carolina State University)

- C4.1 International R&D spillovers and productivity growth in the agricultural sector: A panel co-integration approach
Luciano Gutierrez (University of Sassari)
- C4.2 Impact of modern technology adoption on output growth and sustainability of major cereals production in Bangladesh
Fakhrul Islam (Bangabandhu Sheikh Mujibur Rahman Agricultural University)
- C4.3 The contribution of different components of total factor productivity in high potential rice-wheat systems in Indian Punjab
Joginder Singh (Punjab Agricultural University)

Contributed Papers Session 5

Impacts of Commodity Research

Chairperson: Robert Chambers (IDS)

- C5.1 Effects of innovative wheat breeding in marginal environments
Maximina Lantican, Prabhu Pingali, and Sanjaya Rajaram (CIMMYT)
- C5.2 The impact of bean research in Honduras
David Mather and Richard Bernsten (Michigan State University); and Juan Carlos Rosas, Aberlardo Viana, Danilo Escoto, and Julio Martinez (Escuela Agrícola Panamericana)
- C5.3 A study of Philippine peanut farming communities: Impacts of new peanut RSP technology and influences on sustainability
Robert Moxley (North Carolina State University), Aida Librero (PCARRD), and Dave Alston (University of Maryland-Eastern Shore)
- C5.4 Impact of public sector versus private sector in R&D and technology generation: The case of maize in Asia
Roberta Gerpacio (CIMMYT)

Contributed Papers Session 6

Use of Impact assessment Research in NARSs

Chairperson: Nancy Johnson (CIAT)

- C6.1 Winding up the impact pathway: An approach to strengthening the impact orientation of national agricultural research
Andreas Springer-Heinze (GTZ); Frank Hartwich and Doug Horton (ISNAR); Simon Henderson (NRI); and Isaac Minde (ASARECA)
- C6.2 The importance of impact assessment studies for the Brazilian agricultural research system
Antonio Flavio Dias Avila and Geraldo Da Silva e Souza (EMBRAPA)
- C6.3 Potato production and pesticide use in Ecuador: Linking impact assessment research and rural development intervention for greater ecosystem health
Charles Crissman, Steve Sherwood, and Patricio Espinosa (CIP); and Donald Cole (University of Toronto)

Discussion Session 2: Media Perspectives

Impact studies often reveal issues of great potential interest to the general public and to policy makers in developing and developed countries, but these issues are rarely communicated in a compelling manner outside a narrow community of academics and development professionals. How can the results of impact studies be communicated more widely? In this session, a panel of distinguished journalists will share their experiences and offer insights into how stories related to impact assessment can be communicated effectively to policy makers, opinion leaders, and the general public.

Chairperson: Timothy Reeves (CIMMYT)

Panelists: Barbara Rose (Future Harvest), Gideon Lichfield (The Economist), G. Venkataramani (The Hindu)

Wednesday, February 6, 2002

Plenary Paper Session 3

The Green Revolution: A Retrospective View

Chairperson: Peter Matlon (Rockefeller Foundation)

- PI 3.1 Resolving conflicting evidence about the impact of the Green Revolution
Peter Hazell (IFPRI)
- PI 3.2 Professional error, critical awareness and good science
Robert Chambers (IDS)
- PI 3.3 Why the Green Revolution failed in Africa and how this impacted the poor
Simeon Ehui (ILRI)

Panel Session 3

Potential Impacts of Nutritional Improvement Strategies

Chairperson: David Schimmelpfennig (USDA/ERS)

- PA3.1 Golden rice: What role could it play in alleviation of Vitamin A deficiency?
David Dawe (IRRI); and Richard Robertson and Laurian Unnevehr (University of Illinois at Champaign-Urbana)
- PA3.2 Assessing the indirect impact of mungbeans on nutrition and productivity; new insights from case studies in Pakistan and India
Katinka Weinberger (AVRDC)
- PA3.3 Agriculture and nutrition: Adversaries, bedfellows or allies?
Lawrence Haddad (IFPRI)

Panel Session 4

Enhancing Research Impacts through GIS

Chairperson: Jim Ryan (Australian National University)

- PA4.1 What GIS can (and can't) bring to impact assessment: Novel data, analysis, and insights
Gerald Nelson (University of Illinois at Champaign-Urbana)
- PA4.2 GIS tools: They're not just for experts anymore
Dave Hodson and Jeff White (CIMMYT)
- PA4.3 Lost in space: Fulfilling the promise of spatial analysis in impact assessment
Stan Wood and Jordan Chamberlin (IFPRI)

Contributed Papers Session 7

Distributional Impacts of Technical Change: Modeling Approaches

Chairperson: Michael Morris (CIMMYT)

- C7.1 The welfare effects of maize technologies in marginal and high potential regions in Kenya
Daniel Karanja (Michigan State University) and Mitch Renkow (North Carolina State University)
- C7.2 How agricultural research affects urban poverty in developing countries: The case of China
Shenggen Fan, Cheng Fang, and Xiaobo Zhang (IFPRI)
- C7.3 Impact of the adoption of modern varieties of rice on productivity gains and income distribution for the irrigated and rain-fed ecosystem
Mahabub Hossain, Manik Lal Bose, Tran Thi Ut, A.G. Agarwal, Jawhar Thakur, and Esther Marciano (IRRI)

- C7.4 Household resource endowments and impacts of soil fertility management
Meredith Soule (USAID) and Keith Shepherd (ICRAF)

Contributed Papers Session 8 Impacts of Pest Control Technologies

Chairperson: Dave Watson (CIMMYT)

- C8.1 Socio-economic, ecological, and policy impact assessment in the introduction of a transgenic staple crop variety to the developing world: Insect resistant maize for Africa
Adrian Ely (University of Sussex); and Hugo de Groot and Steven Mugo (CIMMYT)
- C8.2 A farm level evaluation of the impact of IPM on pesticide use: A comparative analysis of IPM trained and ordinary farmers in Zimbabwe's smallholder sector
Shephard Siziba (University of Zimbabwe, CIMMYT) and Mulugetta Mekuria (CIMMYT)
- C8.3 Impact assessment of biological control in Africa: Twenty years experience of the International Institute of Tropical Agriculture
Peter Neuenschwander and Boru Douthwaite (IITA); and Hugo de Groot (CIMMYT)
- C8.4 A socio-economic analysis of farmers' field schools implemented by the national program in integrated pest management of Thailand
Suwanna Praneetvatakul and Hermann Waibel (Hannover University)

Contributed Papers Session 9 Economics Benefits of Research Collaboration

Chairperson: Gustavo Sain (CIMMYT)

- C9.1 Network approach in soil management research: IWMI's experience in Southeast Asia
Amado Maglinao, Djoko Santoso, and Frits Penning de Vries (IWMI)
- C9.2 The impact of Rockefeller funded Forum for Natural Resources Management Program in eastern and southern Africa
Alex Phiri (Bunda College of Agriculture)
- C9.3 Impact of the Coordinated Rice Improvement Program on movement of improved germplasm and productivity gains across the Indian states
Aldas Janaiah, Mahabub Hossain, and E. Cabrera (IRRI)

- C9.4 Economic benefits of research cooperation: The case of the Regional Maize Program for Central America and the Caribbean
Miguel I. Gomez (Cornell University) and Prabhu Pingali (CIMMYT)

Thursday, February 7, 2002

Plenary Paper Session 4 Impact assessment: Research and Policy Making

Chairperson: Tim Kelley (CGIAR-TAC)

- PI 4.1 Measuring the benefits of international agricultural economics research
David Schimmelpfennig (USDA/ERS) and George Norton (Virginia Tech University)
- PI 4.2 Evaluating the impact of economic policy research: Concepts and practices
Jim Ryan (Australian National University)
- PI 4.3 Why has impact assessment research not made more of a difference?
Ponniiah Anandajayasekeram (ISNAR) and Mandi Rukuni (FAO)

Panel Session 5 Does Agricultural Research Alleviate Poverty?

Chairperson: Anthony Bebbington (University of Colorado at Boulder)

- PA5.1 Assessing the impacts of agricultural research on poverty using the sustainable livelihoods framework: Concepts and methods
Michelle Adato and Ruth Meinzen-Dick (IFPRI)
- PA5.2 Impact of rice research on poverty reduction: The case of Bangladesh
Mahabub Hossain (IRRI); and David Lewis, Manik Lal Bose, Alamgir Chowdhury, and Ruth Meinzen-Dick (IFPRI)
- PA5.3 Improved vegetable and fishpond technology on poverty in Bangladesh
Kelly Hallman (PRDPC); and David Lewis, Suraiya Begum, and Agnes Quisumbing (IFPRI)
- PA5.4 The impact of improved maize germplasm on poverty alleviation: The case of Tuxpeño-derived material in Mexico
Mauricio Bellon and Javier Becerril (CIMMYT); and Michelle Adato (IFPRI)

Panel Session 6 Benefits of Genetic Resources Conservation

Chairperson: Robert Chambers (IDS)

- PA6.1 Economic costs and benefits of a participatory project to conserve maize landraces on farms
Melinda Smale (IFPRI); and Mauricio Bellon, Javier Aguirre, Jorge Mendoza, Ana Maria Solano, Rafael Martinez, and Alejandro Ramirez (CIMMYT)
- PA6.2 The distribution of benefits from public international germplasm banks: The case of beans in Latin America
Oswaldo Voyses, Nancy Johnson, and Doug Pachico (CIAT)
- PA6.3 Endowing future harvests: The long-term costs of conserving genetic resources at the CGIAR centers
Philip Pardey (University of Minnesota), Brian Wright (University of California at Berkeley), and Bonwoo Koo (IFPRI)

Contributed Papers Session 10 Non-Conventional Approaches to Impact assessment: Institutionalist Perspectives

Chairperson: Simeon Ehui (ILRI)

- C10.1 Can impact analysis be used for research evaluation?
Javier Ekboir (CIMMYT)
- C10.2 An evaluation approach for achieving and attributing impact for INRM and IPM
Boru Douthwaite (IITA); and Thomas Kuby and Steffen Schultz (GTZ)
- C10.3 From measuring impact to learning institutional lessons: An innovation systems perspective on improving the management of international agricultural research
Andrew Hall (ICRISAT), Rasheed Sulaiman V. (NCAP), Norman Clark (University of Strathclyde), and Yoganand B. (ICRISAT)
- C10.4 Disciplines, institutions and organizations: Impact assessment in context
Rajeswari Raina (NISTADS)

Contributed Papers Session 11 Environmental Impacts of Agricultural R&D

Chairperson: Nina Lilja (CGIAR)

- C11.1 Tradeoff analysis as a tool for assessment of economic and environmental impacts of agricultural research
David Yanggen (CIP, Montana State University), John Antle (Montana State University), Jetse Stoorvogel (University of Wageningen), Walter Bowen (CIP, IFDC), and Charles Crissman (CIP)
- C11.2 Agricultural development and impacts on the environment: Experiences from India
D.D. Naik (D.D. & Associates) and Archana Godbole (AERF)
- C11.3 Impact of salinity management research in Northwest India
K.K. Datta (ICAR); and Laxmi Tewari and P.K. Joshi (NCAP)
- C11.4 Adoption and impact of soil conservation technologies in Central America
Gustavo Sain and Monika Zurek (CIMMYT)

Contributed Papers Session 12 Impacts of Investment in Training and Extension

Chairperson: Gerald Nelson (University of Illinois at Champaign-Urbana)

- C12.1 Evaluating capacity development of the Plant Genetic Resources Center in Bunso, Ghana
Samuel Bennett-Lartey (PGRC, Ghana), Raymond Vodouhe (GRENEWCECA), and Jamie Watts (IPGRI)
- C12.2 Evaluating capacity development in research and development organizations
Douglas Horton and Nancy Alexaki (ISNAR)
- C12.3 The costs of transforming public extension services towards participatory approaches
Gerd Fleischer (World Bank), Hermann Waibel (University of Hannover), and Gerd Walter-Echols (Egyptian-German Integrated Pest Management Project)

Closing session What Next for Impact assessment?

Chairperson: Prabhu Pingali (CIMMYT)

Panelists: Tim Kelley (SPIA), Peter Matlon (Rockefeller Foundation), and Simeon Ehui (ILRI)

Discussion Session Presentations

Discussion Session 1: Donor Perspectives

1. IFAD's contribution

Rodney Cooke (IFAD)

The conference began with the observation that if we don't care about the impact of agricultural research and development, we are dead in the water. In other words, we must be concerned to demonstrate cost-effective interventions arising from donor investments.

Why should IFAD be interested? First, IFAD's focus is on rural poverty alleviation through agricultural and rural development supported by loans and grants. A major problem facing the agricultural research and development sector is the declining financial support for rural development research projects from national governments and the donor community. IFAD's commitment to reverse this trend relates to the observation that 75% of the world's poor people live in rural areas. Yet, despite this, the proportion of official development assistance for agriculture fell from 20% in the 1980s to 12% today. This is despite the fact that the rural poor depend primarily on agriculture (directly or indirectly) for their livelihoods.

IFAD is attempting to reverse this decline by a series of policy dialogues such as the production of IFAD's Rural Poverty Report in 2001, a partnership with the World Bank and others to reverse the declining support for rural development, and not least a continued support for the CGIAR which equates to over US\$ 100 million in the last 20 years.

However, on a less positive note, even though IFAD is an international financial institution with a portfolio of around US\$ 500 million a year, grant aid (to all activities) equates to a maximum of 7.5% of our total expenditure. Unfortunately, agricultural research is a long-term investment with a risky reputation. Many donors see agricultural research as a blunt instrument for change. For these reasons, IFAD has been a financial supporter of the IAEG (now SPIA) in order to further clarify the advantages of targeted, effective R&D programs.

Agricultural research leading to the adoption of improved technology may reduce rural poverty in many ways. We must get away from the too simplistic internal rates of return based on adoption of high-yielding varieties. New approaches could include:

- higher on-farm yields;
- expansion of farm employment opportunities and higher wages;
- growth of non-farm activities;
- lower food prices;
- reduced vulnerability to crop and other risks; and
- empowerment of the poor and of their organizations.

The last item, empowerment, has gained increasing attention in recent years. Unless the poor have the power to participate in deciding which technology to use, they are unlikely to benefit from it. In other words, better farm technology will most benefit the farmers who are active partners in setting priorities of R&D.

An analytical framework for approaching these six issues should cover the following:

- What is the probability that applied research will be successful, and hence, what is a desirable measure of successful research in an R&D continuum?
- How soon will the results be available for adoption, how widely applicable will the results be, and when will they be adopted by various groups and for how long?
- Once adopted, what is their contribution to productivity and incomes of different groups of people, especially smallholders?

In terms of screening of research and development concepts, IFAD assesses such proposals according to three types of criteria: consistency with the IFAD mandate (targeting of the proposal); effectiveness of the proposal (institutions identified have competence and comparative advantage), multiplier effects, feasibility of the approach and potential to deliver medium-term benefits to the rural poor etc.); efficiency (value for money).

2. USAID's contribution

Dana G. Dalrymple (USAID)

It is a pleasure to participate in this panel. It will be, I think, informative from several points of view. First, it is seldom that practitioners get to hear directly from more than one donor at a time. Second, it is perhaps even more seldom that donors get to hear what other donors think about this issue and get feedback from practitioners. So I look forward to this session as a learning experience as well.

My message could be summarized in a few words: we need all kinds of impact information in various forms. We need summary information for administrators and Congress, and we need more detailed information to use with other staff members and to use ourselves in presenting the work of the international agricultural research community and in making out own internal budget decisions. Ours is a case where one size does not fit all.

Setting for Decision-Making in the U.S. Government

The setting for decision-making in the U.S. government may share some similarities with other governmental donors, but also may have some distinct qualities. Clearly, a wide range of factors is involved, and their relative importance may change over time. The list includes many factors external to USAID (exogenous): world and national events, politics at all levels (including both politicians and their constituencies, lobby groups, and special interests); the national budget; and other governmental agencies (in our case, the Department of State). Internal (endogenous) factors include; the individual beliefs of high-level political appointments in the agency made by the political party in power, and the on-going nature of USAID bureaucracy.

Obviously, not all decisions are made on the basis of a highly analytic process and component factors may be weighted differently than they would be by a group of

economists. The challenge is to bring as high a degree of analysis into the decision-making process as possible. This cannot be done unless the analyses exist and are available in a form that can be readily communicated.

Government Performance and Results Act (GPRA).

There are some measures in place, and others that are being stressed, which are meant to add to the analytical dimension in the U.S. Government. One that has been in place since 1993 is the GPRA. This is a well-intentioned Act that has triggered a lot of activity at the agency level. I have been involved in responding to it since it was enacted. If the task were left to economists and they were given sufficient time and resources to respond to it, I think that the outcome would have been better. The development of quantitative measures for a wide range of government activities can be difficult: those that seem important may be difficult to measure; those that can be more easily measured may be trivial. More generally, as a recent newspaper article noted: "There seems to be little consensus on how to define good performance and how to measure it."

The Bush administration has made its views clear with respect to aid in general, the role of productivity, and the need for evidence of impact. With respect to foreign aid in general, Paul O'Neill, Secretary of the Treasury, has stated that "Over the past 50 years, the world has spent a lot of money in the name of development without a great deal of success." Administration concerns have also been expressed. In recent years "tens of billions of dollars in aid for developing countries have produced disappointing results." The emphasis of President Bush is clearly on "improving, rather than increasing foreign aid." A key factor will be the degree to which the effectiveness of the aid can be demonstrated.

Currently, there is a strong Administration emphasis on raising productivity and measuring the results. This has been expressed most clearly in relation to U.S. expectations of the World Bank. Secretary O'Neill stated that, "Development banks must focus their efforts of raising productivity growth in the developing world." Similarly, President Bush stated, at the World Bank, that the World Bank and other development banks must "...focus on raising productivity in developing nations." Moreover, "President Bush will ask Congress to base future increases in aid to poor countries on evidence that the aid is actually bringing progress." Bank funding to IDA will be conditional on development indexes demonstrating that aid was productive. The Bank should be "...more rigorous in measuring the results of its aid." A senior State Department official said that there might be more development assistance available "...provided one could be assured that it will be effective in projecting sustained growth and development." It is acknowledged that, "...developing benchmarks to show what kind of aid works best is not a simple process."

While the initial emphasis appears to be on health and education, agriculture has not been overlooked. Secretary O'Neill commented that "Economic history has taught us, for example, that investing in agriculture...is a key to development." And Alan Larson, Undersecretary for Economics, Business and Agricultural Affairs at the State Department has noted, in the context of hunger, the need to "...increase agricultural research in areas of importance to developing countries. The levels of support for agricultural research in developing countries have tended to decline. We need to find a way to build those up and support some of the institutions that have been a network for disseminating information about agriculture around the world." USAID administrator Andrew Natsios has repeatedly expressed his support of agricultural development.

Types of Information Needed by USAID

Now, I will turn more specifically to CGIAR matters, as viewed from where I sit at the staff level. Basically, our office gets a certain amount of money that we can use for unrestricted core funding of the CGIAR system. The factors that determine the amount we receive are largely external (exogenous) to my office, but the allocation decisions are largely internal (endogenous). Our office makes recommendations on how they might be allocated and these are discussed with and sanctioned at higher administrative levels in our bureau. On a voluntary basis, other offices provide additional restricted funding for special projects and we usually play no role in its allocation.

The exogenous factors that determine the amount of funding available to us are usually not very clear at the staff level. They are partly determined by the overall agency funding request for development assistance and the congressional response. Congress often will provide earmarks for special activities or programs without increasing overall funding. Biotechnology is a recent example. These earmarks range from mild to strong. And the stronger they are, the more influence they have on the amount of discretionary funding remaining. CGIAR funding in the past has been in the discretionary to mild earmark stage. It is not in the strongest position.

The decisions concerning the actual allocation of the CGIAR funding have basically been made at the office level (principally Robert Bertram and myself) in consultation with (1) the regional bureaus (the Africa Bureau has provided \$2 million of funding in recent years), (2) the environment office, (3) other members of our office, and (4) those higher in the administrative structure, especially those that serve as the official USAID representative to the CGIAR (Emmy Simmons in recent years). We have drawn on our personal knowledge of the system, recent reports and activities, and USAID interests and priorities. Generally, year-to-year changes have been modest.

Information needs are different at the exogenous (external) and endogenous (internal) levels. In terms of building a case at the exogenous level, it is more a case of selling the CGIAR system as a whole, drawing on center accomplishments and activities. It is partly a matter of building good will. At the endogenous level, allocating funding, it is more a question of individual center performance and changing needs and priorities. In terms of impact analyses, at the exogenous level we need center-wide regional or global information on impacts. This needs to be pulled together. TAC does some of this in its thematic studies, but we need a more systematic way of compiling and summarizing individual center studies, such as is done in the IFPRI 2020 briefs. At the endogenous level, we can make better use of what we have available. A more systematic summarization, as noted above, would be useful. It would also be useful to have a clearer idea of the strengths and weaknesses of the analyses, preferably done by a third party.

Summary Remarks

The process followed by the U.S. government in making funding allocation decisions, probably like many others, may not seem entirely analytical and rational from some viewpoints. It depends on where you sit and how you weigh individual factors. But it is clear the Bush administration is generally putting increased emphasis on measuring the effectiveness and productivity of government programs. This seems to be particularly true in the area of foreign assistance, both for USAID and World Bank programs, where the emphasis is on increasing productivity in developing nations.

Thus, there is need to strengthen the analytical component where we can, and impact information is part of this process. What is being done by the centers is a vital component. But while necessary, it is not sufficient. More attention needs to be given by the centers and the Science Council Secretariat to preparing reader-friendly summaries of impact studies. This could be done in two ways at the System level: (1) a series of fairly standardized summary briefs, much like the IFPRI 2020 Vision Briefs just noted (which might be extended to electronic form), and (2) have someone periodically engaged to do an interpretative summary of the evaluations. There is a need to close the information gap between the analysts and the donors.

3. GTZ's contribution

Stephan Krall (GTZ)

Establishing Plausibility in Impact Assessment

This paper discusses findings, of the “Workgroup On Assessing the Impact of Agricultural Research in Development” (part of the Deutsche Gesellschaft für Technische Zusammenarbeit - GTZ), based on the detailed analysis of an impact assessment exercise conducted by the IITA¹.

The workgroup contends that traditional approaches to impact assessment tend to predispose impact evaluators to establish unrealistic and unjustifiable relationships between development interventions and observed impacts. Impact evaluators often try to prove or quantify impact on a highly aggregated level and gloss over the fact that innumerable factors play roles that are often un-quantifiable but even more significant than the intervention itself. In most cases, this leads to attribution gaps. Attribution gaps are caused by the interactions of numerous and significant variables that are external to the experimental design. The effects of external variables make it impossible to isolate the effect(s) of a single development intervention, which, ultimately, leads to an over-interpretation of data.

The workgroup determined three fundamental goals of impact assessment:

1. Learning about more and less successful approaches to development and poverty reduction.
2. Steering projects, programs, and strategies, within their given dynamic settings, to maximize effectiveness and sustainability.
3. Improving accountability for investments in development cooperation by trying to ensure that they truly effect changes in the lives of people, especially the poor.

To achieve the above goals and establish plausibility, the workgroup proposed impact assessment guidelines and standards, namely:

- Identification of the source of the impact being investigated.
- Presentation of the model or concept of impact used by the impact evaluators and how it applies to the case at hand.
- Statement of the objectives and limitations of the impact assessment.
- Outline of specific theory of action on which the intervention or strategy has been based.
- Statement of the impact hypotheses that the impact assessment tests.
- Presentation of other factors that could have affected the observed changes and alternative impact hypotheses.
- Discussion of other informed opinions that support and contest the study findings.

In conclusion, the paper emphasizes that establishing plausible links between development interventions and observed impacts is the central task of impact assessment and that honesty, openness, and transparency should be its cornerstones.

¹ “Social impact of soybean in Nigeria’s southern Guinea savanna” by P.C. Sanginga, A.A. Adesina, V.M. Manyong, O. Otite, and K.E. Dashiell.

Discussion Session 2: Media Perspectives

1. Barbara Alison Rose (Future Harvest, Washington, DC, USA)

Future Harvest: Science for Food, the Environment, and the World's Poor

Future Harvest was initiated four years ago to raise awareness and support for international agricultural research. We are a global public charity registered in the United States and the United Kingdom. Our principal funding comes from the 16 food and environmental research centers funded through the Consultative Group on International Agricultural Research. We also receive funding from foundations, governments, and private individuals. During our early history, we have been developing Future Harvest's image, position, communication strategy, and approach to fund raising.

Future Harvest is issue-oriented, not focused on promoting agricultural research per se. Rather we promote the benefits of international agricultural research to peace, the environment, economic growth, human health, and population—issues high on the policymaker's and the public's agenda.

Future Harvest commissions research on the links between agriculture and these issues with organizations outside the agricultural community. We have sponsored two studies: one on the links between agriculture and peace with the International Peace Research Institute of Oslo, Norway, and one on the links between agriculture and wild biodiversity conservation with the World Conservation Union (IUCN). We have another study under way with CARE.

Future Harvest has a cadre of international public figures who serve as ambassadors, including Oscar Arias, Queen Noor, Norman Borlaug, and Desmond Tutu, among others.

Future Harvest promotes the studies it commissions and the work of the 16 Future Harvest Centers. News and feature releases have appeared in many languages in media outlets throughout the world. These include

the Economist, the *Financial Times*, the *Hindu*, the *Jakarta Post*, the BBC, CNN International, the *Asian Times*, the *Ugandan New Vision*, and the *Wall Street Journal*. Future Harvest has built a cadre of journalists in the agricultural and science fields, but has augmented it through the development of contacts that cover the environment, business, health, and general development. Through these "nontraditional" journalists, Future Harvest is expanding the understanding and coverage of linkages between agriculture and broader issues.

Future Harvest principally uses the Internet to disseminate its materials. Since the launch of its website almost three years ago, some 6,000 individuals from a wide range of backgrounds have voluntarily signed on to our email list at www.futureharvest.org to receive regular updates.

The Centers assess the impact of their work for a number of reasons: to determine if their science is on target, to see what results they have achieved, and to provide donors and other interested audiences with information they need to justify investment. Because Future Harvest works closely with the centers, I will refer to "we" in my comments.

While scientists and donors have been discussed as targets for impact assessment research, there is another audience that has not been addressed: those individuals who pay the donor's bill, the taxpayers. International taxpayers need to be part of our target audience for two reasons. One, we have an obligation to tell them how we are spending their money and that their tax dollars are making a difference. Two, they want to know. Future Harvest is starting to position itself and the centers to reach this important audience.

New science deserves new communications. In his presentation yesterday, Tim Reeves noted four points about the future of science.

First, he said that the “Centers need to do more science and to do it differently.” This is also true about how we communicate this new science. We need to do more of it and to do it differently.

Second, he said that “science is more complex and that it will become more so.” This is true, but we have to explain this science simply and sharply in order to be heard over the many voices that are competing with us for attention.

Third, Tim said “the nature of the scientific tools we are using for research today are more advanced.” This is also true for our outreach methods. The tools are more advanced. The Internet, including the Worldwide Web and email, and CD Rom and DVD technology have changed our outreach modes.

Fourth, Tim noted that the research undertaken by the centers involves more partners and alliances in research efforts and that this often causes attribution difficulties when reporting final results. Expanding alliances is a good development, one that we need to communicate as well. To do so, we need a unified framework, something that Future Harvest is working to provide.

What we say is critically important, and it is also changing. Clearly, our message is about:

- the environment, human health, political stability, and so on; it is no longer just about a bigger pile of food;
- the critical role of agriculture in economic growth and poverty alleviation, and about framing the problem and highlighting solutions;
- the complex relationships that define the research, what I call the three “Gs,” governance, gender, and genes;
- the people—particularly women, children, and families who have better lives as a result of what center science does. It’s about creating emotional resonance as well as intellectual significance;
- long-term solutions as an alternative to short-term fixes.

These messages need to be delivered directly, with well-explained technical concepts, and with the public persona well identified.

New Partnerships and Forward Focus

The issue of attribution has been discussed throughout this meeting. Some of the discussions have suggested that increasing the number of partnerships, and therefore partners that share the credit for research results, can be a problem. I would like to suggest that it is an asset.

The journals *Science* and *Nature* have a strong following among the scientific and policy communities. Many of the main articles cover research in the biological sciences and are often authored by ten or more scientists. In many fields, this is not an uncommon practice. There is no reason why center scientists cannot take up this example and share scientific credit more broadly. In the past, agricultural research has been viewed as too insular. We need change that image. Our new collaborative arrangements will help make that happen.

We also need to focus on the future. There is a propensity, clearly in the area of impact assessment, to look backward and to congratulate ourselves for the good work of the past. We need to ask how can our impact assessments provide insights for the future. How can we better learn from the past to frame our approaches in the future? Our audiences want to know what the critical issues of the 21st Century are and how we are going to help solve them? Let me add that many in the new generation of leaders, public officials, and general public were born after the Green Revolution. They do not know the past. They want to know what are you going to do for me next year and in the years to come? What do our impact assessments say about where we are going?

What Can You Do?

I would like to end with some practical ideas about what center staff, and this may apply to others in the audience as well, can do.

In his comments yesterday, Prabhu Pingali mentioned that economists often feel that impact assessment research is too important to allow the involvement of colleagues from other disciplines. He stressed the need for more involvement of scientists from other disciplines. I agree and suggest that involvement needs to be as broad as possible, involving other Future Harvest Centers and national research systems. It also should include communications specialists who can determine the type of information that will be most useful for message development.

Donors do not want the same kind of information. Currently, very few donors understand or use complex studies, and factors other than impact data, such as politics and institutional needs, affect how they make funding decisions. We need to find out what donors want and how they operate. This means involving your donor relations staff when developing assessment priorities. They can help guide the direction of impact assessment work with an eye to donor needs.

We need to stop talking to ourselves and to start talking to others outside of the agricultural research community. This will require that center scientists receive media training so they can better articulate the benefits of research.

Although the research efforts of the future will include more partners at many levels, we need to speak with one voice.

At every stage of the assessment and communications process, we need to ask how is what we are doing helping the poor? How has it, or how will it, make their lives better? Thank you for inviting me to participate in this session.

2. G. Venkataramani (The Hindu Newspaper, Chennai, India)

Forging an alliance to win, win, win all the way

Respected Chairman and dear friends, let me thank the organizers of this international conference for inviting me to participate in the session on Media Perspectives.

My presentation may not be as well-structured as you would expect. Quite often, representatives of the media are not good public speakers. Public speaking is an art, while speech writing is a science. I belong to the category of silent communication scientists, working behind the scenes. I would be more comfortable in an interactive session than making a presentation like this one.

We all know that public awareness is critical for public-funded agricultural research and development. The public has the fundamental right to know, and the policy-makers need to be enlightened to make well-informed investment decisions. Researchers are accountable to the public. The media is bound, by responsibility, to mould public opinion and inform policy-makers and donors in order to justify their decisions in supporting research programs.

Quite often, the role of media is either ignored or under-rated. There seems to be some reluctance among many scientists to deal with the media. They presume the media is not relevant in publicizing their work. According to them, time spent with the media is wasted. Some scientists are wary of journalists and avoid them like a plague. Scientists are quite content to publish peer-reviewed articles in professional journals. Media stories are of no consequence to them. However, there are exceptions to this general observation, and there are exceptionally gifted

media-friendly scientists, who provide us with “good stories.” Our wish is that scientists should shed their inhibitions and reach out to the media. I am sure the media will only be too willing to join hands to ensure that research findings reach the target audience.

Scientists should also make a distinction between the lay media and the science media. It is quite unfortunate that, in the general media, inaccuracies creep in when reporting agricultural research and development. This largely stems from the lack of understanding on the part of the media, and a serious communication gap between the scientists and the media representatives. Scientists can help to avoid such problems by taking time to explain complex scientific findings in simple terms. Again, the communication gap could lead to adverse and negative stories. There have been many examples of such misinformed stories that caused great damage to the image of organizations such as ICRISAT and IRRI in the mid-1980s. Such damage could have been easily averted, had these institutes adopted proactive public awareness strategies.

The science media is different from the lay media. The science media is well trained and geared to accurately report authentic advances. Agricultural research and developments generally do not make headline stories; but they are excellent material for specialized columns, development features, and opinion-editorial page articles. The agricultural writers and media professionals are a step ahead of the general media in getting their stories right. In addition to the usual journalistic “mantra” of what? when? where? why? and how?, these professionals have their own formula of what? and how is it done? how is it possible? how can it help?, and how can one get such help?. Generally, the media relies heavily on media-friendly and articulate scientists with good public relations skills to get a good story supported with credible information and authentic data.

I wish to share our experience as public awareness consultants at ICRISAT a few years ago. My wife Gemmarie, also a media specialist, and I produced at least four issues of a glossy publication called "Food From Thought." This series was a brainchild of Dr. Jim Ryan, when he was the Director-General of ICRISAT. "Food from Thought" was based on a series of impact assessment studies initiated by Dr. Ryan. They are essentially 6 -to- 8 page executive-summary-like reports with lively quotes from farmers, NGOs, the industry and other partners of ICRISAT research. They were uniformly well received by donors, media and policy-makers. These publications contained all the desirable elements of a media feature, and were backed by intensive, peer-reviewed impact assessment studies. Interestingly, they turned out to be pithy human-angle stories any editor would only be too happy to publish.

I wish to mention here that, some of these publications helped ICRISAT to win the prestigious King Baudouin Award for two successive years. Scientists who contributed to the publication tasted some media glare, and above all they had the sense of satisfaction of effectively communicating their research findings to the end users (farmers and consumers). The society gratefully recognized their contributions, and respected them.

Yesterday, Dr. Prabhu Pingali referred to the hard fact of life that social scientists are under peer pressure, compelled to publish in reputed professional journals and, while doing so, remain in a closed society. The public awareness group is just one step behind the social scientists. The impact assessment group will do well in forging a meaningful triple-alliance with them, the media and the donors in order to sustain the impact assessment research efforts and the interest of donors. Social scientists are the best-trained professionals who can provide the food for public awareness. Be re-assured that you are the ones who could build effective bridges between the scientists and other partners in the development process.

I have had the privilege of reporting on several impact assessment studies conducted by ICRISAT, IFPRI and several farmer-oriented success stories of IRRI since 1979. I have written, and still write, about ICRISAT's adopted village, Thadanapalle. I am sure that there are several good stories in the other CGIAR centers as well. I must mention that the CGIAR has several unique strengths, but they have to use them to their advantage. Research for public good, not for profit, and a transparent agenda are its strengths. Altruism and your role as the custodian of the largest collection of germplasm of major crops add to your strength. The CGIAR centers should take a pro-active initiative in reaching the media through concerted public awareness exercises. The media have no reservations in joining hands with these centers in disseminating the research findings for the benefit of the farmers, consumers and policy makers. We look forward to more productive and mutually reinforcing media-related initiatives from the CGIAR centers.

Today, we are in a super-dynamic world. Things are changing so fast. We are in an era of information explosion. New science and technologies, pointed out yesterday by Professor Tim Reeves, provide new opportunities. We know that a traditional approach is no longer adequate. Business-as-usual-approaches do not take us anywhere. We need innovative initiatives to build more partnerships and alliances to address complex research and development challenges. We have to switch to consensus-building modes creating a situation where all the partners are winners. No one wants to be a loser. Let us make a quick SWOT analysis of all the partners, and use our strengths to convert the weaknesses and threats into new opportunities and create a situation of win, win, win all the way in our relentless battle against poverty, hunger and malnourishment.

3. Gideon Litchfield (*The Economist, Mexico City, Mexico*)

I want to start with a saying of Richard Feynman's: "Anything is interesting if you look at it closely enough."

Well, that's nice and optimistic. Your first problem as scientists trying to get your stories into the press is what "interesting" means. I think Feynman could have meant "interesting" in two ways. The first kind of interesting is that there is something unexplained, something mysterious about it. That's what makes it interesting to a scientist. The second kind is that there is something new, or unexpected, or counter-intuitive. That makes it interesting to the general public. So your first problem for making the story is to pull out of your researcher's mindset and think like a non-scientist.

The second problem is that Richard Feynman was a great physicist and a brilliant thinker, but he never worked on a newspaper. My definition of a newspaper is this: a place where nobody looks at anything closely enough. When I worked on the science desk of *The Economist*, each press release was looked at for an average of about 5 seconds. (That's my unscientific estimate.) So, there is a third kind of interesting, what makes a story interesting to news editors. And that is what can catch their attention in five seconds with an angle that will interest their readers.

Let me give you a quick rundown of the average life of a press release in a newspaper. It comes in and, if it doesn't get lost on the floor in a pile of papers, it will be scanned quickly. Whether or not it gets transformed into an article depends on whether or not the paper has recently covered that general theme, whether the competition have done it, whether there is an angle that will interest the readers, whether there is room for it among the other articles, and whether the journalist in question has time or is too busy writing other stories or taking his kids to school, or whatever. So the story has to jump quite a few hurdles.

Now we come to the third problem.

When I was a science journalist, I covered physics, chemistry, materials, astronomy, space exploration and, new technology. When most people see words like that they automatically assume that they know nothing about the subject at all, perhaps because they think that those areas don't overlap with their daily lives. So, my job was easy. Practically anything you tell somebody about those subjects will surprise them. "The electrons go around the... *really?* Wow... the galaxy contains billions of stars... *no, seriously?*"

The problem is that people think they know what agriculture is. "Oh, yeah, we've been doing the same thing for 12,000 years." They don't associate it with technology. And if they do, they automatically think genetic modification. Basically, I'm saying that when people hear "agricultural research" they either think "Frankenfood" or they think "rain and mud." And as for impact studies, well, those aren't even agriculture *per se*, they're *numbers* about agriculture. For the general public, *new* means a new kind of wheat that kills bugs by itself; *new* means a tomato that stays fresh for three times as long; *new* means a corn breed that yields five times as much. But the discovery that this new corn breed reduces farmer's costs by exactly, say, 35% is not really big news.

That's the prejudice of the general reader, and news editors are at least as ignorant as their readers, or more so—that's what qualifies them to be news editors. Unfortunately, even specialized science editors share a lot of the same prejudice. This is why you sometimes have to rely on names like "Super wheat" or "Golden rice," even if not everyone in the research community likes them. People do catch on to them. In English, the process of making science accessible to the public is called "popularization." In French they understand better: they call it "*vulgarization*." Remember how well the church did when it switched from Latin to vulgate worship? Same thing.

The result of all this is that the journalists who cover agricultural research stories aren't necessarily the same ones who cover other kinds of science stories. It depends on what the news editor thinks the angle is. It could be the science reporter (if there is one), or an environment, economics, business or farming correspondent. Each will pick a different focus.

Which means that it's hard to get agricultural research stories covered in the press. But you knew that already. Let me give you a more concrete illustration of just how hard it is.

One of the many benefits of working for *The Economist* is that I have access to an online press database through our website that covers more than 7,000 periodicals, both specialist and general. Since this is a conference about impact assessment, I did my own impact assessment. This is the impact of your research on the world's media. Are you ready?

The first thing this tells me is that most of your stuff comes up in the specialist journals. I found 185 references to CIMMYT over the last five years, and of those 115 were in the journal *Crop Science*. Most of the rest were in fairly specialized scientific and business journals too, hardly any in the general press.

Now comes the really interesting data. Let's look at the top stories in agricultural research, the ones that Tim Reeves mentioned in yesterday's opening speech.

Drought-tolerant maize, the most exciting breakthrough Tim has seen. About 150 stories over five years — I searched for both drought-tolerant and drought-resistant, and maize and corn, and that's about the number. I'd say that at least half of them were in specialized or semi-specialized journals that very few people read. Remember, too, these are stories mentioning drought-tolerant maize; they're not necessarily *mainly* about it.

"The story that everyone knows about," Golden rice. Well, Tim, I'm sorry, but I don't think everybody does. Over 300 mentions altogether. It got decent coverage when the *Science* paper about it was published in January 2000 — a couple of dozen stories. But the

roughly half of those used the same report, from the Associated Press news agency. I'll have a bit more to say about the news agencies later. That means perhaps a dozen original pieces were written about the story that everyone knows about.

The World Food Prize, the equivalent of the Nobel Prize for food research. Quality protein maize, which took 30 years develop, got the prize in February 2000. Now of course QPM had been written about before, but for most people the first they hear about a scientific discovery is when it wins a major award. OK, in February 2000, there were just 13 stories about the World Food Prize, and none of them appeared in a major newspaper; there was one piece in the *Hackensack Record* of New Jersey. Some of the news agencies covered it but it seems like nobody took the story up.

By comparison, let's look at the Nobel Physics Prize awarded in October 2001. I chose this one rather than 2000 just to make it a really brutal comparison because the prize in 2001 was for Bose-Einstein condensates. As a physicist I can tell you that Bose-Einstein condensates are very clever and very weird but so far, unlike quality protein maize, they haven't done anybody any good. Well, 42 stories in October 2001, including some of the biggest international papers. *The Economist* makes a point of covering the Nobel Prizes every year. It doesn't cover the World Food Prize. I don't think anybody does. Why is that?

So the problem with getting your stories in the press, to sum up, is that news editors think they're dull. The best way to get them in is to think of how they affect the readership.

To do that, I want to give you some illustration of how different media cover the same story. I've taken one that got quite a lot of play last year; it was a study of organic apple farms in the state of Washington, reported in the journal *Nature*. It compared organic, conventional and hybrid farming methods. The basic conclusions were that after six years, the three methods came out equal on horticultural performance, but the organic farms did better in soil quality, environmental impact, energy efficiency and the taste of the fruit.

How was it reported? Pretty much, as you would expect. Journals with a special interest in organic farming like the *Natural Foods Merchandiser* described the science carefully but had quotes from people in the organic-food movement portraying it as good news.

Mother Earth News also said it was good news and told its readers the best way to care for their organic apples.

The Independent of London had a strong pro-organic farming line, and brought in the Friends of the Earth view. The paper clearly wanted the issue put on the government's policy agenda and used this report as a way to push that.

The Economist, as you might expect, took an economic angle, even though this story appeared in the science section. It described the science carefully but went into some detail on the potential profitability of other organic crops, even though there was no further evidence about it.

The Seattle Times is the paper you would expect to give the best coverage, because the story was in its own back yard. However, it used a report from the *Los Angeles Times*, which presumably assigned the story to its Northwestern correspondent. Quite possibly the *Seattle Times* didn't have a science journalist on the staff. Naturally, the report focuses on the likely effects for the local apple-growing industry, though it's also more balanced about the benefits.

Finally, let's take a look at the agencies, or wire services. Most local and regional papers use these for international news, science news and anything else they don't have specialized staff to cover, so what they say can have a huge impact. Remember that most of the coverage of Golden Rice in the general press came from *Associated Press*.

The Xinhua news agency has a short and very balanced report; one of the few reports to make a point of the fact that the results may not apply to apple production outside Washington State. This was also recognized in the *Associated Press*. Oddly, though, the *United Press International's Farming Today* roundup simply clipped the *Los Angeles Times* story, though it included the skepticism.

So, the conclusion from all this is that, if you want a story placed in the press, you have to think about:

- Which media you want it to appear in?
- What their readership is?
- What that means their likely angle is?
- Why would your story interests them, remembering that people instantly associate your research with either Frankenfood or mud and wet weather?
- Which journalist is likely to be assigned to it and what's his or her speciality?
- What's the best way to approach them: a press release, or a direct contact?

Discussion Session 3: What Next for Impact Assessment?

1. Hans Gregersen and Tim Kelley

Where Do We Go From Here?

This conference has produced a number of insights for guiding the future direction of impact assessment (IA) research. We have heard about a variety of methodologies and analytical tools, both quantitative and qualitative, which have been applied across a wide range of research areas, including some of the hard to measure areas like Natural Resource Management (NRM), policy and training. Some interaction has taken place between those who use IA results and those who produce them. However, much more dialogue is in order to better match what is needed and wanted by decision makers with what reasonably can be produced by analysts and researchers, given data, resource and time constraints.

The question addressed in this last session is: “What next for impact assessment?”

From the interim Science Council (iSC) perspective, which is consistent with the main threads of the discussions taking place at this conference, there are three main areas in which progress is possible and in which the iSC would like to get involved:

1. matching IA outputs to decision makers’ priority needs;
2. making IA outputs more credible, plausible and understandable, without losing rigor in the process, and;
3. improving methods, particularly in terms of developing a set of impact indicators for a broader array of impacts beyond the traditional economic ones.

In terms of each of these three areas, there exist the following needs and opportunities.

Make IAs more relevant to decision makers needs, by:

- Interacting more frequently with the various users of IA outputs, recognizing that their needs are varied, even for a given user (e.g., at internal allocation stage and at external fund raising stage, in accountability needs vs. planning needs);
- Using such interactions as an opportunity to learn not only about user needs, but also to inform decision makers (including investors in the CGIAR) about what is possible with different levels of resources and different time constraints. We have to end up with realistic expectations for IA. The CGIAR may not always be able to solve poverty and environmental degradation problems directly, but we can develop technologies, inform policies and help build formal and informal institutions that can. As IA is often expensive, resources available need to match the increased demands for IA; often increased sustainable resources do not accompany increased demands for IA results.
- Going beyond a cost-benefit framework to provide richer information on the factors influencing impacts by spelling out and testing programs underlying theories and assumptions. This may entail broadening the disciplinary base beyond agricultural economics and, when appropriate, using mixed-method approaches. The IFPRI-led ‘impacts on poverty project’ is a good model.
- Remembering that major user groups consist not only of the funders of research (an accountability function mainly), but also of planners and decision makers who are shaping future programs; i.e., they want ex-post and ex-ante IAs as input in decision-making about such programs.
- Effectively publicizing and disseminating results of IA. At the system level, there is a need to bring together the disparate information on IA being generated by the centers. This could entail the development of a website “IA in the CGIAR,” which could serve as: (a) a central repository of credible impact information (peer reviewed plus others); (b) a channel for exchange of information, and; (c) a means of reporting results to users, and other functions as needed.
- Recognizing that, in many situations, attribution may not be important. The more effective a research partnership is, the less desirable and feasible it is to

attempt to attribute impacts separately to each partner. It can be counterproductive and even threaten good working relations within the partnership. This point needs to be understood particularly by funders and decision-makers who promote partnership as a means of making research more effective and efficient.

- Not limiting IA to success stories. Honest attribution of project shortcomings as well as benefits is required; recognition of risk and uncertainty associated with successes must be transparent in order to gain confidence of those who use IAs. This relates to sampling of case studies; i.e., purposive (cherry-picking) vs. random (including picking lemons).

Make IAs more effective, plausible, credible and understandable by:

- Establishing credible counterfactuals for transparency and plausibility purposes (e.g., validate assessment using the double delta approach), especially critical for external audiences. Related to this is the importance of establishing and maintaining baseline data on the livelihoods of the poor.
- Based on the expressed needs of donors, producing and disseminating attractive, reader-friendly, short CGIAR IA briefs based on peer reviewed studies.
- Not confusing IA with program performance evaluation. These quite distinct functions belong in different places. Different types of assessment and evaluation have separate functions and should be executed by different actors.
- Fully institutionalizing IA as a management function (e.g. for priority setting, resource allocation, feedback to program planning). In many research organizations it is often carried out in response to external demands rather than as an integral part of planning, and for drawing out lessons and deriving implications.
- Developing improved methods of IA through collaboration/division of labor among those involved in impact assessment. A more effective process for organizational collaboration is needed.

Improve IA methods and develop new more integrative approaches to consider a wider set of impact indicators more closely linked to CGIAR goals by:

- Formulating a set of principles and strategic guidelines for future ex-post IA in the CGIAR, highlighting good, credible studies as models to follow, and working towards “best practices,” addressing key issues such as plausibility, impact pathways, use and synthesis of evidence across multiple sources and causality/linkages issues.
- Recognizing the many, mostly complementary, approaches that are used by different analysts when carrying out IA and, hence, the opportunities for more interchange of ideas, methods and results. Mechanisms are needed to facilitate the exchange of information. A web site can be one of those mechanisms, but not the only one.
- Devoting more resources to developing methodologies / procedures for:
 - ▶ Multidisciplinary IA based on a problem driven approach,
 - ▶ Up-scaling and synthesizing (of cases studies, smaller studies),
 - ▶ Rapid, low-cost data collection, with acceptable levels of accuracy,
 - ▶ Modeling adequate counter-factual estimates, and,
 - ▶ IA and evaluation methods for capacity building, NRM and policy research that have proven elusive in the application of existing IA methods.

Many of these needs and opportunities were also identified at the 2000 SPIA workshop on IA in the CGIAR². Some progress has taken place in many of these areas since 2000, yet much remains to be done. The Interim Science Council welcomes comments and suggestions from conference participants on which of these needs and opportunities are no longer priorities today, and what additional conclusions and recommendations flow out of the current conference that should be added to the list? Such suggestions would be helpful as the Council and its CGIAR center colleagues move ahead in formulating a program for the future.

² TAC. 2001. The future of impact assessment in the CGIAR: Needs, constraints and options. Proceedings of a workshop, 3-5 May, 2000. Rome: FAO, TAC Secretariat.

Abstracts of conference papers

To obtain copies of the papers associated with these abstracts, contact either the journals listed in the section "Conference papers published to date" or contact the authors directly, using the information in the section "List of participants"

Milestones in Impact Assessment Research in the CGIAR, 1970-1999

Prabhu L. Pingali

The Consultative Group for International Agricultural Research (CGIAR) has probably had a greater impact on agricultural production, productivity and the livelihoods of the rural poor in the world than any other agricultural research organization. This paper does not intend to document the substantial impacts of the CGIAR (subsequently referred to as CG) but rather to dwell on the stock and state of impact assessment research conducted by CG scientists, especially economists. What is not so widely realized is that over the past three decades, contributions by CG economists and other scientists to the science of impact assessment have, in many cases, been path-breaking, and have created milestones in the ever increasing body of technical literature on impact assessment theory and methods. In numerous instances, the CGIAR was a forerunner to a substantial body of academic research literature on particular themes related to impact assessment.

For the purposes of this paper, a milestone is defined as a research contribution that identified a new area or theme of impact assessment research; it could also include methodological contributions. In all cases, the seminal contributions (milestones) were quickly followed by other studies, both from within and outside the CGIAR, that verified the findings or

applied the methodology developed in the study. In all cases, the milestone contributions were published in refereed journal articles, books or official, peer reviewed center publications (not working papers and other non-refereed documents).

This review documents and highlights the important milestones in impact assessment research that can be attributed to current and past CG economists and social scientists. While the scope of impact assessment research in the CGIAR has expanded over time, beyond production impacts, there continues to be a need for and a pressure to further broaden the agenda of impact research. Evidence that modern technology has contributed to poverty alleviation is particularly sought after by the donor community. Similarly, studies on the impacts of agricultural modernization on the sustainable management of agricultural eco-systems, in general, and biodiversity in particular, are also in demand. CG economists have also begun measuring the impacts of policy research and advocacy, training and human capacity strengthening, and networks for technology generation and exchange. The impact assessment community faces enormous methodological challenges as it gears up to measure impacts in the above areas, but these are also the areas where future milestones can be achieved.

The Green Revolution: An End-of-Century Perspective

Robert Evenson and Douglas Gollin

This paper reports on the empirical and methodological lessons to be drawn from a multi-year study of the productivity impact of crop research within the CGIAR. This study was commissioned by the Standing Panel on Impact Assessment of the Technical Advisory Committee (SPIA -TAC) of the CGIAR. The overall goal was to document the impact of international research on crop genetic improvement in developing countries. The study focused on eleven major food crops: rice, wheat, maize, sorghum, millet, barley, beans, lentils, groundnuts, cassava, and potato. Eight CGIAR centers participated in the study, which drew together an unprecedented amount of previously unpublished data.

From an empirical standpoint, the major lesson of the study was that productivity impacts have been large and have occurred across crops and regions. Contrary to popular opinion, the so-called Green Revolution does not appear to have been limited to rice and wheat in Asia and Latin America; instead, there is convincing evidence of productivity gains in all major crops and all regions. For the most part, impacts have been related to research inputs. In general, where impact has been small, we can attribute this to modest research efforts or comparatively recent research. Where research efforts have been large and sustained, there have been demonstrable impacts.

From a methodological standpoint, the study has underscored some of the difficulties inherent in carrying out impact assessment. Too often, data on productivity gains are non-existent or are simply inadequate for deriving convincing conclusions. Traditional approaches to measuring impact often overstate some benefits (such as the added value of production within a crop) while understating other benefits (such as spillovers into the macro economy). There is little nationally representative evidence, and available data are often incompatible with aggregate measures of production such as those reported by FAO.

In an effort to move beyond the traditional single-crop impact estimates, the study included two novel features: first, a set of country studies, and second, a series of “meta-analyses” that sought to synthesize data from many crops and regions. Both the country studies and the meta-analyses involved methodological innovations. This paper will report on the results of these analyses, summarize the approaches taken, and briefly describe the methodological innovations required.

Under-investment in Agricultural R&D Revisited

Johannes Roseboom

Since the early work by Griliches on hybrid corn, rate-of-return studies have become standard practice in documenting the economic impact of agricultural research and development (R&D). Although the estimated ex-post rates vary quite substantially, the average tends to range in the order of 70-80%. Despite criticisms on the accuracy of these rates, as well as how representative the selected projects were, a widely shared belief is that the estimated rates are robust enough to accommodate such criticisms and still be in a range that is substantially above the social rate. Based on this evidence, Ruttan argued that there is serious under-investment in public agricultural R&D. This argument has become widely accepted among agricultural economists and hence any slowdown or contraction in the growth of public agricultural R&D expenditures is reason for serious concern.

What do we actually know about this under-investment? How real is it? Is under-investment greater in developing than developed countries? Is it greater for some types of research than others? Has it increased or decreased over time? And, how much more should have been invested in agricultural R&D? In order to answer these questions, the under-investment hypothesis needs to be defined more clearly. This can be done by means of the following simple model of R&D project selection. The ex-ante distribution of possible R&D projects on an expected-rate-of-return (ERR) scale can be thought of as declining asymptotically, which can be approximated by a semi-log function with a negative slope coefficient. Assuming full information and rational economic

behavior (i.e., selecting the R&D project with the highest ERR first), the under-investment gap can be defined in strict economic terms as the difference between the ERR of the marginal R&D project (the actual cut-off rate) and the social rate.

Important findings of the study are:

- ▶ Not the mean but the mode of the ex-post rate-of-return distribution is the relevant variable for assessing under-investment in agricultural R&D.
- ▶ Under the assumption of full information and economic rationality, developed countries could have invested about 40% more in public agricultural R&D and developing countries about 137% more. In terms of agricultural R&D intensity (i.e., expenditures as a percentage of agricultural GDP), developed countries could have invested 2.8% rather than 2.0%, and developing countries 1.0% rather than 0.4% in the period 1981-85.
- ▶ Low investment in public agricultural R&D in developing countries is caused first and foremost by a relatively smaller portfolio of profitable R&D projects to invest in. Under-investment certainly plays a role (the gap is bigger for developing countries), but it explains only a small part of the difference in agricultural R&D intensity between developed and developing countries.
- ▶ While efforts to reduce the under-investment gap should continue (e.g., better information and priority setting), more emphasis should be placed on designing policies that help to shift the portfolio of R&D projects higher up on the ERR scale, even at the risk of increasing the under-investment gap.

Impact of Agricultural Research in Bangladesh: Productivity, Economic Returns, and Varietal Replacement Issues

Joseph G. Nagy and Md. Ferdous Alam

An impact study of the Bangladesh agricultural research and extension system was undertaken for varietal development interventions of rice, wheat, potatoes, sugarcane, and jute. The study focused on contributions made by the research and extension system to varietal development over the past ten to twenty years. The study looked at five impact areas: (1) trends in agricultural production and yield/hectare productivity growth; (2) percentage adoption of post-1980 varieties and incremental production due to adoption; (3) economic rates of return to research and extension expenditures on varietal development, using the economic surplus methodology; (4) foreign exchange earned or saved from new varietal development; and (5) the rate of varietal adoption and replacement.

The findings indicate: (1) that the growth in agricultural production and partial productivity growth rates (yield/ha) among the major crops varied; some crops exhibited highly positive production and yield/ha growth rates (Boro rice, wheat, potatoes, jute) while some exhibited negative growth rates (T. Aman and Aus rice, and sugarcane); (2) the highest adoption and incremental production rates were for rice, wheat and potatoes, while sugarcane and jute adoption and incremental production rates were much lower; (3) there were high rates of return to research and extension for some major crops (rice, wheat, potatoes) but more modest returns for others (sugarcane, jute); (4) substantial foreign exchange savings have been made for rice (US\$ 3.8 billion in 1997-98 prices), while foreign exchange savings for

wheat (US\$ 0.16 billion) and sugarcane (US\$ 0.08 billion) were more modest. Jute earned additional foreign exchange of US\$ 0.07 billion and (5) the rate of varietal adoption and timely replacement of older varieties is a cause for concern—the 1995-1999 mean average age of T. Aman rice varieties is 24.6 years, wheat 15.7 years, and sugarcane 18.9 years and the dominant variety in terms of area planted for each of these crops was released in the early 1980s.

The high rates of return, since 1980, of the commodities studied are an indication that the Bangladesh research and extension system has done reasonably well. However, there is no room for complacency. Because of poor adoption by farmers, many research projects and interventions developed by the Bangladesh national agricultural research system have yet to show a return on research and extension investment. This study demonstrates that the rate of return on benefits from the aggregate of all research and extension benefits, relative to the total of all research and extension expenditures would be much lower for rice, wheat, and potatoes. The immediate future economic returns to research and extension and future productivity gains from varietal development and adoption is uncertain in light of the low new varietal adoption rates and low varietal replacement rates of major commodities. Increasing research and extension funding is only part of the answer. To effectively utilize any increased funding, research and extension systems require further institution building and strengthening, research priority setting, and increasing management and research capacity.

Herding Cats: Is Impact Assessment the Ultimate Exercise in Futility?

Patti Kristjanson and Philip Thornton

The International Livestock Research Institute (ILRI) has invested a considerable amount of time, effort, and resources in a wide range of impact assessment activities in recent years. It is a good time to address the issue of how effective that effort has been. ILRI initiated the adoption of a systems approach around six years ago. However, it is only now that we have the array of tools and databases needed to facilitate deeper understanding of the various livestock production systems and examine impacts of interventions or changes within a particular system. Even so, each new assessment we undertake highlights the insufficient resolution of critical data. However, as we develop a better understanding of livestock systems, we are able to develop predictive models incorporating important driving and conditioning forces such as human population growth, climate change, and policy changes.

Beyond endorsing a systems approach, we are also witnessing, and hopefully catalyzing, a shift towards a multi-centered, multidisciplinary, and participatory research approach based on strong teamwork and collaborative databases. We propose that it is the

traditional top-down, uni-disciplinary approach to impact assessment research that underlies its historical lack of effectiveness. We believe that it is the ongoing sea change in research approaches now being undertaken within the CGIAR, coupled with recent advances in technology (making high resolution satellite data cheaper and more accessible, for example), that will in fact make impact assessment, including monitoring and evaluation activities, much more effective in the future.

In this paper, we look at some of the costs and benefits of the systems approach we are advocating and the methods we have been using at ILRI for institutional and donor priority setting as well as ex ante and ex post assessments, in the hopes of shedding some light on the following issues. First, what benefits do we see arising from our impact assessment research? Second, why has it not had more impact? Third, how can we make it more effective without devoting an unserviceable level of capital expenditure in order to do so? It is hoped that our experiences at ILRI will benefit our partners and other institutions grappling with similar issues.

Resolving Conflicting Evidence About the Impact of the Green Revolution

Peter Hazell

The Green Revolution was launched in the late 1960s at a time when many developing countries faced an alarming widening of their national food gaps and rapid population growth. Much of the initial focus was on growing more food, a tenable view at the time given the threat of famine. Green Revolution technologies played a major role in increasing food supplies and in lowering food prices. They also increased farm incomes and generated powerful trickle down benefits in the form of additional income and employment in the non-farm economy. These impacts raised an enormous

number of poor people out of poverty and prevented many more people from falling into poverty and hunger. Despite these successes, the Green Revolution is widely criticized today for not having done more to eradicate poverty and food insecurity in the developing world. This paper reviews the validity of this criticism, and asks whether Green Revolution technologies might have been managed more effectively to achieve even greater poverty reduction. Important lessons are drawn for the design of future technology transformations in developing countries.

Professional Error, Critical Awareness and Good Science

Robert Chambers

The history of development is littered with examples of beliefs which, though sincerely held by professionals in the social and natural sciences, have later come to be seen as ill founded or wrong. Nine examples help to explain the tendency for questionable and erroneous beliefs and policies to be robustly resilient. Interactions of power, interests and mindsets, and of behaviour and experiences play a part in generating and maintaining

myth and error. Critical epistemological awareness to offset and correct misleading influences of professional, institutional and personal interests and orientations is proposed for a more prominent role in good science and policy, and for enhancing the impact of impact evaluations. Questions for self-critical reflection are proposed. The reader is invited to improve on these.

Why has the Green Revolution Passed by Sub-Saharan Africa?

Simeon Ehui, Samuel Benin, John Pender, and Mark Rosegrant

Agriculture accounts for 17% of Sub-Saharan Africa's (SSA) gross domestic product (GDP), employs 67% of the total labor force and is the main source of livelihood for the region's poor. Therefore, agriculture remains important in rural SSA and indicators of rural well-being are closely related with agricultural performance. However, the Green Revolution that swept through Asia over the past 30 years failed in Africa. SSA's agricultural performance during the 1967-97 period was the worst in the developing world. Low productivity has seriously eroded the competitiveness of African agriculture in the world market. For example, Africa's share of total world agricultural trade fell from 8 percent in 1965 to 3 percent in 1996. The question asked by many, including policy makers, researchers, and development agencies, is why has agriculture in SSA performed so poorly over the past three decades while it has improved significantly in Asia, lifting many millions of people out of poverty? In this paper, we argue that the root causes of the poor agricultural performance in SSA rests mainly with poor development strategies and policy choices. Although adverse resource endowments have also played a role, the overall unwillingness of many leaders to recognize the importance of agriculture to overall economic growth has been a major contributing factor. For many decades, policies continued to heavily tax agriculture through over-valued exchange rates and price-

depressing interventions in food markets. Despite the very high tax levels, there has been very little investment of the surplus in rural public services and infrastructure. Subsidies for fertilizer and credit usually benefited larger, export-oriented farmers who are capable of exercising political power. Inefficient input markets and weak property rights have been major limiting factors for long-term entrepreneurial planning by undermining both the will and ability of farmers to invest. Unfortunately, poor domestic policies were reinforced by protectionist policies of the OECD countries. In addition to poor policies, conflict has also inhibited growth. Many countries, and often entire regions, are ravaged by wars. Lack of vision or effective governance by African leaders contributed to the deleterious situation. Consequently, rural incomes per capita have declined with negative consequences on poverty, food consumption and asset development. The outlook for the future is not bright; although total consumption of food will double by 2020, per capita consumption will only increase marginally. As with Asia, aggressive public investments in education, research and infrastructure (e.g. roads, irrigation) will be needed to sustain growth. In addition, policies must also reach out directly to the poor, particularly through investments in their human capital and health. Agricultural transformation in SSA will occur only if the countries in the region follow stable macroeconomic policies (market-friendly and open trade policies).

Measuring the Benefits of International Agricultural Economics Research

David E. Schimmelpfennig and George W. Norton

Impact assessments of agricultural social science research (SSR), including agricultural economics research (AER), have made relatively little difference, probably because there have been few SSR assessments. The reason for so few assessments is that the output of SSR is difficult to measure, is aimed at diverse objectives, and is often embedded in recommendations, institutional changes, or quantitative methods. Causality between AER and specific decisions or institutional changes is difficult to establish because the research information is often just one of many inputs into a political process; and political decisions may influence AER, reversing the causality.

Quantitative evaluation of SSR (or AER) is challenging, but can potentially be achieved through casting the problem in a political-economic framework, and addressing the causality issue by using a method that captures the role of SSR in helping decision makers update their prior probabilities for specific events. The economic value of AER arises primarily from its effect on economic efficiency through reductions in uncertainty about the optimal (or a preferred) way to allocate resources, or the optimal (preferred) design of a policy or institution. Therefore a framework for evaluating the benefits of AER can be built that explicitly models (a) the impacts of AER on policymakers and private decision-makers' subjective beliefs about the consequences of actions, (b) the economic efficiency or welfare effects of those actions, and (c) the political-economic interactions between policymakers and interest

groups that underpin policy decisions. The model builds on earlier work by Feeney and Hillman, and considers how firms and consumers, who are also investors, influence government policies through their lobbying efforts in the presence of AER. Strategic interactions between different governments in policy formation are captured in a non-cooperative game through the ability of each government to use subsidies to indirectly shift profits from foreign to domestic firms in imperfectly competitive markets at home. Risk-averse investors, who can share in the profits of domestic or foreign firms and can act as lobbyists at home, are impacted by the policy outcome through the return on their portfolio holdings. General scientific and other non-SSR reduces uncertainty in productivity and firm profits, subsequently shared with investors. SSR messages reduce uncertainty in political-economic decision-making, but may not necessarily override the will of lobby groups, if the influence of those groups is greater than the reduction in uncertainty.

The framework is empirically tested by implementing a Bayesian decision theory approach to updating the uncertainty in the model, and is applied to AER (research on producer and consumer subsidy equivalents) that supported international strategic interactions during the Uruguay Round and other operations of the World Trade Organization. Its potential role in evaluating research on United Nations agreements for the international preservation of biodiversity and the Kyoto Protocol for the control of greenhouse gas emissions is briefly addressed.

Evaluating the Impact of Economic Policy Research: Concepts, Practices and Lessons

Jim Ryan

Evaluating the impact of economic policy research remains a challenging assignment, with few “best practices” to draw on. Case studies remain the preferred way forward in the absence of an agreed-upon impact evaluation paradigm. The major problems are those of measurement, sampling and attribution. The approach to impact evaluation is conditioned, to a significant extent, by the primary purpose that underpins such studies. For a research institution, this is to improve accountability and credibility; quality and relevance; program/project design and implementation; future planning and prioritizing. However, depending on the primary purpose, the unit of analysis and approach tend to differ.

The importance of understanding policy processes when undertaking impact evaluation is discussed in the paper. This includes the pros and cons of adopting a “supply-side” versus “demand-side” perspective and recognition of the policy formulation, decision-making and implementation phases when judging the influence of policy research. The products of economic policy research can be delineated into four elements: outputs, outcomes, policy responses and final environmental and socio-economic impacts. The paper describes various indicators that can be used to articulate and measure these products and alternative qualitative and quantitative approaches that can be employed to elicit them. Key issues that continue to arise in the actual conduct of impact evaluations of economic policy research are discussed under nine headings: scale and scope; time horizon; supply- versus demand-side approaches; the importance of surprise; attribution; choice of indicators; case studies; time lags; and ex ante and ex post assessments. Methods of enhancing impact are then discussed, including the importance of effective communications and an understanding of the policy environment and processes.

Lessons are drawn from a number of case studies commissioned by the International Food Policy Research Institute (IFPRI) which enable an assessment of the influence and impact of IFPRI’s research and related activities on a number of policy themes. The lessons are intended to guide the conduct of future impact studies; assist in articulating, measuring, and documenting successes and failures; and help enhance impacts in the future. Aspects addressed include the importance of research quality, timeliness, and communications; type of collaboration and collaborators; the policy environment; data availability; time scale; consensus building; and the breadth of experience on which to draw.

The paper concludes that, in the last five years, progress has been made in the conduct of case studies designed to assess the impact of economic policy research and lessons have been drawn for the future. There has also been some progress in the development of methodologies for quantifying impact in economic terms. However, a number of issues remain. These include attribution, measurement and the enhancement of impact. As the need for more accountability has driven much of the work on impact assessment in recent years, attribution has been, and is still is, a challenging question to which answers remain to be found.

It seems that it is preferable to begin from the “demand-side” in impact assessment. This entails using major policy events as the starting point and working retrospectively to establish the separate influences of the many research suppliers and other factors on policy responses. When the interest is on the impact of particular institutions in a “supply-side” approach, whole bodies of work on topics rather than individual projects of limited duration would appear to be preferred. As far as possible, joint impacts of various players should be measured rather than trying to separate the contributions of individual institutions.

There is a need for more research on sampling and elicitation techniques to ensure objectivity and devise best practices. In this quest, it seems that exploring the elements of surprise in research information that policy makers were exposed to offers considerable promise. This is especially so with Bayesian approaches.

The most appropriate approaches to impact assessment should involve a mixture of both qualitative and quantitative methods. Retrospective narratives are an essential component of the former and, indeed, provide the basis for quantitative estimates and the related issue of attribution.

In order to be effective, impact evaluation must be institutionalized and not simply an exercise in accountability. Staff and management should have responsibility for recording outputs, outcomes and policy responses from their research. Independent evaluators can verify these and endeavor to translate them into meaningful measures of their impact on economic welfare.

Researchers have a responsibility to ensure that their research is disseminated to policy makers using appropriate communications media. A degree of advocacy is also appropriate. However this should not be taken to lengths that might compromise the independence and credibility of the researcher. With the increased availability of IT and the growing role of participatory democracy and good governance in developing countries, there is increased scope for credible policy research to be accessed by disparate groups and thereby better inform the policy process.

A remaining difficulty is the attribution of economic value when economic policy research reinforces current policy settings. Economic policy research that illuminates the distributional consequences of current and/or prospective policies seems to have the most influence on policy makers. Estimates of deadweight economic losses do not seem to be nearly as influential.

In order to further refine approaches and methodologies, we need to continue to undertake more case studies and apply the lessons learnt to enhance future impact and help to define “best practices.”

Why Impact Assessment Research Has Not Made More of a Difference: Lessons From Eastern and Southern Africa

P. Anandajayasekeram and M. Rukuni

The paper begins by providing a conceptual framework to assess the impacts of agricultural research and development (R&D) activities. The results of impact studies conducted in the region and lessons learnt are presented. Although the rates of returns estimates (ROR) for R&D investments are relatively attractive, available evidence suggests that the initial efforts had little impact on resource mobility, and did not significantly improve the reallocation of scarce research resources. In addition, very limited progress has been made to institutionalize impact assessment as a planning/management tool.

The results identify reasons for the limited influence of impact assessment research. This survey of researchers and research managers provides empirical evidence of how group perceptions differ due to the use of impact studies. Results include an assessment of impact studies in the processes of; resource mobilization and allocation, informing policy, feedback to researchers, extension staff and donors, as well as performance assessment of staff and programs. Finally, some suggestions are made to improve the utilization of impact assessment research results.

Estimating the Benefits of Plant Breeding Research: Methodological Issues and Practical Challenges

Michael L. Morris and Paul W. Heisey

Impact assessment studies consistently show that the benefits of plant breeding research are large, positive, and widely distributed. Economic analysis consistently indicates that investment in crop genetic improvement generates attractive rates of return compared to alternative investment opportunities. Similarly, social impact analysis consistently indicates that welfare gains resulting from the adoption of modern varieties (MVs) reach both favored and marginal environments and are broadly shared by producers and consumers. Partially because of the large body of empirical evidence that supports these findings, governments, international lending agencies, philanthropic organizations, and private corporations have invested millions of dollars in plant breeding research.

But how reliable are the results of studies that estimate the benefits of plant breeding research? Are the methods used to conduct such studies theoretically sound? And are the data sufficiently complete and accurate?

This paper reviews methods specifically used to estimate the benefits of plant breeding research and discusses methodological issues and practical challenges that often receive inadequate attention in applied impacts work. The idea is not to question the validity of the broad conceptual frameworks used to estimate the benefits of plant breeding research (e.g., the economic surplus approach, the production function approach) or to examine the major issues in research evaluation in general. Rather, the objective of the paper is to examine and propose workable solutions to a number of problems that frequently arise when the widely accepted conceptual frameworks are used for empirical analysis of plant breeding research.

Issues and challenges can be grouped into three general categories:

1. Measuring adoption of MVs:

- ▶ Defining the terms “improved germplasm” and “modern variety” in the presence of seed recycling, farmer selection, and creolization.
- ▶ Measuring the area planted to MVs (given the definitional problem).
- ▶ Measuring the area planted to MVs based on sample surveys, seed sales, and expert opinion.
- ▶ Consistency; given the limitations of data availability and reliability of estimates over time.
- ▶ Accounting for external factors that affect the rate and extent of MV adoption (e.g., cost and availability of improved seed and complementary inputs, farmers’ knowledge and management skills, economic policies that affect the profitability of adopting MVs).

2. Estimating the benefits associated with adoption of MVs:

- ▶ Estimating farm-level productivity gains attributable to adoption of MVs.
- ▶ Consistency between estimates based on yield trials and aggregate production data.
- ▶ Dealing with different types of productivity gains (e.g., yield increases vs. yield losses foregone).
- ▶ Distinguishing between the effects of improved germplasm and the effects of improved crop management practices.
- ▶ Accounting for non-yield benefits (e.g., reduced growing cycle, improved grain quality, positive environmental externalities).
- ▶ Estimating the longevity of benefits attributable to the adoption of MVs when the benefits erode through time.
- ▶ Anticipating what would have happened to productivity in the absence of the plant breeding program (counterfactual scenario).

3. Assigning credit for plant breeding research:

- ▶ Dealing with research spillovers (assigning credit to different breeding programs when innovation results from collaborative research).
- ▶ Feasibility of evaluating returns to alternative plant breeding strategies.

CIMMYT researchers, in collaboration with colleagues from national agricultural research organizations, have conducted a series of studies designed to document and quantify the impacts of international maize and wheat breeding research. Based on lessons learned from the CIMMYT studies, each of these issues and challenges is discussed in detail, and practical guidelines are presented to help those interested in conducting applied impacts studies to avoid common pitfalls, which, if ignored, may lead to incorrect empirical results. We conclude with a discussion of the policy significance of improved empirical estimates.

The Impact of Agricultural Maintenance Research: The Case of Leaf Rust Resistance Breeding in CIMMYT-Related Spring Bread Wheat

C. N. Marasas, M. Smale, and R.P. Singh

Leaf rust, caused by *Puccinia triticina*, is a wheat disease of major historical and economic importance worldwide. Genetic resistance, rather than the use of fungicides, remains the principal means of disease control. We estimated the impact in developing country production of efforts by the International Maize and Wheat Improvement Center (CIMMYT) to breed leaf rust resistant spring bread wheat varieties since 1973.

The challenge in estimating these benefits is dealing with the fact that rust pathogens are able to mutate rapidly and form new races that can infect previously resistant varieties. Various single genes or gene complexes determine the type, level, and longevity of a variety's resistance. Breeding for leaf rust resistance is therefore an example of crop maintenance research. Whereas productivity enhancement is measured in terms of positive yield gains, productivity maintenance is estimated in terms of the yield losses that would have occurred in the absence of research investment. Although its importance has long been argued, there are relatively few economic analyses of maintenance research, and, in particular, breeding for crop disease resistance.

The benefits of CIMMYT's investment in leaf rust resistance breeding were estimated using an economic surplus evaluation framework, adjusted for maintenance research. Gross research benefits were modeled as the surplus generated by avoiding a cost-increasing shift in the supply curve resulting from changes in the environment caused by evolving leaf rust pathogens. A standard capital investment analysis was then applied to estimate the economic returns on the research investment.

A sample of major spring bread wheat varieties grown in the developing world were classified by their type and level of genetic resistance to leaf rust through trials conducted at CIMMYT. The estimated yield losses of these varieties were compared with those that would have occurred had all these varieties been fully susceptible. The area to which yield savings applied was estimated by fitting historical logistic diffusion curves to the global area potentially affected by leaf rust. The analysis was further separated by wheat breeding mega-environment, a classification developed by the CIMMYT Wheat Program to guide its germplasm enhancement activities. We included the full cost of CIMMYT's wheat improvement effort since 1973 to calculate the net present value and internal rate of return on the research investment. A range of investment values were elicited by varying assumptions on percentage yield savings, research costs, and the discount rate.

The results of this study have two major policy implications. Firstly, they demonstrate the economic returns on CIMMYT's investment in leaf rust resistance breeding since 1973. The global decline in resources for agricultural research increasingly necessitates their efficient targeting. Secondly, the results emphasize the importance of maintenance research, which has often been undervalued in economic analyses. Studies at CIMMYT indicate that part of the progress in wheat yield gains through the years has been achieved by protecting this yield potential through disease resistance breeding. Failure to account for the effects of maintenance research could therefore bias rate of return estimates.

Economic Impact of Post-Harvest Research in Potato and Sweetpotato in Developing Countries

Keith O. Fuglie and Thomas S. Walker

Research to lower post-harvest processing costs and losses and to expand market utilization of crop commodities has important economic implications for farmers, marketing agents, and consumers. However, the public sector has not invested heavily in post-harvest research, which continues to be the domain of the private sector. The lack of success in rate of returns and difficulties encountered in assessing the impact of this kind of research has not strengthened the case for greater public sector intervention in post-harvest research, vis-a-vis plant-oriented production research. Nonetheless, demand for public-sector investment in this type of research is rapidly growing because of perceptions driven by market competition and increasing globalization. We critically review the

International Potato Center's efforts in post-harvest research on potato and sweetpotato, drawing on case studies in several regions of the world. The paper also presents a general framework for examining economic impacts of post-harvest technical change. Three ways of modeling technical change in food processing are discussed: reducing unit costs of processing, reducing post-harvest crop losses, and expanding market demand for processed food products. The model is used to illustrate the effects of various types of post-harvest technical change on consumer and producer welfare. We conclude with an assessment of how post-harvest research compares with other areas of research investment in the improvement of potatoes and sweetpotatoes.

Impact Assessment in Natural Resource Management Research

John Poulsen, Boru Douthwaite, and Douglas White

This paper provides an overview of natural resource management impact assessment (IA), conducted by the Task Force on Integrated Natural Resource Management (INRM). It represents progress made during and following the INRM workshop in Cali, 28-31 August 2001. It also incorporates the results of an ongoing literature review of impact assessment studies related to natural resource management research.

A Community of Practice initiative on Impact Assessment in NRM research was formally launched at the INRM workshop in Cali. The ultimate purpose of the initiative was to develop approaches and methodologies for INRM impact assessment and to integrate them into the framework of the INRM research cycle. Such methods are intended to identify more effective and efficient research and management interventions as well as enabling an assessment of the impact of agricultural research on decision-making strategies regarding the adoption or non-adoption of specific practices. However, some intermediate concerns need to be addressed before appropriate methodologies can be developed for IA of INRM. In particular, we explore concepts and operational definitions with respect to:

- ▶ what types of impacts are of interest to decision makers
- ▶ what impacts need to be measured
- ▶ what types of indicators/ measures are appropriate

Furthermore, we explore how results of the above would be used and operationalized.

Impact assessment monitoring and evaluation must be an integral part of the INRM process. While ex-post impact assessment is still essential, a greater emphasis is needed on monitoring and evaluation. This is primarily because INRM attempts to catalyze change in complex environments using complex interventions. Perfect knowledge is not possible before a project starts and project coordinators need to learn as they go along.

Hence, monitoring and evaluation constitute a key feedback mechanism. Monitoring and evaluation are therefore the basis of good, adaptive project management. It is also necessary to know what success looks like before progress in achieving that success can be evaluated. Changes in the five capitals (natural, social, physical, financial, human) would capture changes in production functions, human well-being poverty measures, and ecosystem functions, but actual indicators chosen for a specific project should be guided by what people think and want. Participatory evaluation is an essential part of INRM.

Evaluation of success must include scaling up. INRM research by CG centers to produce location-specific solutions is not enough. Processes by which location-specific solutions can be scaled up both horizontally and vertically must also be developed. Both horizontal and vertical scaling up are about changing people's opinions, thinking and practices at different levels. This includes farmers, national stakeholders, and international researchers. This vital impact of INRM is often overlooked by CG center research. Innovation is a social learning process, including the use of new knowledge. There is an attribution gap. Learning itself is a social process because people construct new knowledge often in interaction with others. People socially construct technology and in the process adapt new technologies and ideas to their systems. Innovation is therefore inherently a complex process with high degrees of non-linearity. This would seem to make conventional impact assessment for INRM activities on highly aggregated development indices, such as poverty alleviation, almost impossible.

INRM views innovation as a social process, in which people construct solutions to their problems. Once one accepts that users are modifying technologies and their own systems to accommodate new technologies and that these adaptations affect adoption rates and who benefits and loses, then one must also accept that technological change is an immensely complex process,

with a high degree of non-linearity. Current best practice economic evaluation methods commonly used in the CGIAR system, which attempt to establish a linear link between a project's outputs and wider level impacts, struggle with this complexity. Hence IPM and INRM require different evaluation approaches that can bridge this "attribution gap." We can learn from other fields, for example evaluation of social programs. However, different skills are required, such as those offered by anthropologists, ecologists and sociologists.

The central question is whether or not we should aim to bridge the attribution gap or simply accept that there is a grey area where multiple forces come together before a final impact is reached and supposedly quantified. Therefore the term "gap" may be misleading. It is more a junction where the many efforts meet. Our difficulty is attempting to quantitatively measure the (often) distinct efforts. But given the complementarity of inputs/efforts (e.g. improved seeds and fertilizers, using the agriculture example), it may be nearly impossible to distill due credit for any one effort. Moreover, given the limited financial resources with which we can analyze impact, those monies used to precisely attribute impact are probably best directed elsewhere. Thus, plausible arguments and qualitative measures of impact become more reasonable analytical approaches.

IA is also essential for establishing accountability and securing continued funding. Technologies of the Green Revolution could be relatively easily scaled-up/out, demonstrating high rates of return. However, INRM is not as easily scaled-up/out. There are problems associated with scaling-up/out of site-specific technologies. INRM involves far more complex technologies than those coming out of the Green Revolution. The benefits of improved INRM are typically accrued in the medium and long term, requiring coordinated efforts between private rural

dwellers and public institutions. Conventional extension approaches, which often merely disseminate technologies, are therefore not likely to be successful. It is difficult to attribute impacts on the ground to INRM (given the array of other factors affecting local livelihoods and resource management).

Scaling up/out is difficult and there are few examples of where it has been done. The difficulty is in how to attribute the scaling up/out of INRM to our work and not other variables. Some work is ongoing in this area (e.g., rules of thumb on how to deal with attribution). The difficulty of scaling up/out are two important but separate issues. Scaling out difficulties stem from the heterogeneity of geographic areas. Not only are biophysical conditions different (the same ones that affected Green Revolution efforts), but also INRM includes socio-economic-cultural issues. These latter subtleties are the crux of scaling out challenges. Areas and people are different. As for scaling up, the appropriate level of action/analysis is determined by the specific challenge. Scaling up incurs a loss of detail. The goal is to determine the correct scale of analysis. Just as the Green Revolution did not scale up all efforts (e.g. CGIAR in different parts of the globe) nor should INRM. A balance between specificity and generality is required. Collaborative research networks offer a cost efficient approach. One example would be networks for sharing germplasm and research results for a range of commodities.

A key question is whether or not participatory approaches comprising monitoring and evaluation are sufficient in terms of timeliness and scientific rigor. While participatory efforts are important, there is a probability that they need to be supplemented with more structured analyses. How this balance can and should be found is an important development research question.

Assessing Environmental Impacts of Productivity-Enhancing Crop Research: Concepts, Evidence, and Challenges

Mywish K. Maredia, Prabhu Pingali, and Michael Nelson

The objectives of the paper are to present and discuss (1) an empirical estimation the environmental impacts associated with productivity-enhancing technologies; and (2) the problems and possibilities of attributing environmental impacts to research. This is achieved by examining the factors that contribute to positive and negative externalities and the conceptual and methodological issues related to impact assessment.

Evidence related to the nature and magnitude of environmental impacts of productivity-enhancing technologies include: land-saving impacts, soil degradation impacts, human health impacts, and impacts associated with loss of genetic diversity. Aggregate cost estimates of these externalities in developing and industrialized countries are presented where appropriate to give an idea of the scale and magnitude of environmental costs of modern agricultural technologies. The review of this evidence indicates that: (1) with the exception of salinity problems associated with irrigation, the loss of soil fertility associated with monoculture, and the health impacts of pesticides, the evidence on the extent of the negative externality problems and their environmental impacts are not well documented; (2) it is difficult in most cases to move from examples to aggregate global estimates of externality impacts, although it is possible in a few cases; (3) the conceptual and measurement issues in estimating the monetary values (associated with impacts) are too complicated to derive any meaningful estimates of aggregate environmental costs and benefits and; (4) an appropriate measure of such impacts is reduced “land savings” or the counterpart to the positive environmental impact associated with productivity enhancing technologies, namely, “land savings” achieved.

The challenge for the environmental impact assessment of productivity enhancing research is to analyze and measure impacts beyond productivity effects. This means quantifying the positive and negative externalities and assessing the environmental impacts of these externality effects. The emerging conclusions from the review indicate the difficulty and complexity involved in determining the counterfactual and attributing the impacts to agriculture research. Factors other than research have played an important role in creating the environmental problems. Moreover, many of the negative externalities observed today and discussed in the literature have nothing to do with new technologies that resulted from agricultural research (such as the Green Revolution technologies in the 1960s and 1970s).

A possible option for attributing environmental costs to past research efforts is to consider the contribution of mainstream research as speeding the rate of increase in the intensive use of inputs such as fertilizers, pesticides and irrigation. Alternatively, estimates of counterfactuals can be derived using a general equilibrium framework and modeling input use (HYVs, irrigation, fertilizers, pesticides) as functions of different technical, economic and policy variables, and relating them with an associated measure of externalities at different levels of input use. Another possible approach towards integrating environmental impact assessment into economic assessment is including resource quality variables and environmental externalities in econometric models using Total Social Factor Productivity or production function analysis. A more feasible approach, at least in the short-run from a NARS' or research organization's perspective, would be to carry out site-specific case studies on environmental impacts of research. The purpose of such case studies should be to review the linkages between environmental degradation and crop technologies in specific regions/sites, which are impacted from productivity-enhancing research technologies.

Measuring the Impact of User Participation in Natural Resource Management Research

Nancy Johnson, Nina Lilja and Jacqueline Ashby

Persistent poverty and environmental degradation demand a constant effort to improve the effectiveness and impact of agricultural and natural resource management research. Participatory research methods have been developed to enable researchers to better target their work towards the needs and constraints of specific stakeholder groups. Beyond improving the efficiency of the research process, participatory research may also strengthen the capacity of participants to initiate a continuous process of innovation suited to their particular needs and conditions. The capacity of users to locally evaluate and adapt technologies may be particularly important in natural resource management.

This paper assesses the impact of using participatory methods in three natural resource management research projects. The analysis assesses the technological, economic, human, social, and cost implications of incorporating users into the research process. Data for the analysis was gathered using both participatory and conventional survey methods.

The results suggest that user input early in the project can be critical for identifying relevant technologies. User input was also linked to higher levels of adoptability and/or economic impact. While human capital impacts were found to be very high when farmers worked intensely with researchers, no significant social capital impacts were found. This could possibly be related to the plot-level nature of the technologies being developed.

Finally, participatory methods do appear to imply increased short-run costs. However, these costs are not as high as might be expected and are often one-time costs associated with building capacity to do participatory research.

Golden Rice: What Role Could it Play in Alleviation of Vitamin A Deficiency?

David Dawe, Richard Robertson and Laurian Unnevehr

Golden Rice is a new variety that has been genetically modified to contain beta-carotene, a source of vitamin A. This modification was undertaken as a strategy to address vitamin A deficiency, which is widespread in the less developed countries of Asia. Children's food intake data from a poor rural region of the Philippines is used to simulate the potential impact of Golden Rice on vitamin A intake. The potential impact, coverage of deficient subpopulations, and costs of Golden Rice are

compared to two other interventions that have been tried in Southeast Asia, fortification and supplement. Golden Rice could deliver amounts of vitamin A that are modest but significant in the context of current intake levels. Also, it compares favorably with other interventions in terms of costs and coverage. Understanding where it may have greatest impact on vitamin A deficient diets would help to target efforts to adapt this new variety for release and adoption.

The Impact of Iron Bio-availability-enhanced Diets on the Health and Productivity of School Children: Evidence from a Mungbean Feeding Trial in Tamil Nadu, India

Katinka Weinberger

Currently, there is no consensus regarding the measurement of indirect impacts of improved technologies for the poor, for instance on health and productivity. The objective of this paper is to contribute to the discussion by quantifying the impact of improved mungbean related technologies on the micronutrient status and productivity of women in Pakistan and India.

Micronutrient deficiencies remain a persistent health problem in South Asia. Among the different forms of micronutrient deficiencies, iron anemia is one of the most prominent. It is estimated that 60% of South Asian children under five suffer from some form of iron deficiency. The principal cause of micronutrient malnutrition is inadequate diets. Foods rich in micronutrients, such as vegetables and pulses, are consumed in insufficient quantities because they are either unaffordable or undesirable. Promoting micronutrient rich crops, such as pulses, can help to reduce micronutrient deficiencies. This can be achieved by reducing pulse prices, through technological innovations, and by attempting to change processing and preparation habits.

Mungbeans are a promising crop in this respect because they benefit both producers and consumers. For producers, mungbeans require low inputs, restore soil fertility, are a short-duration crop, and can easily be integrated into cereal-based crop rotations using wheat, maize and rice. For consumers, mungbeans contain high levels of protein and iron, hence providing important nutrients for the cereal-based diets of the poor.

Previous studies in Pakistan have shown that improved mungbean varieties provide US\$8.8 million annually to producers and consumers. Of this direct economic benefit, 62% goes to producers (5.5 million US\$), and 38% go to consumers (3.3 million US\$). While these figures are impressive, indirect benefits due to technological improvements, which typically exceed those of direct benefits, are not included in this estimation.

This study quantifies the indirect benefits of improved mungbean-related technologies in Pakistan and India. A feeding trial in India measured the impact of improved mungbean food preparation practices on the bioavailability of iron. Blood iron content, health, and cognitive achievements were assessed in 225 adult women and 225 children during a one-year time period. Preliminary results indicate that, compared to the control group, the anemic status of participating women improved considerably.

The study found that in Pakistan, the release of new mungbean varieties led to an increase in consumption. The impact of increased micronutrient intake on productivity was estimated using the combined results of a food consumption survey and health and wage information. Since wages and nutrient intake may be determined simultaneously, income was treated as an endogenous variable, and a two-stage least square approach was applied. Preliminary results indicate that productivity, measured in wages, is determined by micronutrient intake. Mungbeans were an important iron source for the women sampled.

In conclusion, policy interventions aimed at enhancing micronutrient intake can be regarded as investments in improved health and productivity and higher household incomes.

Agriculture and Nutrition: Adversaries, Bedfellows or Allies?

Lawrence Haddad

There is a growing consensus that the reluctance of agriculture and nutrition communities to collaborate is undermining attempts of both to meet their stated objectives. This paper briefly reviews the conceptual linkages between the two sectors, summarizes current impact evidence on these pathways, outlines the

drivers that will force a closer collaboration in the future, and makes some suggestions about the strategic choices that need to be made if the “forced” collaboration is to be between allies, not between bedfellows or adversaries.

What GIS Can (and Can't) Bring To Impact Assessment: Novel Data, Analysis, and Insights

Gerald C. Nelson

A key characteristic of geographic systems analysis is that location of an observation is known. The goal of this presentation is to indicate where the addition of location information adds value to the impact assessment of agricultural research. I adopt the 6

categories of impact assessment research identified by Pingali as an organizing framework for assessing the value of spatially explicit information and analysis. Selected results from the literature are presented and areas of future use and research identified.

GIS Tools: They're not just for Experts Anymore

D.P. Hodson and J.W. White

Despite advances in software usability, data access and analytic approaches, GIS is still only utilized by a fraction of potential users. This is particularly true in developing countries. However, an increasing number of software options and data sources are becoming available, and the situation is rapidly changing. This paper highlights a selection of widely accessible GIS tools, coupled to geographic datasets. These include the Africa Maize Research Atlas (International Maize and Wheat Improvement Center-CIMMYT, incorporating ArcExplorer from ESRI Inc.), DIVA (International Potato Center-CIP/International Plant Genetic Resources Institute-IPGRI), and the Almanac Characterization Tool (Mud Springs Geographers Inc.). These tools represent increasing levels of complexity in entry-level GIS systems, but all permit non-GIS experts to analyze and interpret geospatial data. The tools provide a means to improve spatial awareness amongst researchers that, in turn, can foster more efficient use of higher-level GIS resources. Additionally, such tools typically require a minimal amount of training (a maximum of two days), and represent zero or minimal cost options.

To encourage GIS data access, CIMMYT has promoted the distribution of such tools, including data sets, to agricultural researchers. Climatology, soils, topography, infrastructure, demographics, and crop production data are typical inclusions. Additionally, these tools have considerable utility for the dissemination of data products arising from more advanced GIS analysis, namely, accessibility surfaces or poverty maps.

Several examples are given of real world applications of these tools, including how they can assess impact. The adoption of conservation tillage (CT) technologies in the rice-wheat region of the Indo-Gangetic Plains is highlighted. Nearly two decades of research on tillage options now appear to be driving a substantial increase in the adoption of reduced tillage practices. Through the Rice Wheat Consortium; researchers are using hand-held GPS units to rapidly record field locations where farmers have adopted different CT technologies. These locations, and all associated attribute data, can then be transferred directly into a GIS to produce an accurate spatial and temporal record of technology spread across the region. This is possible in near real time, is undertaken entirely by researchers in the region, and requires an investment of less than US\$200 in GIS/GPS hardware and software.

Lost in Space: Enhancing the Role of Spatial Analysis in Strategic Impact Assessment

Stanley Wood and Jordan Chamberlin

Assessing the past or potential impact of agricultural research and development at national and international scales is confounded by a great deal of real-world heterogeneity. One attraction of spatial analysis is its capacity to represent simultaneously the spatial variability of many key factors influencing agricultural production decisions and performance: climate, terrain, soils, water resources, and the physical accessibility of infrastructure and markets. In the same framework, these factors can be juxtaposed against the spatial distribution of ecosystems, people, crops, livestock, and the threat of pests and diseases. In theory, this analytical capacity holds great promise for our ability to better understand the ranges and combinations of socioeconomic and environmental conditions under which agriculture takes place and, therefore, to make more informed assessments of the potential impacts of specific policy, institutional and technological innovations. In practice, there are very few impact assessment applications, at the meso or macro scale, in which GIS has played a significant analytical role – rather than serving simply as a data mapping tool.

This paper reviews some of the conceptual and practical difficulties in converting the promise of spatial analysis into a reality for the type of strategic,

cross-country impact assessment that is (or should be) of high priority for the CGIAR. Many of these difficulties relate to differences in definitions, formats, resolution, and time periods among spatial data sources. But even more problematic is the fact that many critical datasets simply do not exist, or do not exist at resolutions that are sufficient or consistent. Three examples are: the spatial distribution of production, the spatial distribution of people, and the spatial distribution of soil and water resources. Ironically, these are precisely the core datasets we need to trace through the potential chain of impact from, for example, technology adoption to productivity change and hence to markets, food availability and incomes, and to natural resource stocks and flows.

We describe work being undertaken by IFPRI to address several of these challenges. These include the development of a robust method to perform the crop-specific spatial allocation of production, and of improved population distribution maps that explicitly distinguish between urban and rural areas and populations. We also describe progress on the development of a compatible economic model (DREAM) designed to assess the potential benefits of technical change in a multi-region setting.

Assessing the Impact of Agricultural Research on Poverty with the Sustainable Livelihoods Framework: Concepts and Methods

Michelle Adato and Ruth Meinzen-Dick

As the Consultative Group on International Agricultural Research (CGIAR) goes beyond the goal of increasing food production to the broader goal of reducing poverty, both agricultural research and studies of its impact become more complex. The Standing Panel on Impact Assessment (SPIA) has commissioned a multi-country study of the impact of agricultural research on poverty, led by International Food Policy Research Institute (IFPRI) with the participation of several other centers.

The studies use an expanded definition of poverty that goes beyond income or nutrition-based head counts, to consider other aspects of well-being and empowerment. The Sustainable Livelihoods

framework provides a common conceptual approach to examining the ways in which agricultural research and technologies fit into the livelihood strategies of households with different types of assets and wealth, and the types of outcomes for reducing poverty and vulnerability. Applying this framework requires interdisciplinary research and a combination of quantitative and qualitative methods.

This paper reports on the conceptual framework, methods, and findings to date of these studies. The first paper provides an overview of the approach, followed by more detailed methods and results from three of the case studies: two in Bangladesh and one in Mexico.

The Impact of Rice Research on Poverty Alleviation: The Bangladesh Case

Mahabub Hossain, David Lewis, Manik Lal Bose, Alamgir Chowdhury, and Ruth Meinzen-Dick

Bangladesh has made notable progress in sustaining a respectable growth in food grain production over the last three decades through large-scale adoption of modern rice varieties. This is despite the declining availability of arable land and predominance of small farmers and landless agricultural laborers. Recent studies analyzing secondary data have indicated moderate improvements in poverty for both the rural and urban population. In order to understand the impact pathways of rice research on the welfare of the poor, this paper analyzes the differential adoption of improved rice varieties across socially differentiated groups and the effect of adoption on productivity, employment, profitability, and asset accumulation. It also attempts to explain how resource-poor households have gained or lost from changes in livelihood strategies and outcomes induced by productivity growth in rice cultivation, especially mediated by key institutions and infrastructure development.

The paper utilizes two-point (1987-88 and 1999-2000) sample household survey data on the operation of the rural economy for a subset of a nationally representative sample drawn by the Bangladesh Institute of Development Studies in 1987. The sample for the 1987 survey was drawn using a multi-stage random sampling method and consisted of 1,240 sample households from 62 villages belonging to 57

districts. The 1999-2000 survey selected half of those villages, which represented different rice ecosystems and infrastructure development, and drew a sample of 30 households from each village using the wealth-ranking method. The surveys generated information on sources of household vulnerability, asset bases, livelihood strategies, and conventional economic indicators of outcomes, including self-perceptions of poverty status. The paper analyzes the quantitative information using the sustainable livelihood framework and tests hypotheses through focus group discussions conducted in a few selected villages within the sample.

The analysis covers the following issues: a) changes in the asset base for socially differentiated groups in technologically progressive and backward villages and how they affect livelihood strategies; b) determinants of the adoption of modern rice technology using a Tobit model incorporating biophysical and socio-economic factors; c) the impact of technology adoption on productivity of inputs, profitability, household incomes, and asset accumulation for households stratified by livelihood strategies and; d) the relationship between growth in rice productivity and income generated for the resource poor households in rural non-farm activities using the village level data within a multi-variate regression model.

Impact of Improved Vegetable and Fish Pond Technologies on Poverty in Bangladesh

Kelly Hallman, David Lewis, Suraiya Begum, and Agnes Quisumbing

This case study examines the impacts of improved vegetable and fishpond technologies on poverty in rural Bangladesh. It builds upon a broad quantitative survey undertaken by IFPRI in 1996/1997 that examined the impact of the delivery of agricultural technologies by NGOs—with training and credit—on nutrition, micronutrients, and women's status within the household. Careful attention was paid in the survey design to the construction of a set of appropriate counterfactuals for measuring impact. Study sites were not purposefully chosen as areas where the pro-poor impact was most likely to be observed, thus providing an unbiased setting to begin to address "poverty impact" questions. The present study undertakes an integrated economic and social analysis to assess the impacts of such agricultural programs on poverty. Poverty is conceived here to encompass not only income and expenditure, but also vulnerability and capabilities. Issues not easily addressed in a quantitative study—such as perceptions of poverty, livelihoods strategies, the institutional setting, and technology dissemination pathways—are informed by qualitative data collection.

In this paper we report on: (1) Mapping of "well-being" concepts derived from an independent countrywide participatory poverty assessment onto the existing household survey data for the purpose of determining where survey households fall along a participant-defined global "well-being" spectrum. These well-being categories form the basis for selection of 54 focus groups: 3 male and 3 female groups from middle, poor, and "hard core" poor households, respectively, in 3 villages in each of 3 study sites.

(2) Using quantitative data on myriad community characteristics, the credibility of the counterfactual design of the quantitative survey is assessed. This is to ensure that NGOs did not purposefully select villages for introduction of the technologies where they may have been more likely to be successful as such a situation would contaminate the validity of the control sample. (3) Assessing how various livelihood assets influence membership in NGOs and how they help shape adoption of the agricultural technologies. Findings will be drawn from focus group discussions and analysis of a census of households in each site and the household survey data. (4) Describing the vulnerability of contexts of households as reported in the focus groups. (5) Characterizing how the technologies fit into livelihood strategies of households. This will include findings from the focus groups and from the construction of income source portfolios for "adopter" versus "likely adopter" households using the survey data. (6) Documenting the impact of agricultural extension programs and technologies on the empowerment of women and other disadvantaged groups, via focus group results and analysis of the survey data. (7) Demonstrating how technologies were described by participants in focus groups to contribute to their overall well being and comparing the livelihood outcomes of "adopter" versus "likely adopter" households using the survey data. In both instances, traditional and broader concepts of poverty are considered.

The Impact of Improved Maize Germplasm on Poverty Alleviation: The Case of Tuxpeño-Derived Material in Mexico

Mauricio R. Bellon, Javier Becerril, Michelle Adato, and José Alfonso Aguirre Gómez

Improved maize varieties have been available in Mexico for more than 40 years. Unfortunately, diffusion of these varieties has been relatively limited, despite repeated government campaigns to encourage use of improved seed. However, the relatively low rate of diffusion may give a misleading impression of the true impacts of improved germplasm on the welfare of rural households. A growing body of evidence suggests that many small-scale, subsistence-oriented farmers have taken up improved varieties and through their management transformed them to better suit their needs. This process can be seen as a “middle way” by which scientific technology is adapted to local farmer conditions, thus serving as a vehicle by which the poor benefit from improved technology. The objective of this study is to assess the impact of improved maize germplasm on rural poverty in lowland tropical Mexico. Its focus is on the Tuxpeño germplasm complex, which has been subjected to an intensive breeding effort by the International Maize and wheat Improvement Center (CIMMYT) and its national partner INIFAP during the last forty years. The study involved three separate but related activities: 1) measuring the diffusion, local adaptation, and use of improved maize germplasm; 2) understanding how choices about adaptation are linked to the livelihood strategies and vulnerability context of rural households, and; 3) assessing the impacts of adoption on the welfare of rural households. Different methodologies such as participatory methods, ethnography, case studies, a household sample survey

and a collection of agronomic evaluation of maize samples were used. Twelve communities, with different degrees of marginality (very high, high, and medium) were selected in two of the poorest states in Mexico (Oaxaca and Chiapas). This was done with the help of a geographic information system (GIS) that synthesizes information on marginality, formal distribution of improved germplasm, and the agroecological adaptation of improved Tuxpeño germplasm. In the twelve communities, a series of focus group discussions were organized to assess technical issues regarding maize production and variety adoption. In eight of them, additional focus groups were organized with poor and relatively wealthy informants to understand their livelihood strategies. Finally, in four of them, in-depth case studies on the local livelihoods were carried out with selected households. Based on the qualitative information generated with the focus groups, a survey has been developed and a sample survey will be implemented in the twelve communities. The survey includes a section on farmers’ evaluation of maize types grown in terms of traits previously identified as important using participatory methods. This should allow a comparison of the different maize types based on farmers’ perceptions. Finally, grow-outs of the collected maize samples, as well as sample from available commercial varieties, will be carried out to quantify the agronomic differences among the samples and assess how the adapted maize compares to the original products of breeding.

The Economic Costs and Benefits of a Participatory Project to Conserve Maize Landraces on-Farm

Smale, M, Bellon, M, Aguirre, A. Manuel, J. Mendoza, A.M. Solano, R. Martinez, and A. Ramirez

The aim of this paper was to assess whether farmer welfare in the Central Valleys of the state of Oaxaca, Mexico, could be enhanced through participatory crop improvement while maize genetic diversity is maintained or increased. The underpinning project rationale is conservation of potentially valuable alleles in landraces that have evolved on farms under natural and human selection pressures. The paper characterizes the unique structure of the economic costs and benefits of the project, which include both private and public benefits; estimates the private costs and benefits to farmers as well as from the perspective of a private investor; and describes the distribution of

benefits among social and economic groups. Farmers as a group obtained a high benefit-cost ratio from participating. However, from a private investor perspective, benefits are not likely to justify the cost. There is a clear gender bias in both participation and benefit distribution, though there is also evidence of a positive welfare transfer to maize deficit households. Many public benefits of the project would be exceedingly difficult and costly to document. The study raises issues concerning the application of standard economic methods to impact analysis in similar situations.

The Distribution of Benefits from Public International Germplasm Banks: The Case of Beans in Latin America

Oswaldo Voysest, Nancy Johnson, and Douglas Pachico

The unrestricted international flow of genetic resources from international gene bank collections is perhaps one of the greatest impacts of international agricultural research. This paper examines the distribution of benefits from bean genetic resources across countries in Latin America.

The genealogy of commercial bean cultivars released since 1976 was analyzed. This enabled the source of commercially grown genetic resources to be calculated for each country. All countries were shown

to be heavily dependent on imported genetic resources for their commercial cultivars. Information on the economic impact of improved bean varieties enables the share of economic productivity benefits associated with imported germplasm to be calculated by country of origin. The benefits received by each country from improved bean germplasm are compared with the contribution of that country's germplasm to other countries. Patterns in the flow and use of genetic resources and associated benefits are analyzed.

Endowing Future Harvests: The Long-Term Costs of Conserving Genetic Resources at the CGIAR Centers

Bonwoo Koo, Philip G. Pardey, and Brian D. Wright

The eleven Consultative Group for International Agricultural Research (CGIAR) gene banks have grown considerably in size over the past few decades, currently holding over 660,000 accessions of germplasm. Conserving germplasm is a long-term, if not in perpetuity, proposition. Hence, the mismatch between the predominantly annual financial support for this conservation effort and its long-term aims is a serious concern. Using the results of five CGIAR gene bank case studies, this study estimates the size of an endowment or stewardship fund, the earnings from which would assure a funding stream to conserve this genetic material for future generations. It is estimated

that the annual cost of conserving and distributing genetic material presently held in the CGIAR gene banks is US\$5.7 million/year, and a commitment to underwrite these core gene bank services for the benefit of all future generations could be met by setting aside a fund of US\$149 million (invested at a real rate of interest of 4%/yr). This would be sufficient to underwrite the CGIAR's current conservation activities in perpetuity (estimated to be US\$61 million), as well as maintain the distribution activities (US\$88 million) that provide germplasm to breeders, scientists, farmers, and others worldwide.

The Simple Econometrics of Impact Assessment: Theory with an Application to Milk-Market Participation in The Ethiopian Highlands

Garth Holloway and Simeon Ehui

This paper presents novel econometric techniques for enhancing the robustness of impact assessments in the context of econometric investigations of research productivity, institutional innovation or poverty alleviation. The methodology has broad application to time series or cross-section data. However, it is especially useful when applied to household panel data (the focus of this study) when adoption and participation issues are in question.

In these circumstances, one problem that frequently arises is a policy choice between alternative means of achieving stated objectives. Because the impacts of various policies are often predicated on econometric results, policy options are associated with a probability distribution about their impacts. When these distributions emanate from different parametric families, a problem of comparison arises. For example, the distributions of the precise impacts of two alternative policies may have different locations (as indicated by their respective means estimates) and may also have different scales (as indicated by their respective variance estimates). Even when the distribution of one policy stochastically dominates another, a problem of ranking arises when budgetary considerations limit resources.

In this paper, we demonstrate how measurement problems of stochastic impact assessment can be resolved tractably, intuitively and robustly as an outcrop of most conventional econometric modeling exercises. The methodology exploits recent advances in Markov Chain Monte Carlo (MCMC) methods. MCMC methods are a collection of iterative techniques for estimating models in which discrete-choice, truncated or censored-regression formulations are at issue. This general class of models appears frequently in empirical

investigations of agricultural productivity, equity, poverty, social health, and nutrition, especially where the traditional household-production model is the *modus operandi*. Surprisingly, there have been no applications of these powerful techniques to impact assessment. Hence, the study represents the first of its kind.

In our application, we present empirical results related to an emerging market in the Ethiopian highlands. We explore the measurement of various policies targeted toward promoting participation among formerly subsistence milk producers at two peri-urban sites close to the capital city, Addis Ababa. In this context, the policy questions include the identification of the covariates and the levels that are required to effect entry by non-participants in a market; in other words, measures of the inputs needed to create and sustain a market. This application is important in the context of developing economies, where the density of non-participants is high and is considered to be the main impediment to economic development.

Our main objective was to estimate the covariate levels that prompt market entry of non-participating households. The strategy was very simple. First, we estimated each non-participant's distance from the market in terms of the (latent) level of marketable surplus that the household would wish to produce, given its covariates. These are the augmenting data. By definition, they are negative real numbers.

Subsequently, we computed the levels of the covariates that make these negative numbers become positive, signifying positive marketable surplus and, presumably, entry into the market.

Measurement and Sources of Efficiency in Argentina's Agricultural Sciences Research System: A Stochastic Frontier Analysis

Daniel Lema, Susana Mirassou, and Martin Guppy

In 1999, the total science and technology budget in Argentina reached US\$ 1, 517 million. This corresponds to 0.54% of the national PBI and represents US\$ 50,800 of annual investment per capita for the 20,911 research staff. Agricultural, forestry and fisheries research receives 10.6% of the budget.

The focus of the present study is to evaluate the productivity of this sector by analyzing the efficiency of agricultural research scientists in the National Research Council of Science and Technology of Argentina (CONICET).

The data used in the study was obtained from CONICET databases and covers 1996-2000. The specific discipline of Agricultural Sciences has 107 researchers representing 3% of a total of 3,685 individuals. There are also a significant number of researchers who belong to other disciplines but with research competences in agricultural subjects and who are not included in this sample.

To evaluate efficiency, we use the approach proposed initially by Farrell in 1957. It consists of the estimation of a production function that allows the calculation of the maximum output (y^*) that can be obtained by each production unit for an input combination. The level of technical efficiency (TE) of each production unit can be defined as the relationship observed among the actual product (y) and this maximum (y^*): $0 \leq TE = y/y^* \leq 1$. Therefore, to evaluate TE, it is necessary to know the underlying production function; i.e., the production function that could be estimated from the available data. Then, TE can be calculated from the best practices observed.

The proposed model is: $y_i = f(x_i, b) + e_i$

where y_i is the output of unit i ; x_i is the input vector, b is a vector of parameters and e_i is a composed random error: $e_i = v_i + u_i$. v_i is a symmetrical error that represents the aleatory variations in production, taken as i.i.d. $N(0, s^2)$. The u_i is an asymmetric term that represents technical inefficiency and it is assumed that it is distributed independently of v_i and that it satisfies the condition $u_i \geq 0$.

The stochastic frontiers models used in the study are those proposed by Battese and Coelli (1996). These models allow the use of panel data (a sample of N individuals in T periods), and have different specifications about the composition of u_i (technical inefficiency effects). To assess the determinants of CONICET Agricultural Sciences Researchers' efficiency and productivity, research output will be measured in quantity and quality of publications, patents, theses, and advice given. Different input measures will be considered such as project budgets, actual expenses, and wages. Specific variables will be included to assess efficiency effects and to identify scale effects and size economies. These variables are namely: type of research institution (university, public research institute, private institution); geographical location; use of technological and scientific networks; individual characteristics (age, gender); and environmental aspects.

Making an Impact with Impact Assessment: The Tradeoff Analysis Approach and Lessons from the Tradeoffs Project in Ecuador and Peru

John Antle, Jetse Stoorvogel, Walter Bowen, Charles Crissman, and David Yanggen

This paper addresses the question raised in the conference title: why has impact assessment research not made more of a difference? Impact assessment research has been carried out for a long time, but we see that the research agenda of most institutions is not significantly affected by its results. What is going wrong? In this paper we will draw from lessons learnt from the development of Tradeoff Analysis (TOA) to help answer this question. Perhaps the most important lesson is that the integration of decision makers, other stakeholders and scientists into the process of impact assessment is a critical element in making an impact with impact assessment. In a companion paper, we address another key issue, namely, the need for suitable methods and tools to implement integrated assessments of agricultural production systems that account for both economic and environmental impacts.

The TOA approach is based on the concept that, in order to be used by public policy decision makers and other stakeholders, impact assessment research must be integrated into a process that involves both the decision makers and the scientists engaged in the research. The TOA approach to integrated assessment begins by bringing together decision makers and scientists to identify quantifiable sustainability indicators that are judged to be relevant to assessing the impacts of a production system. This group also formulates hypotheses about relationships between these indicators (which may be either tradeoffs or win-win outcomes), and determines how information about these relationships can best be delivered to the users of the information (decision makers, interest groups, the general public, etc.).

The next step in the TOA approach is to develop data and models that are capable of quantifying the sustainability indicators on relevant spatial and temporal scales. Among the critical methodological issues that must be addressed are the availability of suitable data, and methods for appropriately

integrating disciplinary data and models into a coherent representation of the agricultural production system. The Tradeoff Analysis Model was developed to facilitate the process of data organization and model integration for application of Tradeoff Analysis.

Does the use of TOA guarantee that impact assessments will have an impact? Our experience with developing and applying this approach in Latin America suggests that the involvement of stakeholders and the development of an operational tool that can quantify indicators selected by users can significantly increase the impact. However, there remain important barriers to the use of integrated assessment findings by decision makers and the general public. Scientific data will always be only one of many factors influencing political decisions. The political leadership and public institutions, especially in developing countries, are highly dynamic and the identification of sustainability indicators in the beginning of the research does not mean that those are the indicators the same institution is interested in. Moreover, social concerns about a technology's impacts may be evolving rapidly (as in the case of the use of genetically modified materials), so the relevant set of indicators may change over time.

To illustrate these issues, we review how TOA was applied in Ecuador. Key concerns addressed were the economic, environmental, and human health effects of pesticide use, as well as longer-term soil conservation issues related to tillage and land use practices. We describe how research was formulated and how results from the impact assessment were communicated to local, regional and national interest groups; assess the degree of impact that this project had, and draw lessons from this experience for impact assessment research. We conclude that the integration of decision makers, other stakeholders and scientists into the process of impact assessment is a critical element in making an impact with impact assessment.

Factors Affecting the Adoption of Maize Technologies in the Hills of Nepal

J. K. Ransom, K. Paudyal, and K. Adhikari

Maize, the most important cereal crop in the hills of Nepal, is used as food and stover for animal fodder. Furthermore, it is a traditional cereal crop and farmers have developed farming systems that efficiently utilize the resources that are available to them. Average maize yields, over the period 1970 to 1984, declined from 1.9 t/ha to 1.4 t/ha. Since 1984, however, yields have improved to around 1.8 t/ha. Maize farms are small and population pressure necessitates the intensification of existing farming systems. Research directed at developing technologies for maize production began in 1965. In 2000, a survey was carried out in two districts of Nepal to determine the current level of adoption of improved maize production practices. In each of these districts, remote and accessible Village Development Committees (VDCs) were surveyed. Questionnaires were administered to 54 randomly selected households in each of these VDCs.

Data analysis determined the socioeconomic, physical, and technological factors that influence the use of technology by farmers. All households use composted farm yard manure (FYM) as part of their fertility management strategy. On average, 75% of the farmers used inorganic fertilizers, primarily urea. However, use patterns varied considerably depending on location. Urea use was considerably higher in Dolakha, regardless of the remoteness of the VDC, than in Dailekh, and the adoption of the use of fertilizers

occurred five years earlier in Dolakha than in Dailekh. Only 32% of the farmers used fertilizers in the remote VDC of Dailekh. Somewhat surprisingly, availability was not mentioned as a serious constraint to the use of fertilizers in Dailekh district. Averaged across the two districts, the use of improved open pollinated varieties (OPVs) of maize was less than 30%. The highest use of OPVs (59%) was recorded in the accessible VDC of Dolakha and the lowest use (13%) in the inaccessible VDC of Dailekh. The adoption of improved OPVs was consistently less than the adoption of fertilizers in all VDCs. The main reason for the non-use of OPVs in Dolakha was the lack of availability of seed, while in Dailekh it was the lack of knowledge of the new varieties.

Data from this impact assessment exercise suggests that the strategy for improving the adoption of new technologies may be quite different for the two districts. Since the lack of information and experience with the new technologies is the major constraint to their adoption in Dailekh, a program of more intensive on-farm demonstrations and testing is probably justifiable. In Dolakha, on the other hand, availability is more constraining than knowledge. Therefore, actions should focus on improving the availability of inputs. Community-based seed production programs should be supported and policy/institutional adjustments should be made to ensure the timely delivery of fertilizers to the locations where they are needed.

Variety Characteristics, Transactions Costs and Maize Adoption in Honduras

Hernando Hintze, Mitch Renkow, and Gustavo Sain

Maize is the main annual crop in Honduras, both in terms of its share of total cropped area and its role in direct human consumption. Approximately 25% of all arable land is planted with maize and Hondurans' per capita maize consumption is among the highest in the world. Yet despite the potential yield gains from the adoption of improved varieties and the fact that seed prices (of hybrids) are relatively low compared to other Latin American countries, the level of adoption of improved varieties of maize in Honduras is below 20%.

This paper summarizes research into the factors that contribute to these low levels of adoption of improved maize varieties in Honduras. The literature on adoption of agricultural innovations is vast. Commonly identified constraints to rapid adoption of new agricultural technologies include credit rationing, information asymmetries and/or differential access to information resources; risk aversion; small farm size; human capital deficiencies; disruptions in markets for labor and complementary inputs; and poor infrastructure. The low levels of adoption of improved maize varieties in Honduras are commonly ascribed to three factors: (a) inappropriateness of improved varieties for the specific environments or needs of farmers; (b) incomplete or non-existent markets for certain varieties due to high transactions costs; and (c) inadequate transmission of information on new varieties to farmers.

Our empirical work is based on an agricultural household model that explicitly incorporates variety characteristics and transaction costs into the household's optimization process. We considered a multitude of production characteristics (e.g., yield, yield stability, duration, and plant height), and consumption characteristics (including taste,

storability, and husk cover thickness) that are valued by farmers. Distance from markets, road quality, vehicle ownership, and availability of marketing agents were used as proxies for household-specific transaction costs.

We implemented our model, using data collected in a survey of 167 farmers located across 34 villages, in two distinctly different agro-ecological zones. In one of these zones, maize farming is highly commercialized, average farm sizes are comparatively large, and hybrids are planted by 60% of farmers. Near-subsistence farm households with smaller landholdings and much lower levels of high yielding varieties (HYV) adoption dominate the other zone.

Non-parametric tests indicate that farmers perceive significant differences among varieties. In general, improved varieties dominate in terms of production characteristics but are regarded as inferior with regard to consumption characteristics in both production zones. Zone-specific adoption equations confirm that in both areas production characteristics variables are jointly significant factors that influence variety choice, while consumption characteristics appear to be less important. In addition, transactions costs are found to have a significant positive impact on HYV adoption in the commercialized zone. No detectable effect of transactions costs on adoption is found in the near-subsistence zone. Instead, the dominant element conditioning adoption appears to have been whether or not farmers received free HYV seeds in the aftermath of Hurricane Mitch, a result indicating that information deficits may be an important limiting factor to adoption there.

Factors Affecting the Adoption of Selected Wheat Production Technologies by Farmers in Njoro and Rongai Divisions of Nakuru District, Kenya

Alice Ndiema, W. Ongo'ndo, A. A. Abdallahi, and M. G. Kinyua

In Kenya, wheat is usually grown on a commercial basis for the domestic market. However, as wheat supply has continually failed to meet the country's demand, the shortfall is supplemented by wheat imports.

Despite the continuous generation of new wheat technologies via Kenyan agricultural research centers, adoption by Kenyan farming communities has been very poor. Plant breeding has increased wheat productivity, but farmers continue to experience low yields. The adoption of recommended wheat production technologies by Kenyan farmers could significantly reduce the need for wheat imports.

The purpose of this study was to identify and describe factors affecting the adoption of selected wheat production technologies by farmers in Njoro and Rongai, Nakuru District, Kenya.

The factors investigated were derived from previous studies and observations. These included high yielding varieties, land preparation and planting time, fertilizer application rates, improved seed source, pest, disease, and weed control strategies. A sample size of 150 farmers was selected using a stratified proportion random sampling technique. The data were obtained using a validated questionnaire and analyzed using the descriptive and inferential statistics. Each hypothesis was tested using Chi-square at $P < 0.05$.

In conclusion, the study developed the following specific recommendations to facilitate the effective transfer of wheat production technologies:

- In-depth similar studies should be carried out in all wheat growing district to confirm if the trends are the same.
- Education for both large- and small-scale wheat farmers should be emphasized to allow easy dissemination of knowledge and information about wheat production technologies. This will modify the farmers' perception and help them to grasp the potential benefits of adopting new technologies.
- There is need for collaborative efforts in educating the farmers by all parties interested in agricultural development so as to increase adoption levels.

Expanding the Use of Impact Assessment and other Evaluation Research Evidence

Ronald Mackay and Douglas Horton

The rationale behind impact assessments is the commonsense notion that the evidence from these will be used to bring about improvements in the policies and programs evaluated and thereby contribute to economic and social betterment. As it becomes evident that impact assessment research is making less than the desired difference to the alleviation of human distress, evaluation researchers seek to understand why, and what can be done about it.

This paper addresses the difference/lack of difference made to social betterment (e.g. food sustainability, poverty reduction, and the sustainable environmental management) by impact assessment and by evaluation research more broadly. First, the paper examines the principal reasons why evidence from evaluation research is not more immediately and effectively used; then it explores some of the ways that practitioners in the international evaluation community are working to design and conduct evaluations that promote relevance, credibility, and the practical use of findings.

The paper reviews the international evaluation community's current thinking about impact evaluation and other evaluation research. It also draws on the authors' direct experience conducting and promoting the use of evaluation in research and development organizations over the past 25 years.

Evaluation is a powerful, emerging "transdiscipline." It is also a highly sensitive field of practice in that it is virtually never undertaken in a politically or ideologically neutral environment and seldom within a policy vacuum. However, it has been long acknowledged that its principal weakness is the relatively mild influence that evaluation evidence exerts on individuals, organizations, and the broader communities charged with decision making. Many explanations have been put forward for this, in addition to the fact that evaluation evidence is only one source of information used to influence policy and operations, others being the values, beliefs, preferences, prejudices, and needs of the decision makers and their constituencies. It is acknowledged that some evaluations are biased towards the perspective of a single stakeholder group, some fail to establish an evaluation team with credibility in content or methodology, some unjustifiably assume that the evaluation approach adopted is acceptable to the principle decision-makers.

To address the lack of influence of evaluations, the different philosophies, perspectives, values and practices that make up the evaluation discipline have been subjected to close scrutiny. The purpose of this scrutiny is a better understanding of the construct "evaluation use" and the identification of practices that promote utilization. The paper reviews this work and makes practical suggestions as to what evaluators can do in order to "make more of a difference" to the policies and programs they address.

Why does Impact Assessment Continue to Neglect Institutional Sustainability?

Daniel Ticehurst, Simon Henderson and Alistair Sutherland

This paper is concerned with developing a balanced approach to impact assessment (IA), and one that distinguishes between the need for accountability on the one hand and learning on the other. Drawing upon both programmatic and strategic experience gained from working with the UK's Department for International Development's Renewable Natural Resources Strategy, it addresses the need for learning about institutional impacts of this program on Research and Development (R&D) systems in Southern partner countries. A central thesis is that the International Development Targets and the subsequent adoption of more holistic, poverty-focused approaches are beginning to enhance organizational capacity in these countries to develop a variety of approaches and methods to IA. The paper argues that these are driven by a perceived need for accountability to better document success as a response to external pressure for clear evidence of impact. This concern for accountability tends to support historic decisions. The paper highlights four interrelated areas of concern with regard to the management of IA by donors and the international and strategic agricultural research agencies:

(1) agencies are driven to manage IA to justify continuing what they do, as opposed to informing future strategies; (2) the emerging concern with frameworks and approaches to poverty reduction, including those that espouse embracing error, have failed to build on past lessons about the use of IA; (3) the absence of a systematic and rigorous framework to assess institutional capacity and prospects for sustainability has marginalized the role of national R&D systems and reduced them to "risks and assumptions;" and consequently (4) the capacity and sustainability of local R&D systems is largely overlooked during collaborative research between international and national research systems.

The current preoccupation with assessing beneficiary impact, as gauged by movements in the relative values of household assets, tends to mask the relative lack of information and concern about the capacity and capabilities of local R&D systems before, during, and after investment periods. This makes it difficult to link any sustainable impact among beneficiaries with information on institutional capacity at the time that research products were being developed. This could be one reason why there remains a lack of confidence in the results of impact studies showing high or low rates of return— a coherent and believable story linking impacts to research capacity and process is not presented, especially given that policy makers are well aware of such capacity constraints. There is need for guidance on what research processes worked and did not work in order to identify the strategic implications for future investments in R&D.

The paper concludes by proposing a more balanced approach to IA, one informed by two main considerations. First, that it is not sufficient to simply undertake an assessment of institutional impacts, rather that, it is a question of understanding how such changes complement socio-economic studies. Second, that there is a need to develop sustainability indicators that relate to capacity and development. These considerations will help to guide the development of a more balanced IA strategy, one that reflects changes within R&D systems and which provides information to policy makers about the sustainability of impacts among end-user / beneficiary environments.

Demand-driven Technological Change and the Traditional Cereals in Sub-Saharan Africa: The Malian Case

Jeff Vitale and John H. Sanders

The objectives of this field research were to estimate the potential returns and constraints to the introduction of new sorghum and millet technologies in Mali (West Africa), and to undertake an aggregate analysis of the effects on consumption and prices from the combination of new technologies and demand expansion.

A principal problem with traditional food products is the inelasticity of price with respect to demand. In good rainfall years, cereal prices collapse and farmers quickly lose interest in the introduction of new technologies requiring increased input expenditures. The new focus on demand driven technology needs to re-examine traditional foods as new food products are becoming available and as feed demand increases for the cereals.

Programming models of farms were incorporated into a sector model. The combination of new technologies, different demand expansion scenarios, and increases in liquidity were considered. The feasibility of these different scenarios and the policy implications were considered in detail. Finally, different development strategies for traditional cereals were compared with other investment options with the sector model.

This paper emphasizes empirical results and policy implications. However, the combination of programming models within a sector model provides a strong analytical tool for analyzing actual and potential impacts.

An Assessment of IPGRI's Impact on International Policy-making: A Case Study of the International Undertaking on Plant Genetic Resources (1996-2001)

Raphaël Sauvé and Jamie Watts

While political influence is often assumed for international organizations, it is rarely subjected to a thorough assessment. This study addresses this empirical gap by examining the political influence exerted by the International Plant Genetic Resources Institute (IPGRI) in the international negotiations pertaining to the revision of the International Undertaking for Plant Genetic Resources (IU).

More specifically, the study aimed to assess the level of political influence attained by IPGRI in the renegotiations of the IU, and to obtain knowledge about the general processes by which the Institute exerts influence. The knowledge gained through this assessment would then allow the identification of potential future courses of action for IPGRI in international decision-making.

The evaluation covered a five-year period (1996-2001), representative of the different phases that marked the negotiation process. It employed a methodological framework developed expressly to assess the political influence exerted by international non-governmental organizations in the framing of the Climate Change and Biological Diversity Conventions. This method draws conclusions from different dimensions of evidence, and is well suited to assessing political influence in complex decision-making.

This study obtained evidence from IPGRI staff members who were involved in the negotiations about the expected ways and means by which IPGRI was thought to have been influential, —the so-called “ego-perception.” These perceptions were then either validated or negated by the gathering of other players’ perceptions of the Institute’s influence

(“alter-perception”). In this case, the alter-perception was provided by national delegates and by members of the secretariat of the FAO Commission on Genetic Resources for Food and Agriculture, which manages the negotiation process. Finally, the validity of these perceptions was checked through document analysis (“researcher’s analysis”).

Empirical results relating to IPGRI’s political influence were subsequently linked to a theoretical framework that provided a basis on which to explain IPGRI’s capacity to exert influence. This theoretical framework was built on three criteria: (1) that it would be consistent with the chosen methodology; (2) that it would provide explanatory knowledge on the processes of influence and fill in the gaps where the empirical data was inconclusive; and (3) that it would take into account the limited capacity of an international agricultural research center, as opposed to that of a state, to exert influence in international bargaining. A review of the pertinent international relations literature and the framing of relevant variables provided such a framework.

The results indicate the most effective ways by which an international agricultural research center can exert influence in international policy-making. The provision of timely and relevant technical input (that is, input directly linked to the organization’s domain of expertise) is seen as the prominent means of achieving influence in such a context. Yet, the results also show that other factors may enable or constrain organizations like IPGRI in international decision-making. While political neutrality and reliability were seen as enabling factors, it remained clear that all international organizations lack the resources or formal rights that endow states.

International R&D Spillovers and Productivity Growth in the Agricultural Sector: A Panel Co-integration Approach

Luciano Gutierrez

In recent years, much research has been done to assess the importance of research and development (R&D) and trade in influencing output growth and total factor productivity. There is now a large body of literature that provides theoretical and empirical models where cumulative R&D is the main engine of technological progress and productivity growth. The empirical evidence has been provided by Coe and Helpman in a seminal paper where they find that accumulated spending on R&D by a country and its trade partners helps to explain the growth of total factor productivity. R&D investments are still central to agricultural productivity growth. Alston et al., in the introduction of their recent book on the theme, underline that "Throughout the twentieth century, improvements in agricultural productivity have been closely linked to investments in agricultural R&D and to policies that affect agricultural R&D."

Given the importance of agricultural R&D to sector growth, many works have been devoted to reporting measures of the returns to domestic agricultural R&D, but in a world where the international trade of agricultural products and the dissemination of knowledge are widespread, domestic agricultural productivity depends not only on domestic R&D but also on foreign R&D efforts. This point has been fully recognized by Hayami and Ruttan, who emphasized that a country can acquire substantial gains in agricultural productivity by borrowing advanced technology existing in other countries.

Recent works analyze the effects of international public and/or private agricultural R&D on domestic agricultural productivity growth, finding the presence of strong international spillovers in the agricultural sector and that, without recognizing knowledge spillovers, researchers will end with biased estimates of R&D elasticities. However, the international

transfer of agricultural technology is more difficult than industrial technology. Modern agricultural technology has mainly been improved in developed countries located in temperate zones. Thus, without appropriate adaptive research that helps to assimilate and exploit externally available information, countries located in other ecological zones, for example tropical zones, may not benefit from technological spillovers.

In the next section, we present a theoretical model that links total factor productivity to the cumulative spending on R&D. In the third section, we introduce and review the recent results on estimation and inference in panel co-integration. Co-integrating regression enables us to exploit the relationship among the variables in levels without transforming the data, such as by differencing, to avoid spurious regression problems. In section four, we estimate a simple Cobb-Douglas production function for a sample of 47 countries, during the period 1970-1992, by using panel co-integration. We also split the sample and estimate two production functions, one for the countries in the sample located in temperate zones, and one for the countries in the sample located in tropical zones. The results indicate that both production functions show constant returns to scale but factor elasticities are quite different. Using these results and following Coe and Helpman's empirical model, we are able to utilize panel co-integrating regression to estimate the relationship between total factor productivity and domestic as well as foreign R&D capital stocks. Using these estimates, we calculate the effect of change in a country's R&D spending on the change of total factor productivity in that country, as well as in partner countries. In summary, we find strong R&D spillovers between countries located in temperate zones and, inside this group, between EU countries. International spillovers are of less importance when analyzing tropical countries.

Impact of Modern Technology Adoption on Output Growth and Sustainability of Major Cereal Production in Bangladesh

S.M. Fakhru Islam

Bangladesh comprises a small area—147,570 km²—with a large population (122 million). Rice and wheat are the staple foods of the Bangladeshi people. By the year 2020, 37 million tons of food grain will be required for a projected population of 172 million. Can Bangladesh sustain the growth momentum, driven by the development and application of new technologies, which is required to ensure future food security? This study examined the impact of modern technology adoption on output growth and the sustainability of major cereal production in Bangladesh. The study area consisted of 17 greater districts in Bangladesh, characterized by agro-ecology. A time series database on major cereal production was used. The growth rate of major cereal production was measured using a compound growth rate model, while the sustainability of modern food grain production technology was measured by estimating total factor productivity (TFP), using the Tornqvist Theil (TT) index. A moment based production function was used to estimate factors affecting the sustainability of modern food grain production technology. The model was estimated by the generalized method of moment procedure.

Good progress in the adoption of modern variety (MV) rice was achieved during 1970s and 1980s because of the release of high-yielding varieties and government subsidies on fertilizers, pesticides, and irrigation. Over the last 25 years, since independence, the growth rates in rice production, acreage and yield were 2.53%, 0.33% and 1.20% per annum, respectively. In general, this was achieved via high growth rates in rice yield. However, over the same time period (25 years), the

growth rate of production, area, and yield of MV rice were 7.99%, 8.72% and -0.73% per annum, respectively. During the 1980s and 1990s the highest growth in acreage (9.64%) and production (9.03%) was achieved for MV wet season rice (Aman) followed by MV winter season (Boro) rice whose growth in area and production were 8.84% and 8.83% per annum, respectively. Growth in acreage and production of MV summer rice (Aus) were 7.93% and 5.46% per annum, respectively. In general, a positive growth rate in MV rice production was achieved due to the area expansion of MV rice. Yield for MV rice all three seasons declined. This could be attributed to the degradation of soil fertility due to intensive cultivation, inappropriate fertilizer application, deficiency of micronutrients in soils, and a general deterioration in varietal traits. Since independence, the area and production of all cereal crops in Bangladesh has increased. However, with the exception of wheat, yields have decreased. The estimates of TFP indices of MV Aus, Aman, Boro and wheat indicated that modern food grain production technology became unsustainable after the mid-1980s. It revealed that MV Aus production technology was sustainable up to 1983, MV Aman technology was sustainable until 1985, and MV Boro was sustainable until 1989. MV wheat production technology was sustainable until 1984, indicated by a declining trend in TFP indices. The study also identified and quantified the impact of technological (fertilizer, pesticides, etc.) and environmental factors (rainfall, humidity, etc.) on the sustainability of modern rice and wheat production in Bangladesh, using production distribution moments.

Component Analysis of Total Factor Productivity in High Potential Rice-Wheat Systems in the Indian Punjab

Joginder Singh and M. Hossain

After the mid-1960s throughout the Punjab, India, the Green Revolution resulted in rapid growth of farm output. During the 1980s, growth in paddy field productivity averaged 1.27% /ha, declining to -0.04% /ha in the 1990s. In the case of wheat, there was an increase in average productivity from 2.73 t/ha in 1981-82 to 3.80 t/ha in 1991-92 and 4.56 t/ha in 2000-01. This demonstrated a CGR of 3.00% in the 1980s, which decreased to 1.45% during 1990s. The decomposition of productivity growth, made by Kalirajan, Obwona and Zhao, has demonstrated the components as technical change, technological improvement and input use. The first two components account for total factor productivity (TFP) growth. Using this model in the Indian Punjab, which has almost exploited the available potential of soil, water and other natural resources required particularly for the rice crop, sustainability, as a component of TFP, was segregated out. An effort to apportion the contribution of sustainability as an important determinant of TFP growth was made. The decline in TFP, due to a fall in the output index since early 1990s, has highlighted the

issue of the deterioration of ecological parameters. In this high potential rice-wheat belt, resource degradation attributed to the rice crop is more serious than wheat. Further, the contribution of sustainability to the TFP growth is increasing at an alarming rate. Based on the household data collected from 300 farmers, over the 1981-1998 period, it is clear that the TFP growth is declining. Deducting their effect from TFP growth, the negative unaccounted factor is termed as "sustainability", the value of which came out to -1.11% and -4.90% in case of paddy fields and -0.81% and -3.07% in the case of wheat cropping in the 1980s and 1990s respectively. This calls for immediate policy options to arrest the trend by providing alternatives to rice cropping in Punjab agriculture. Moreover, farmers engaged in environmentally degrading practices such as the early transplanting of rice, indiscriminate use of pesticides, burning of paddy straw, irrational use of underground water, and those cultivating paddy crops in areas of brackish water need to be curtailed through strict policy measures.

Effects of Innovative Wheat Breeding for Marginal Environments

Maximina A Lantican, Prabhu L. Pingali, and Sanjaya Rajaram

Approximately one-third of the developing world's wheat area is located in environments that are regarded as marginal for wheat production because of drought, heat, and soil problems. Nearly one-third of the area planted to bread wheat and about three-fourths of the area planted to durum wheat suffer from severe drought stress during the growing season.

Despite these limitations, the world's dry and difficult cropping environments are increasingly crucial to food security in the developing world. Worldwide, investment in irrigation infrastructure continues to fall, while population growth and demand for wheat are increasing. Gains in wheat productivity in marginal environments are important because it is unlikely that increased productivity in the favorable environments will be sufficient to meet the projected growth in demand for wheat from the present to 2020. The demand for wheat is projected to be 40% greater than its current level of 552 million tons by 2020. Improved productivity in marginal areas would improve food security for the poorer populations that live there.

It is widely believed that the Green Revolution had very little effect in marginal environments, where the harsh agricultural conditions and slow spread of Green Revolution technology resulted in very modest yield gains. For some time, the development community has been concerned about progress in marginal areas and the level of research resources allocated to those areas. This paper provides new information to address these issues by answering the question: Is growth in wheat yield potential in marginal environments approaching the levels attained in favorable environments? More specifically, we:

- ▶ describe breeding research that improved productivity in marginal environments (with an emphasis on CIMMYT's wheat breeding strategies);
- ▶ estimate rates of growth in wheat yield potential in marginal and favorable environments;
- ▶ examine the crossover and spillover of wheat varieties from favorable to marginal environments;

- ▶ identify implications for wheat productivity growth in marginal environments; and
- ▶ discuss future challenges for marginal environments.

Data for this study were obtained from CIMMYT's Elite Spring Wheat Yield Trial (ESWYT), grown in 246 locations in 65 countries between 1979 and 1999, and from CIMMYT's International Spring Wheat Yield Nursery (ISWYN), grown in 411 locations in 82 countries between 1964 and 1995. Nurseries such as the ISWYN and ESWYT are one way in which breeders in developing countries regularly gain access to and exchange a large number of new wheat varieties bred by CIMMYT and partners in national research programs. This system of breeding, germplasm and information exchange is often referred to as "the international wheat research system." Its impact on wheat yield trends in marginal environments will be discussed later.

Data on spring wheat varieties planted in 1990 and 1997, including their pedigrees, year of release, area planted to each variety, and target mega-environment, were obtained from the CIMMYT Wheat Impacts database. A mega-environment (ME) is a broad, frequently transcontinental but not necessarily contiguous area with similar biotic and abiotic stresses, cropping system requirements, consumer preferences, and potential volume of production. Mega-environments usually encompass more than one country and are useful for defining breeding objectives, because each ME comprises millions of hectares that are relatively homogenous for wheat production.

The ISWYN data were grouped into two periods: the Green Revolution period (1964-78) and the post-Green Revolution period (1979-95). The ESWYT data (1979-99) was taken from the latter period. The average of the top three wheat yields for each location per year was used in the analysis. Locations were grouped by ME.

The Impact of Bean Research in Honduras

David Mather, Richard Bernsten, Juan Carlos Rosas, Abelardo Viana, Danilo Escoto, and Julio Martinez

The general objectives of this study are to estimate the rate of adoption of improved bean varieties released in Honduras since 1987, estimate the ex post economic rate of return to the development and adoption of these varieties, and investigate the agronomic, market and consumption characteristics of traditional and improved bean varieties that help to explain patterns of varietal use by Honduran bean farmers.

Collaborative research on beans in Honduras by the USAID-funded Bean/Cowpea Collaborative Research Support Project (CRSP), the bean program at Escuela Agricola Panamericana (Zamorano), PROFRIJOL (a regional network funded by the Swiss Agency for Development and Cooperation, SDC), and DICTA (the national agricultural research program) has resulted in the release of many improved varieties since 1987. Data collection for this study included a farmer survey (N=210) in the three main bean-producing departments of Honduras (El Paraiso, Francisco Morazan and Olancho), implemented in January-February 2001. These departments account for over 60% of national bean production. In addition, the survey team conducted "bean price experiments" with bean traders in the three regions to gain a rough measure of price premiums/discounts for bean coloring, size, shape, etc., of improved beans formerly released, as well as some promising experimental lines.

Adoption rates and yields from this survey, as well as from a CRSP-funded 1994 survey in the same three departments, will be used along with experimental yield data to estimate the financial and economic rates of return to the CRSP/Zamorano/PROFRIJOL investments in bean research in Honduras. In addition, sub-sector analysis, combined with farmer varietal preferences, will help to explain patterns of varietal adoption, non-adoption, and dis-adoption, to suggest priorities for future bean breeding activities, and to recommend the nature and implementation of continued socio-economic research to support the Honduran bean breeding programs at Zamorano and DICTA.

Martel's 1994 survey and analysis highlighted the differential agronomic and market characteristics most valued by different types of farmers in their bean varieties. For example, Dorado, an improved variety with BGMV resistance, enjoyed reasonable popularity among valley farmers, who saved more revenue in stable yields (due to BGMV resistance) than they lost from Dorado's 15% price discount by traders due to its dark color. On the other hand, BGMV was not as serious a problem for most highland farmers, who thus adopted Catrachita instead—a high-yielding variety with little disease resistance but better market acceptance.

In 1997, Zamorano released Tio Canela, an improved variety with the disease resistance beyond that of Dorado and an improved (lighter red) color, thus intended to be more desirable to both valley and highland farmers. The recent survey will therefore give the Zamorano and DICTA bean programs its first feedback on farmers' reaction to this new release, and the trader interviews will provide additional information regarding the market acceptance of Tio Canela.

Although this survey data is currently being analyzed, initial data analysis suggests several findings. As anticipated, adoption of Tio Canela is not very high given that the Honduran seed system is woefully underdeveloped. More surprisingly, many farmers who have experimented with Tio Canela (and even some who previously grew Dorado) have switched back to traditional varieties. This implies that; a) the experimental yield advantage of Tio Canela does not hold up under farmer conditions; b) Tio Canela receives a significant price discount; c) disease pressure in many areas has changed considerably, thus making the resistance embodied by Tio Canela less valuable to farmers.

A Study of Philippine Peanut Farming Communities: Impacts of New Peanut CRSP Technology and Influences on Sustainability

Robert L. Moxley, Aida Librero, and David Alston

This is an exploratory analysis of an extensive study of attempts to introduce two new peanut varieties to two farm communities in the Philippines over the 1988-89 to 1994-95 (5-year) period. This analysis focuses on the: (1) extent of impacts, (2) sustainability of impacts, (3) production impacts, and (4) influences on adoption (including possible influences of the farmer, farm, contact network, community, and a national institution). Adoption and impact studies have almost

exclusively focused on adoption at the end of an extension effort and on the characteristics of the farm and farmer in the target communities. This focus has led to the charge of blaming the victim if there is little impact. This long-term research project intends to draw on context variables in order to identify community, sub-community and contact network constraints and facilitators, which theory suggests will have greater effects on adoption, impacts and sustainability.

Impact of Public Sector and Private Sector in R&D and Technology Generation: The Case of Maize in Asia

Roberta V. Gerpacio

The modern maize varieties which eventually make their way into farmers' fields are products of an international breeding system that includes the International Maize and Wheat Improvement Center (CIMMYT), several national breeding programs, and a multitude of private, national and multinational, seed companies. During the period 1998/99, 179 public and private seed companies were interviewed. These companies were selected due to their involvement in maize breeding research and the production and distribution of maize seed in seven Asian countries: China, India, Indonesia, Nepal, Philippines, Thailand and Vietnam. This study evaluated four principal facets of seed company performance, namely: (a) the level of investment in maize breeding research; (b) germplasm outputs; (c) the nature and extent of roles played in the maize seed industry; and (d) the rate of farm-level adoption of improved maize germplasm.

During 1995-97, Asia produced 152 million tons of maize from 42 million ha, yielding an average 3.6 t/ha. Since the 1960s, increases in maize production have been fueled by yield gains rather than by area expansion. Yield gains, in turn, have been due to the shift in maize cultivation from predominantly open pollinated varieties to hybrids. From a base area of 2.4 million ha in 1990, hybrid maize production grew to 8.7 million ha, or 45% of the total maize area in Asia, in 1998. The shift to hybrid maize cultivation also transferred the locus of modern maize breeding

research from government research organizations to national and multinational private-sector seed companies. In countries where both public and private sectors participated in maize research, private sector research investment in maize research far exceeded that of the public sector. In 1998, primarily due to more aggressive marketing programs, private sector maize seed sales grew by 24%, while those of the public sector grew by only 2%.

In conclusion, public seed research agencies (including universities and cooperatives) have: tended to develop more open-pollinated maize varieties (OPVs) than hybrids; mass-produced and distributed seed cheaply; addressed location-specific production problems and; provided agricultural extension services. Conversely, private seed companies have developed and marketed their own proprietary hybrids. In recent years, the public sector has faced two important challenges: an expanding maize industry that demands improved technologies; and inadequate and declining public resources that, in turn, limit technology development and dissemination activities. Amidst these challenges, governments have encouraged the participation of the private sector by improving the business environment. At present, the public and private sectors in Asia's maize seed industry are linked in knowledge and technology dissemination via human resource development and cooperative experimental trials.

Winding up the Impact Pathway: An Approach to Strengthen the Impact Orientation of National Agricultural Research

Andreas Springer-Heinze, Frank Hartwich, Simon Henderson, Douglas Horton, and Isaac Minde

Not many national agricultural research institutions in developing countries are sufficiently oriented towards generating development impacts. Observers explain the problem by the way research institutes operate, in particular by organizational variables such as the lack of capability in planning and M&E, and the feeble influence that farmers have on research programs. This paper argues that part of the syndrome is the poor knowledge of public researchers about the actual significance of their work for agricultural development. Many agricultural policy makers and researchers misconceive the innovation processes in agriculture by assuming that research is the only source of technical change and that productivity change can always be put down to preceding research results.

Their assumption has consequences. One is that only few research institutions make efforts to analyze their impact. If they do, most are content with measuring the change in technology use or in the production figures of the respective commodity, expecting that technical change will be favorable for rural development anyway. As a consequence, research institutes often do not see the necessity to study agricultural innovation and their own role in it more thoroughly.

This is in sharp contrast to the widely shared recognition of the complexity of agricultural development and the increasing demand for a greater accountability of public development agencies. In fact, the causal chain between an investment in Research and Development (R&D) projects and agricultural change is quite long. As the analysis moves away from the origin—research—and down along the assumed succession of effects, the observed changes become less and less attributable to the initial research investment. The variety of actors increases and hence the possibility of conflicting views on the ongoing change and the

factors driving it. To this, add that we observed negative trends as well; e.g. the depletion of natural resources or the dwindling biodiversity. Claiming positive research “impacts” without a serious effort to understand the real change process is less and less credible—and it prevents research institutes learning from previous experience and becoming more development-minded.

The objective of impact assessment is a greater impact orientation of research. Research institutions clearly need to strengthen their impact orientation if they are to reverse the downward trend in funding. The term “impact orientation” characterizes a research organization that is focused on impact, uniting the different approaches to improve research under the perspective of their contribution to achieving impact. Impact orientation expresses itself in such features as a good comprehension of how impact is achieved, sufficient organizational capacity, intensive communication with all stakeholders, client and service orientation, and the use of planning and M&E techniques. Important aspects of an impact orientation are to better understand the processes of agricultural change, to clarify hypotheses along the impact pathway, and to critically assess them.

An alternative approach to understanding research impact is the pathway concept. The paper introduces the concept of impact pathways in order to better conceptualize the processes by which research achieves development impacts. This is not another impact assessment method but rather a means to integrate and organize information so that the role of research in development becomes more transparent. An impact pathway describes the chain of events linking research and agricultural development. It establishes a series of measurement points; e.g., research input, research output, rates of technology use, production figures, indicators of social change. It names the change processes that are supposed to link

these points. At least three processes may be distinguished: (1) the research process leading to the research outputs, (2) the agricultural innovation process leading to technical change, and (3) the agricultural (rural) development process leading to economic and social change. By combining measurable indicators with process analyses, pathway analysis can help to address the attribution problem and take account of the many factors, other than research, that may be driving change. The three different processes may be studied separately while maintaining a comprehensive view on the way impact is generated. Thus, pathway analysis can reveal opportunities for research as well as identify problem situations in which

it would be pointless to conduct research as a result of, say, the conditions in commodity markets and infrastructure or the availability of complementary services. Pathway analyses can also help to generate plausible arguments demonstrating how research activities actually feed into the development process. The paper presents ideas and examples generated during a series of workshops where a regional project “Strengthening Impact Orientation in Agricultural Research in Eastern and Central Africa” was planned by representatives of the “Association for Strengthening Agricultural Research in East and Central Africa (ASARECA)” with support from the German Development Co-operation (GTZ).

The Importance of Impact Assessment Studies for the Brazilian Agricultural Research System

Antonio Flavio Dias Avila and Geraldo da Silva e Souza

A significant number of agricultural impact assessment studies have been conducted during the last three decades. These studies have demonstrated the considerable contributions of agricultural research towards improved productivity, profitability, and the sustainability of agribusinesses. Brazil is one of the countries where this type of study was frequently utilized. EMBRAPA, a government research company, conducts the majority of impact assessment studies in this country. The most frequently posed questions are, how useful is this type of research and how does it impact on agricultural research funding and research institutions themselves? The principal aim of this paper is to present clear evidence that the development and use of impact assessment studies in Brazil predominantly served to strengthen the position of EMBRAPA.

Brazilian impact studies began in the early 1980s in response to demands made by Brazilian society, who were interested in the efficacy of significant state investments in agricultural research. Initial studies demonstrated that funding from the national treasury and international loans (IDB and World Bank) invested in infrastructure and human capital in the EMBRAPA's research centers generated high returns.

During the next two decades, the Brazilian government continued to invest in EMBRAPA. This allowed the institution to develop a modern, nationwide infrastructure of agricultural research and to adjust the human capital profile dedicated to research activities. In 1974, only 17% of researchers had MSc and PhD degrees. In less than 10 years, this figure changed to 75%. In reality, less than 5% of EMBRAPA's staff lack postgraduate training. Calculated in 1993 dollars, resources allocated to EMBRAPA increased from an average of US\$245 million in 1976-80 to more than US\$450 million during the 1990s.

Continuous public support allowed EMBRAPA to offer competitive salaries, maintain a well-trained research staff, and provide good conditions in which staff could develop their research activities. This context was fundamental for the institution. It enabled a continuous flow of technological outputs that have progressively been integrated into Brazilian agriculture. EMBRAPA was continually asked to demonstrate the efficacy of high state investments.

The importance of EMBRAPA's role in the development of agricultural technology has been systematically demonstrated through impact assessment studies conducted by EMBRAPA and other Brazilian research institutions. EMBRAPA has underwritten the validity of its impacts research by stressing the close collaboration of Yale University's International Food Policy Research Institute and the University of California-Davis in the development of impact assessments. The use of foreign researchers, with international experience and using diversified methodological approaches, has played a vital supporting role in EMBRAPA's accountability reports.

Evidence to support EMBRAPA's important role in the modernization of the agribusiness sector can also be found in annual progress reports where the role of crop varieties in the seed market and other technologies are clearly shown. Aggregate studies demonstrating the link between agricultural research, increased exports, and agricultural technological change have also been contracted to well known economists with influence over the Brazilian decision-making process. A further kind of impact assessment is the annual social balance. Here, EMBRAPA demonstrates that its technological outputs are also generating social benefits.

Another aspect of the EMBRAPA policy is the adoption of an integrated evaluation and award system based on results. All its research centers have been evaluated since 1996. Evaluations are based on economic efficiency (DEA – Data Envelopment Analysis), research funding grants, institutional image, technological impact and research quality. The best teams and employees are awarded annually. As this award is not incorporated into staff salaries and varies according to performance, it has stimulated a general increase in institutional productivity and effectiveness of research centers.

Finally, it should be noted that impact assessment studies are still making a difference in EMBRAPA. This is due to the adoption, in the mid-1990s, of an aggressive policy of communication and marketing. Economic, social, and environmental impacts of

agricultural research outputs have been effectively communicated to congress and the government and, more recently, to the general public. EMBRAPA's marketing policy clearly recognizes the role of partnerships, state research organizations, universities, CGIAR centers, and the private sector in agricultural technology development.

If impact assessment studies are being conducted but are not making a difference, there are two possible explanations—either impact assessments are not being conducted effectively or assessment results are not being communicated effectively to decision-makers. At EMBRAPA, there is strong evidence that impact assessments are important and are making a real difference. They are also strengthening EMBRAPA's institutional image within Brazilian society.

Potato Production and Pesticide Use in Ecuador: Linking Impact Assessment Research and Rural Development Intervention for Greater Eco-System Health

Charles Crissman, Donald Cole, Steve Sherwood, Patricio Espinosa and David Yanggen

Most potato-farming families in the Carchi Province of Ecuador use the highly toxic insecticides carbofuran and methamidophos. Exposure to these neurotoxins causes health problems and productivity losses. An integrated research and intervention project, financed by the innovative IDRC–Ecosystem Health Program, aimed to reduce that exposure, whilst maintaining and, in some cases, enhancing farm productivity. This paper analyzes the results of a follow-up intervention project and survey that incorporates a longitudinal study to measure changes in neurobehavioral performance of farm families before and after exposure is reduced. The interventions are designed to influence social units, ranging from the farm family to the international community. The integration of participatory intervention techniques and sample-based quantitative research created tensions for the multidisciplinary team and demanded compromises that, on balance, have been positive.

Drawing on risk reduction principles of industrial hygiene, our intervention program targets various levels of social aggregation with diverse strategies. At the farm and family levels, we have utilized individual counseling and farmer field schools for enhancing capacities in integrated pest management (IPM) and promoting safer pesticide use. Following training activities, which contributed to pesticide reductions, productivity increases and heightened awareness of the negative consequences of pesticides, farmers have shown a remarkable willingness to invest in personal protective equipment. At the community level, we worked with women's groups, primary schools, and community education campaigns. One particularly effective intervention was an action-research tracer study using fluorescent dyes to identify pesticide exposure pathways. At the regional level, we held public forums to inform and develop policy recommendations and used radio spots to increase

public awareness. At the national level, together with the ministries of agriculture, health, and the environment, we supported a policy formulation and lobbying process that included information sessions with ministries and the pesticide industry, a public forum, and media events. Furthermore, we are coordinating with national programs throughout the Andes, as well as the Food and Agriculture Organization and the Latin American Pesticide Action Network, for regional-level advocacy. While the project has generated promising local results, the broader context will ultimately prevent lasting impact. Efforts to promote national-level policy intervention have arguably been futile due to internal political pressures that prevent rational policy formulation. As a result, the project has begun to use international support to provide further pressure for change.

The combination of quantitative methods needed for rigorous economic and epidemiological analysis, and participatory methods needed for community-based action, created unique conflicts in disciplinary and methodological design. The rhythms of research and participatory intervention move at different cadences, calling for adjustments in both. Other conflicts include; participant-beneficiary control over activities, farm family sample identification and maintenance, burdening participants with tedious interviews, and scheduling measurements, interventions, and communications.

Impact assessment research is often an ex-post, conducted long after the principals are dispersed. Consistent follow-up is key to obtaining impact from impact assessment. When integrated into an ongoing program, impact assessment provides mid-course guidance that can justify follow-up by actors that are still present.

The Welfare Effects of Maize Technologies in Marginal and High-Potential Regions of Kenya

Daniel D. Karanja and Mitch Renkow

A long-standing debate within the CGIAR system concerns the effects on various populations (particularly the poor) of different allocations of research effort between marginal and favored production environments. Some argue that there has been systematic under-investment in marginal production environments, to the detriment of the large group of impoverished people within those areas. Others counter that historically: investment in marginal areas has been low precisely because the returns to those investments are low, and that diverting research resources away from favored production environments would, overall, do more harm than good.

In Kenya, this debate is critically important for several reasons. First, agriculture is the dominant sector in the economy, accounting for 28-30% of GDP. Second, the country has one of the fastest growing populations in the world, which puts considerable pressure on arable land (20% of total land area) to produce sufficient food. The consequence of this has been reduced fallow periods, fewer crop rotation options, and loss of soil fertility and land productivity. Third, and partly due to the rapidly growing population, there has been notable out-migration from high-potential to low-potential agro-ecological zones, with an accompanying increase in the importance of agricultural production on less-favored lands. This transformation of the spatial distribution of production has serious implications for both agricultural research and the environment. Finally, Kenya's economy has been on the downturn for the past two decades, resulting in severe reduction in available resources for agriculture research.

Past increases in maize production were fueled by the development of high yielding varieties suitable for a range of agro-ecological zones, as well as an increase in

the area under maize cultivation. However, future productivity gains are likely to rely more on the former than the later. While maize productivity growth has declined since the mid-1970s, a wide gap separates experiment station yields from those achieved in farmers' fields. This indicates that significant productivity gains could be achieved through better targeting and promotion for adoption of improved technologies.

This study uses a multi-market model of maize production to assess the potential impact of improved maize technology on incomes and welfare of both rural and urban households in Kenya. We analyze the likely impacts on various household types of the diffusion of improved maize varieties and crop management technologies that are currently "on the shelf." The direct effects of technical change are based on assessments made by experts in the Kenyan agricultural research system. The model computes the indirect effects that are transmitted through product and factor markets via endogenous changes in output prices and input prices.

The model is disaggregated into six distinct agro-ecological production zones. This allows us to investigate alternative technology adoption scenarios (e.g., a "balanced diffusion" scenario) in which technical change occurs in all areas, versus scenarios in which diffusion is confined to either favored or marginal production environments. Our results indicate that on both efficiency and equity grounds, the most desirable outcomes include targeting of agricultural technologies toward more favored agro-ecological zones.

Agricultural Research and Urban Poverty: The Case of China

Shenggen Fan, Cheng Fang and Xiaobo Zhang

This paper develops a framework to measure the impact of agricultural research on urban poverty. Increased investment in agricultural research and development (R&D) will lower food prices through increased food production. Lower food prices will, in

turn, help the urban poor, as they often spend more than 60% of their income on food. Using China as a case, the study empirically estimated these effects. These effects are large, and are comparable to those on rural poverty.

Impact of the Adoption of Modern Varieties of Rice on Productivity Gains and Income Distribution for the Irrigated and the Rain-fed Ecosystem

Mahabub Hossain, Manik Lal Bose, Tran Thi Ut, A.G. Agarwal, Jawhar Thakur, and Esther B. Marciano

Modern varieties (MV) cover approximately 75% of Asian rice lands, with 55% of rice production occurring in irrigated ecosystems. However, a significant portion of MV rice is grown under rain-fed conditions with unfavorable growing environments. Good water control is considered a precondition for realizing the productivity and profitability potentials of modern rice varieties. This paper tests the hypothesis that the adoption of modern varieties under rain-fed conditions would not increase yields enough to compensate for additional input costs, and would only have a marginal impact on profitability gains and household incomes compared to substantial gains for the irrigated ecosystem.

The data for this paper are drawn from household level sample surveys conducted by the Social Sciences Division of the International Rice Research Institute (IRRI) in collaboration with national agricultural research system partners in Bangladesh, in the states of Bihar and Chhatisgarh in India, and in the Philippines and Vietnam during the late 1990s. The villages were selected to represent different rice growing environments. All households in selected villages were covered by the survey except for Bangladesh and Vietnam, where a sample of the households was selected using stratified random sampling.

The primary data are used to estimate unit costs, labor productivity, and household incomes, and the factor shares of land, labor, and capital in the production of modern varieties under irrigated and rain-fed conditions. A multivariate regression model of determinants of income is estimated to identify the effect of technology, factor endowments, and environmental factors on incomes from rice cultivation, as well as total household incomes. Two interaction terms of the coverage of modern varieties and irrigation are included in the model for rice incomes to measure the separate effects of the adoption of modern varieties in rain-fed and irrigated areas. The model is estimated for total household incomes to assess the net effect, as the adoption of modern varieties may lead to diversion of household resources from non-rice and non-farm economic activities to rice cultivation. A Gini Decomposition Analysis is conducted to assess the income distribution effect associated with the adoption of MV rice for the irrigated and the rain-fed ecosystems. Results are discussed in this paper.

Household Resource Endowments and the Impacts of Soil Fertility Management

Meredith J. Soule and Keith D. Shepherd

Scientists are increasingly being challenged to provide policy makers with information on the trade-offs between environmental and economic development goals. There is a need for new approaches for assessing potential impacts of interventions that combine scientific knowledge with empirical information on constraints of land users. In this paper we use a custom-built, economic-ecological simulation model to examine the impact of existing and proposed soil management strategies on farm productivity, profitability, and sustainability for smallholder farmers in western Kenya. The model is applied to three representative farm types, which were developed using wealth ranking and other participatory techniques to reflect the differences in resource endowments and constraints faced by farmers in Vihiga District of western Kenya.

The model is first used to examine the impact of existing soil management strategies. Results show the importance of differentiating farm types by important characteristics that impact opportunities and management. The current soil management practices of high resource endowment farms are productive, profitable, and ecologically sustainable. Low and medium resource endowment farms, on the other hand, use techniques with much lower levels of productivity and profitability that result in a declining soil resource base.

The model is then applied to analyze the potential impacts of improved soil fertility management, using various sources of phosphorous (P) and nitrogen (N). Results indicate that high resource endowment farmers are already using near optimal management practices, and new management techniques have little impact on yields or other indicators. Low and medium resource endowment farmers, on the other hand, can greatly improve farm profitability and sustainability through improved management of P and N, but low land and capital resources constrain the adoption of the improved practices. Targeting interventions to low and medium resource endowments will, therefore, have much larger payoffs.

Model results—as well as extensive discussions with farmers during the participatory data collection exercises—suggest that most farmers are aware of better soil fertility management practices but are not able to apply them due to lack of resources. When cash is available, investment in soil fertility must compete with other needs and investments such as education. It is likely that high resource endowment farmers only began to invest in soil fertility when other needs and higher-return investments (such as educating children) were already satisfied.

Socio-Economic, Ecological, and Policy Impact Assessment in the Introduction of a Transgenic Staple Crop Variety to the Developing World: The Insect Resistant Maize for Africa Project, Kenya

Adrian Ely, Hugo de Groote, Steven Mugo

In Kenya, as in most of East and Southern Africa, maize is the primary staple. However, the country has yet to become self-sufficient for maize, and current increases in productivity fall short of population growth. Throughout the region, pre-harvest losses due to stem borers are estimated by farmers to range around 15%. The identification of maize varieties with seed-based insect tolerance has been an ongoing focus of the Kenyan Agricultural Research Institute (KARI) since its inception in 1979. The Insect Resistant Maize for Africa (IRMA) Project, a partnership between CIMMYT and KARI funded by the Novartis Foundation for Sustainable Development, was initiated in 1999. Its aim was to increase maize production and food security through the development and deployment of insect resistant maize, both through conventional breeding and through the use of lines transformed with toxin genes from the entomopathogenic bacteria *Bacillus thuringiensis* (Bt). Whereas genetically modified insect resistant maize has been grown widely in the US since 1996, controversy, public opposition, and regulatory confusion have characterized the history of Bt maize in Europe. Although Kenya is ahead of most African nations in the adoption of the technology (with the third GM crop currently undergoing assessment prior to the import of germplasm), policies on biosafety and biotechnology in general are still in the early stages of development, and public awareness is minimal. Through the provision of practical experience, workshops, and continuous dialogue with stakeholders, the IRMA project aims to raise public

awareness of the issues surrounding the technology and to build capacity among local institutions in biosafety and biotechnology policy as encapsulated in Article 22 of the Cartagena Protocol on Biosafety.

IRMA represents the first case in Kenya where non-target effects, genetic erosion, and insect resistance management are all to be assessed prior to the release of the crop. The project is also unique in its incorporation of socio-economic studies in the assessment of the technology, addressing equity, market demand, and intellectual property-rights issues to equip Kenyan scientists, administrators, and policy makers with the full range of tools required for technology assessment. This paper analyses the approaches used to assess the impacts of Bt maize in the ecological and socio-economic realms, and IRMA's subsequent impacts on Kenyan biotechnology policy and public awareness, especially relating to GMOs.

Whereas previous attempts at project impact assessment may have been retrospective, coinciding with or following interventions, IRMA's prognostic impact assessment work will determine whether a release policy is to be pursued and, if so, will continue after commercialization. This predictive and monitoring approach is especially vital with the introduction of a new technology that is under intense scrutiny from national and international observers. This case study provides a model for projects dealing with the introduction of biotechnology products in the developing world.

A Farm-level Evaluation of the Impact of IPM on Pesticide Use: A Comparative Analysis of IPM and non-IPM Trained Farmers in Zimbabwe's Smallholder Sector

S. Siziba and M. Mekuria

Most farmers in Zimbabwe are smallholders whose production systems are predominately subsistence based and in which maize accounts for over 65% of the cultivated area. In Zimbabwe, horticultural production has grown steadily, becoming an important additional source of income for smallholders, and farmers are being encouraged to diversify to the production of high value crops. Tomatoes account for about 60% of the land area allocated to horticultural crops.

Tomato production is vulnerable to pests and disease outbreaks. Currently, pest management in tomato production is characterized by a heavy dependence on chemical pesticides. These are viewed as a quick and easy solution to pest problems. In Zimbabwe and many developing countries, chemical pesticides have received much government support as a means of reducing crop losses. However, mounting evidence points up the negative effects of chemical pesticides on human health and the environment. Toxic substances can accumulate in the ecosystem and have a detrimental effect on non-target organisms. Integrated pest management (IPM) promotes the use of all known (biological and cultural) environmentally benign pest control measures. Farmers are encouraged to integrate the various methods so that chemicals are used minimally and judiciously. In Zimbabwe, IPM has not been widely promoted. Given the increasing cost of agricultural inputs in Zimbabwe, there could be scope for wider adoption of IPM.

This study presents a preliminary assessment of the impact of IPM technology on farmers' pest control practices, perceptions of chemical pesticides, and knowledge of non-chemical pest control alternatives.

The study involved a comparative analysis of 80 non-IPM trained smallholder tomato growers and 50 IPM trained smallholder tomato growers. The farmers were surveyed in 1999 in Chinamora communal area, a horticulture zone 50 km north of Harare.

The study findings indicate some promising implications for wider adoption of IPM by smallholder farmers. IPM training had a positive influence on farmers' knowledge of pests and of the health hazards of chemical pesticides, and led to a reduction in chemical pesticides use. About 92% of the non-IPM trained farmers—compared to only 30% of the IPM trained farmers—used chemical pesticides. All IPM trained farmers knew of the five major pests of tomatoes, compared with only 75% of the non-IPM trained farmers. More IPM trained farmers knew and used alternatives to chemical pesticides to control pests. However, neither the IPM trained nor the non-IPM trained farmers knew how to estimate the economic threshold level of pest infestation. IPM trained farmers anticipated yield losses of 60% due to pest damage compared to 95% perceived by non-IPM trained farmers. IPM trained farmers were more aware of both the acute and the chronic illnesses of chemical pesticides than non-IPM trained farmers: 80% of IPM trained farmers compared to 5% of the non-IPM trained farmers were aware.

Given the findings, policy makers should encourage the use of a pest management strategy like IPM that is information based. This will improve the smallholders' effective use of chemical pesticides, increasing their profitability, and will increase smallholder farmers' awareness of the health hazards of chemical pesticides.

Impact Assessment of Biological Control in Africa—20 Years Experience of the International Institute of Tropical Agriculture

Peter Neuenschwander, Hugo de Groot, and Boru Douthwaite

IITA has a long experience with biological control in Africa. Since the widely publicized success of the Africa-wide biological control of the cassava mealybug, successful classical biological control projects have been undertaken with the same partners against the mango mealy bug, the cassava green mite, and water hyacinth. The four projects documented the impacts of the introduced, exotic natural enemies on the invading pest species and the food web consisting of indigenous species. In a second step, the impact on crop production and the amount of crop loss avoided through biological controls were quantified and translated into economic gains for farmers and/or consumers. In a fifth project, an indigenous entomophagous fungus of locusts and grasshoppers was developed into a commercially available mycopesticide, and the economic viability of the product was evaluated both in terms of avoidance of crop loss as well as environmental and health hazards, compared to the usual insecticide treatments. These projects form the centerpieces of successful integrated pest management (IPM) projects.

The search for natural enemies in the original home of the pests, as well as their importation, rearing, release and monitoring, was financed by donor agencies. All activities in Africa were executed in collaboration with the national quarantine and research organizations, which were prepared for releases and monitoring through workshops and conferences, and who participated as full scientific collaborators. This left a cadre of well-educated scientists capable of collaborating in subsequent projects, executing projects on their own, and influencing public opinion. In each case, collaboration between entomologists, pathologists, and economists proved highly fruitful and the ex-post economic analysis revealed high returns on investment by the donors, with direct impact at the farm level. Benefits to the environment

(compared to pesticide treatments) is usually documented with anecdotal evidence, but not calculated in monetary terms. Similarly, national programs benefited in terms of human resources, capital, and capacity building, but these impacts were not systematically analyzed.

This paper first presents an overview of the ex-post economic analyses of the different projects and a synthesis of the ecological impacts, and is a first attempt to quantify the impact on national programs. It then analyses how the documentation of those impacts influenced decision-making in research and the development of pest management. It is argued that the importance of biological control is now widely felt within the national and international research community, but that it did not have the same impact on the general public, political decision makers and, especially, the donor community. Though the documented biological control projects present very sustainable solutions and are clearly highly profitable, their profile with donor agencies is rather low. Some of the reasons presented here are the lack of guarantee for a sustainable solution from the outset, the long timeframe required, the limited potential for collaboration with the private sector, and the lack of visibility and related poor public awareness. For these reasons, biological control and IPM are often not given their share of recognition within the CGIAR system and the donor community.

It is therefore recommended that biological control and IPM projects include an impact assessment component from the beginning. This will help to guide the development of the technology and document the potential impacts from the start. Furthermore, effort is needed to bring the impact of biological control to the attention of the general public and the donor community.

A Socioeconomic Analysis of Farmer Field Schools Implemented by the National Program in Integrated Pest Management in Thailand

Suwanna Praneetvatakul and Hermann Waibel

This paper analyses the impact of the popular Farmer Field School approach implemented by Thailand's national program on integrated pest management applied selectively in rice, in five provinces.

Data were collected through a standardized questionnaire following the classic "double delta approach," whereby three groups of farmers were interviewed before and after training. The groups were (1) farmers participating in the training, (2) farmers not participating in the training but living in the same village (to measure spread effects), and (3) farmers in a control village. Farmers were interviewed during the irrigated rice-cropping season 1999-2000 for the first time and again in February 2001. All training participants were interviewed. In addition, ten non-participating farmers in the "training village" and fifteen non-participating farmers in the control village were also interviewed.

The analysis was performed in two steps. First, the factors affecting dropout from training were analyzed, because not all farmers completed the season-long training sessions. The analysis was performed by

applying a multinomial logit model. It was found that farmers' level of pesticide use, the quality of training, farmers' a priori knowledge on pest and crop management, and the opportunity cost of labor are the main factors determining dropout.

In a second step, the income effects of farmer training and of farmer-to-farmer knowledge transfer are measured by applying an econometric adoption model. Although the analysis is not yet complete, results indicate that impact varies according to almost the same factors as those explaining dropout.

The paper concludes that to make the concept of Farmer Field Schools an effective and efficient extension tool, these schools have to be well targeted rather than randomly spread over a large number of rural villages. Results also indicate that there are other reasons besides economic ones that determine farmers' participation. This suggests that further studies should investigate the existence of non-market benefits of participatory extension approaches.

Network Approach in Soil Management Research: IWMI's Experience in Southeast Asia

Amado R. Maglinao, Djoko Santoso, and Frits Penning

The International Water Management Institute (IWMI) established its Southeast Asia regional office in Bangkok, Thailand, in April 2001. It absorbed the programs and staff of the International Board for Soil Research and Management (IBSRAM), which ceased to exist upon the merger. The merger carried with it a wealth of experience on the networking approach, which was IBSRAM's major strategy. Activities had been based on joint identification of soil management research priorities with the national research systems and the establishment of regional networks to address problems identified.

The ASIALAND Network on the Management of Sloping Lands started in 1988 with initial funding from the Asian Development Bank (ADB) and continued with support from the Swiss Agency for Development Cooperation (SDC). The fourth phase of the project was completed in August 2001. The fifth and final three-year phase began immediately and is expected to end in 2004.

While it is difficult to clearly delineate the contribution of the network approach in affecting institutional change in the participating research systems, more than 13 years of network experience have yielded many benefits. Through involvement in the implementation of network research, attending training programs and workshops, having better access to information, improved facilities and additional resources, many national systems have improved their capabilities and enhanced their decision-making. This has resulted in the reorientation of research priorities and funding allocations, the integration of sustainable land management in national policies and research plans, the narrowing of the gap between research and extension, and more active participation in regional and global research activities. In most instances, national systems have integrated the concerns for environmental and natural resource management into their institutional work plans.

The Impact of Rockefeller Funded Forum for Natural Resources Management Program in East and Southern Africa

Bharati K Patel, Paul Woomer and Alexander R. Phiri

This paper reviews the impact of the Rockefeller Funded Forum for Natural Resources Management Program in East and Southern Africa since the early 1990s. Since the early 1990s, the Rockefeller Foundation has been funding Masters-level training through grants to principal investigators in universities in Kenya, Malawi, Uganda, Zimbabwe, and other nations of East and Southern Africa. Several principal investigators, mainly from agricultural colleges in these countries, have benefited from these grants through a competitive grant scheme.

The major theme of the research work carried out by these students, together with their principal investigators and collaborators in both East and Southern African, has been household food security.

The major cause of household food insecurity in sub-Saharan Africa has been declining soil fertility. Following the effects of Structural Adjustment Programs (SAPs), which have among other things involved removal of fertilizer subsidies, the majority of smallholder farmers are failing to manage the declining soil fertility through increased use of inorganic fertilizers. In other words, the adoption of a 'Green Revolution' package has been impossible for the majority of smallholder farmers. This has led to a parallel decline in the productivity of the maize-based farming systems, the major staple for the majority of these countries. The Rockefeller Foundation has therefore funded research in these countries that has tried to develop alternative technologies for managing soil fertility.

Impact of Coordinated Rice Improvement Program on Movement of Improved Germplasm and Productivity Gains across Indian States

Aldas Janaiah, Mahabub Hossain and E. Cabrera

In 1965, the Indian Council of Agricultural Research (ICAR) initiated the All India Coordinated Rice Improvement Program (AICRIP). Its principal aim was to facilitate the free flow of information and breeding material, and to organize multi-location testing of improved germplasm across Indian states. AICRIP involves 102 research centers belonging to state agricultural universities (SAUs) and a few ICAR institutions at the national level. AICRIP collaborates with the International Rice Research Institute (IRRI) in the collection, evaluation, and utilization of improved germplasm.

The main objective of this paper is to assess adoption and productivity impacts of genetically improved rice initiated through the AICRIP in India. It also examines farmers' preferences for different traits by relating the rate of adoption of modern varieties (MVs) with their characteristics using a multi-variate regression model.

Data on released MVs (1965-2000), namely pedigree, source of origin and variety traits, were obtained from research reports/bulletins of AICRIP and IRRI. The yield and area planted for all MVs adopted during 1998-2000 in 15 major rice-growing states (accounting for 98% of India's rice area and production) were obtained from the state department of agriculture. A genetic improvement index was computed and its sources were broken down into shares by the national system and IRRI by assigning weights for the sources of parent materials. The area planted to different MVs and their yields were used as weights to assess the adoption and productivity impacts.

Farmers in different states of India adopted 309 of the total 620 MVs released. These covered approximately 81% of the total rice area during 1998-2000. Among them, 30 MVs were adopted in more than one state, occupying 61% of total MV area. About 64% of overall genetic improvement for the released MVs in India was contributed by improved germplasm of the national system, while the remaining 36% came from international spillovers.

Nearly 42% of adopted MVs originated from and moved through the AICRIP network from one state to another, covering 41% of the total MV area. The direct releases of IRRI's material covered about 12% of total rice area in India. The improved germplasm of the national system contributed about 53% of overall productivity gains while the remaining 47% derived from research spillovers of international germplasm (IRRI). The eastern Indian states, which are dominated by rainfed ecosystems, are the major gainers of the AICRIP and IRRI-induced productivity gains. The state of Andhra Pradesh is the major contributor with a share of 50% of the AICRIP-induced productivity gains. The distribution pattern of these productivity gains among the ecosystems and states is discussed in this paper.

The estimates of the variety adoption model indicate that yield, grain quality, and maturity period are major traits significantly affecting the adoption of MVs. Host plant resistance to insects and diseases—traits that plant breeders consider important—are not statistically significant in the model.

Impact of Regional Agricultural Research Networks: The Case of the Regional Maize Program for Central America and the Caribbean

Miguel I. Gómez and Prabhu L. Pingali

This study develops an empirical model to test the hypothesis that technology spillovers produced by regional research networks can reduce the cost of conducting agricultural research in less developed countries. Furthermore, it examines whether returns to public research are overestimated if the spillovers generated by regional cooperation are not identified. The study focuses on the Regional Maize Program (Spanish acronym: PRM), a network of maize breeders in Central America and the Caribbean (CAC). It classifies commercial maize germplasm according to which institutions produced the basic populations, managed the breeding process, undertook adaptive research, and screened the populations. Next, a database on experimental yields was assembled and used in combination with data on technology adoption to: (1) estimate a matrix of potential spillovers; (2) conduct a research impact assessment identifying the incidence of spillovers and; (3) estimate cost-benefit ratios showing the incidence of regional networks. Cost-benefit ratio estimates (CBRs) indicate that

ignoring spillovers leads to overestimating national agricultural research systems (NARSs) impacts by a factor of three. The findings also suggest that although NARSs research has had high payoffs, ignoring technology spillovers considerably inflates the benefits from public maize breeding research in CAC. CBR estimates also indicate that the incidence of spillovers is large: only one-third of research impacts come from independent NARSs' research, leaving the rest to spillover. Amongst all institutions, the PRM is the largest contributor of spillovers and its impacts are more important in countries where maize is used for direct human consumption. The cost-benefit ratio indicates that the PRM contributes to reducing research costs and, therefore, to improving research's financial efficiency relative to NARSs' independent research. Finally, results demonstrate that CAC countries have exploited the advantages of specialization and economies of scale in research by participating in the PRM.

Can Impact Analysis be Used for Research Evaluation?

Javier M. Ekboir

Many impact studies tend to relate changes in a particular impact indicator (e.g., output) with a measure of research investment. This requires the implicit assumption that the link between research outputs and impact indicators dominates all other relationships. However, this is true only for minor improvements along stable technological paradigms (like successive replacement of modern varieties). For most technologies, such as new crops or crop management, other factors, such as policies and markets, influence adoption and, consequently, impact. Allocation of impact (or lack of) to research assumes that all other factors were unimportant in the generation and adoption processes.

Since many factors influence adoption, research impacts must be analyzed within a broader framework. Such a framework is provided by complexity theory, which posits that impacts depend on the technology's own evolution, on external forces (e.g., markets and regulations), and the direct and indirect interactions of networks of agents (e.g., researchers, input suppliers, policy makers and financial institutions). Some of these interactions are formal and some informal; some are planned while others are random. These interactions also depend on the maturity and nature of the technology. Newer and/or more complex technologies are more uncertain and, thus, require greater collaboration. In the development of simpler or better-known technologies, each agent is more aware of the role of other agents and of technology standards; thus, direct relationships are less important than market interactions. The problem is occasionally compounded because the impacts appear after many years and often cannot be measured.

The complexity framework has broad consequences for agricultural and research policies. Impacts result from the technology's own evolution, from changes in the networks that generate it and from the actions of competing and complementary networks. Since impacts ensue from the ways the whole network reacts to internal and external signals, they cannot be allocated to individual agents. In evaluating networks, the relevant parameters to study are the mechanisms that govern their reaction to new technological and market environments. These include rules for generating, collecting and sharing information, financing procedures, intellectual property right regulations and availability of human and financial resources. What can be evaluated for individual agents are their patterns of participation in particular networks and the factors that determine those patterns. These factors are (1) benefits and costs of participation, (2) criteria for promotions, (3) evaluation criteria, (4) financial arrangements, and (5) institutional cultures.

Since technology generation and adoption are random processes, any impact is, in part, the result of chance and could not have been fully foreseen by any agent. Because of this feature, impact analysis should concentrate more on the analysis of development and adoption process and less on sophisticated rules to allocate the result to particular agents. Additionally, since research impacts cannot be predicted, an ex-ante estimation of impact is a poor instrument to allocate resources. Again, the emphasis should be put on the particular mechanisms that enable networks to be efficient: collective learning routines and the inter- and intra-institutional incentives to participate in innovation networks.

An Evaluation Approach for Achieving and Attributing Impact for INRM and IPM

Boru Douthwaite, Thomas Kuby, Elske van de Fliert, and Steffen Schulz

Integrated natural resource management (INRM) and integrated pest management (IPM) take a holistic—rather than reductionist—approach to research. Both approaches see innovation as a social process in which people construct solutions to their problems. Once one accepts that users modify technologies and their own systems to accommodate new technologies, and that these adaptations affect adoption rates and the distribution of benefits, one must also accept that technological change is an immensely complex process with a high degree of non-linearity. Currently, the ‘best practice’ economic evaluation methods, commonly used in the CGIAR system, struggle as they attempt to establish a linear link between a project’s outputs and wider level impacts. Hence IPM and INRM require a different type of evaluation approach that can bridge this attribution gap.

In this paper we look outside the CGIAR system to learn lessons from the broader field of social program evaluation and incorporate experience of the German development organization GTZ (Deutsche Gesellschaft für Technische Zusammenarbeit GmbH). We find that a two-stage program theory evaluation (PTE), guided by an impact model developed by GTZ, is better matched to the needs of IPM and INRM. This type of evaluation is guided by an explicit theory or model of how a research project achieves impact. In other words, PTE is based on a map of the impact pathway(s).

In the first stage of evaluation, the research project begins by developing a program theory for itself and then conducts its own self-evaluation, guided by the program theory, to the point of establishing direct benefits of its pilot site(s) outputs. Self-evaluation and the learning it engenders contribute to adaptive project management, which is crucial to successful INRM and IPM. Based on this learning, the program theory evolves to map out, in greater detail, how the project’s direct benefits can later be scaled-up.

The second stage, conducted some time after the project has finished, is an ex-post impact assessment in which the project’s wider benefits are independently measured. This begins by establishing the extent to which the program theory was valid in the pilot site(s) and the extent to which scaling up has occurred. It is the job of the impact assessor to build a plausible and persuasive case for a link between the project outputs and general level developmental changes, using case study methodology.

We illustrate the usefulness of the 2-stage PET through two examples: an ongoing project to develop integrated management options for the control of *Striga spp* (a parasitic weed) with farmers in northern Nigeria and a completed, integrated crop management project in Indonesia.

From Measuring Impact to Learning Institutional Lessons: An Innovation Systems Perspective on Improving the Management of International Agricultural Research

Andrew Hall

This paper argues that efforts to measure the impact of agricultural research have largely failed to improve developmental impacts, because commonly used assessment methods fail to provide research managers with critical institutional lessons for improving innovation. Approaches such as measuring rates of return to investment, while providing politically expedient evidence of the value of public research, offer little help in understanding the complex processes and institutional factors that gave rise to the relative success of different research initiatives. The reasons behind this problem relate to the disciplinary and conceptual conventions that underpin both impact assessment methods and agricultural research policy generally. The former is based on linear assumptions about the relationship between research inputs and economic outputs. Methodological problems aside, economic analysis of this type is ill equipped to give insights into the evolution of agricultural systems.

This paper proposes a systems model of innovation as a complementary framework to understanding agricultural innovation (technical and economic change) in its wider institutional context. In this systems conceptualization, innovation performance and impact is viewed as resulting from the existence

and ability of coalitions, or systems of public and private research and non-research institutions, to interact, create, transfer, and apply economically useful knowledge. In these systems, innovations are derived from evolutionary combinations of technical and institutional change. Case studies from India and Africa are used to demonstrate how this conceptualization of the innovation process could be used to evaluate research and technology programs and inform planning and research management.

The paper concludes by recognizing that international and national research efforts have some way to go before better integration with a wider set of innovation system actors can be achieved. However, there is increasing evidence that developmental impacts from investments in agricultural science could be improved if policy was informed by the institutional lessons provided by an innovations systems perspective. Adopting the evolutionary institutional learning processes that innovation systems thinking identifies as critically important could be part of a complementary assessment approach to improve planning and research management practices. This would assist policy to address the efficiency of the research process rather than, as at present, only measuring its outputs.

Disciplines, Institutions, and Organizations: Impact Assessments in Context

Rajeswari S. Raina

Impact assessment is designed to inform decision-makers and relevant stakeholders in national agricultural research systems and international agricultural research centers about the impacts of agricultural technologies, research programs or policies. This paper contends that impact assessment research is located within the uneasy relationship between agricultural and social sciences. This relationship is determined by disciplinary constructs (theoretical and empirical remits) of the social sciences and the institutions (rules of the game) and organizations (structures governed by these rules/norms) of agricultural science. Social sciences, especially the economics and sociology used in impact assessment studies, embody this instrumentalism within the agricultural sciences.

The first section discusses how this instrumentalism is operationalized within the institutions and organizations of agricultural research. Agricultural sciences use the social sciences: (a) as a substitute for extension, or the transfer of technology; (b) for statistical verification of experimental results, an economic viability certificate before the release of technology; and (c) for conditional priority setting, evaluation, and policy formulation. Within national systems and international centers, we are now witnessing the 'anomalous expansion' of rigorous academic work on impact assessment. However, the institutional and organizational context of this research has remained grounded in instrumentalism. This isolation of impact assessment studies from the institutional and organizational reality of agricultural science, and of agricultural and social sciences from the ecological, economic, social and cultural realities of the world (which adopts or utilizes the knowledge/technology) can be traced back to the clear distinction made in instrumentalism between reality and morality.

The second section discusses this isolation, which is evident in the information base and methodologies used for impact assessment. Literature discussing the emergence of 'manual mentality' and the over-preoccupation with methods (for impact assessment and/or research management) points to this increasing isolation. Institutionally and organizationally, the social sciences used for impact assessment are tuned to looking for consequence indicators alone. How can we use indicators of requirements, relationships, and monitoring? Will the epistemological and disciplinary constraints of the social sciences within national systems and international centers permit the use of these indicators, which draw from systems concepts and democratic values? These indicators help impact assessments "...demonstrate how research leads to technology and technology leads to development."

Our commitment to an evaluation culture (Trochim 1992) is discussed in the next section. How will scientific credibility (as in economics) and accountability or democratic processes be features of the desired evaluation culture when they contradict each other at a fundamental epistemological level in the social sciences? It is important to challenge disciplinary constructs and develop interdisciplinary frameworks and institutions to facilitate the evaluation culture. This paper will also present analysis of evaluation methodologies and disciplinary handicaps from agricultural research systems in three leading democracies: India, the USA, and Sweden. To make an impact, impact assessment studies must be cognizant of disciplinary and institutional contexts.

Tradeoff Analysis as a Tool for Assessment of Economic and Environmental Impacts of Agricultural Research

David Yanggen, John Antle, Jetse Stoorvogel, Walter Bowen, and Charles Crissman

The public demand for information about both economic and environmental impacts of agricultural research has been widely recognized. Indeed, one could argue that one explanation for “Why Has Impact Assessment Research Not Made More of a Difference?” is that until recently it has focused only on economic impacts. However, it is also true that until recently, methods and tools (data, models, and model integration software) needed to conduct more integrated types of assessments have been lacking. In a companion paper, we address another key issue, namely the need to integrate public decision makers and stakeholders into the assessment process.

This paper introduces the reader to recently developed methods and tools for integrated assessment of agricultural production systems known as tradeoff analysis (TOA) and the TOA model, and discusses how these methods and tools can be used to assess quantitatively the impacts of agricultural research on the sustainability of production systems. Sustainability is defined in terms of economic, environmental, and other quantifiable indicators of the system’s performance.

The paper begins with a discussion of a general approach to the integrated assessment of agricultural production systems that is known as TOA. We show how the conventional economic assessment of research impacts can be embedded in this more general framework, and how it can be used for both ex post and ex ante assessment of research impacts. TOA is based on the identification of key quantifiable sustainability indicators (e.g., economic indicators, environmental and social impact indicators) by stakeholders. A key methodological question is how to assess the impacts of research in

these multiple dimensions and communicate that information to decision makers and stakeholders. In this section, we discuss several approaches taken by economists to this problem, as well as the solution provided by the TOA approach.

The next section of the paper discusses issues related to the implementation of an integrated assessment of an agricultural production system for research impact assessment. Various methodological issues arise related to the choice of spatial and temporal scales, data availability, the suitability of existing disciplinary models, and how these data and models can be integrated to implement such an assessment. In this context, we briefly introduce the TOA model software that can be used to implement this type of integrated assessment. This software organizes data in a GIS framework and links inputs and outputs from disciplinary simulation models (biophysical crop and livestock models, economic models, and environmental process models) on a site-specific basis and aggregates results to a larger spatial unit (such as a watershed or political region).

The final section of the paper illustrates the use of this type of integrated assessment tool to assess impacts of agricultural research using recent case studies in Ecuador and Peru. Examples of technologies being investigated in these areas include late-blight resistant potato varieties, integrated pest management techniques, and soil conservation technologies (terracing, agroforestry, and alternative tillage practices). These examples illustrate how this type of assessment tool can be used to assess impacts of existing and alternative technologies within the crop and livestock production systems.

Agricultural Development and Impacts on the Environment: Experiences from India

D.D. Naik and Archana Godbole

India is principally an agrarian country. However, over the last two decades, it has been rapidly industrializing. The principal aim of industrialization has been agricultural self-sufficiency. Nevertheless, India's population continues to grow, increasing the need for agricultural land. Changing land-use patterns and the increasing use of irrigation are having detrimental impacts on the environment. Agricultural improvements and the Green Revolution have also affected genetic diversity preserved in the form of local crop varieties. The agro-biodiversity of the crop ecosystems is declining rapidly. In 1994, the Indian government passed the Environmental Protection Act. As a result, environmental impact assessments are now mandatory for all developmental projects. This includes irrigation projects designed for agricultural improvement.

Between 1998 and 2001, impact assessment studies were conducted for twelve irrigation projects in Maharashtra, India, including the arid zone in the northwestern part of the state. Results indicate that environmental impacts occurred outside pre-determined parameters. The process designed for impact assessment is not infallible. The role of key actors in the process of development has not been properly addressed; specifically the role of policy makers and project planners in the process of impact analysis. The necessity of providing water for agriculture to achieve food security overrides the aim of sustainable development. Based on the results attained from analysis of the twelve irrigation projects, particularly when considering long-term impacts, it is evident that a detailed analysis of the actors involved is essential.

The studies highlighted the need to evaluate the actual cost-benefit ratios in terms of environmental costs together with the cost of project implementation and consequent increases in agro-productivity. It is necessary to achieve a balance between the requirements of irrigated agriculture and environmental protection/management. Impact analysis and environmental management methodologies are important considerations. Appropriate impact assessment methodologies have the potential to establish linkages between the process of agro-development and impacts on the environment.

The paper illuminates the difficulties involved in accommodating the various attitudes and agendas of developers, farmers, stakeholders, and governmental, non-governmental and local agencies when pursuing the goal of sustainable development. Certain initiatives, namely stakeholder training and consultation, are also evaluated in this paper. In conclusion, this paper argues that there is an urgent need to undertake comprehensive environmental assessments/audits for all major agricultural development projects. In many cases, this may involve the need for the development of suitable, more sustainable, alternatives. There is also a pressing need to generate a deeper understanding of these issues at the policy-making level.

Impact of Salinity Management Research in Northwest India

K.K. Datta, Laxmi Tewari, and P.K. Joshi

Soil salinity is one of the complex abiotic phenomena adversely affecting agricultural production worldwide. Globally, salinity constrains agricultural production on 45 million ha of irrigated land, and this equates to annual losses of approximately US\$ 11.4 billion.

India is no exception. Diverse statistics indicate that the problem is threatening agricultural production on between 5.5 and 13 million ha, some 1 million of which are seriously affected and where agriculture has been abandoned. To manage the problem in highly fertile irrigated areas, the Indian Council of Agricultural Research invested in systematic research efforts at the Central Soil Salinity Research Institute to rehabilitate and manage soil salinity for agricultural production. This concerted and multi-disciplinary effort led to the recommended provision of sub-surface drainage for salinity control. After small-scale operational studies, large-scale pilot projects were launched to install sub-surface drainage in problem areas. One such attempt was initiated in northwest India. This paper assesses the impact of investments in sub-surface drainage for salinity control. Specific objectives of the paper are: (1) to assess impact of sub-surface drainage on efficiency, equity, and sustainability, and (2) to examine factors affecting the sustainability of the technology.

The internal rate of return was computed to assess the efficiency indicator of sub-surface drainage for salinity management. Gini concentration ratios were computed with and without installing sub-surface drainage to measure changes in equity issues. The Radar Approach was used to quantify sustainability in terms of optimizing economic gains and conserving or improving the quality of soil and water resources.

The results showed several farm-level benefits as a result of installing sub-surface drainage. These included (i) a substantial increase in farm income, (ii) crop intensification and diversification towards high value crops, and (iii) the generation of employment opportunities. High internal rates of return justified investment in sub-surface drainage. The program also indicated reduced income inequalities across farm producers. The Radar Approach demonstrated improved sustainability in terms of economic gains and resource conservation.

Despite economic, social, and environmental benefits, the sustainability of the sub-surface drainage technology is always questioned. The specific reasons discussed in the paper are: (1) the indivisible nature of the technology, (2) lukewarm collective action by the beneficiaries, (3) conflicting objectives among beneficiaries, and (4) a growing number of free riders. These were due to the absence of appropriate institutional arrangements. To a large extent, these were addressed in the study area by forming village committees.

The analysis noted that technology without institutional arrangements might not yield the desired results. A technology with high potential benefits may not make a difference and could be abandoned in the absence of essential institutional arrangements.

Economic and Institutional Factors Affecting the Adoption of Soil Conservation Technologies in Central America

Gustavo Saín and Monika Zurek

Due to the mountainous topography of Central America (CA), heavy rainfalls during the long-lasting rainy season, and the continuing use of soil-degrading farm management practices, soil erosion is one of the major threats to the natural resource base, agricultural productivity, and survival of small-scale farmers in the region. Despite the promotion of many different soil conservation techniques by many governmental and non-governmental organizations in the last 20 years, the overall adoption of these kinds of technologies has been relatively low, especially among small-scale farmers. This study assesses the adoption and impact of conservation technologies at three different levels of aggregation.

First, at the regional level, fifteen widely promoted soil conservation practices are assessed according to four economic criteria and compared with the main economic circumstances of small farmers in CA. Results suggest that most techniques promoted in CA do not match small farmers' circumstances for one or more of the criteria.

Second, we conducted a comparative analysis of the factors affecting the adoption of different technologies, using the results of adoption studies performed over the past ten years. The analysis examines both the demand for new technologies and their supply in the region. Results from the supply side show that institutions failed to recognize the particular characteristics that differentiated environmental innovations from commercial innovations, suggesting a need for to understand farmers' demands for such technologies. In particular, three characteristics of environmental innovations

were found to be incompatible with small farmers' circumstances: (1) the need for farmers to make a significant initial investment in terms of land, capital or labor; (2) the existence of a time lag before farmers obtain benefits; and (3) complex management requirements in terms of land allocation and technology maintenance. On the demand side, three main factors were identified as being responsible for the lack of widespread adoption of soil conserving technologies: (1) farmers' inability to capture long-term benefits caused mainly by insecure land tenure and low wealth levels; (2) high transaction costs associated with adopting the innovations, particularly the costs of acquiring and processing information about the technology, as well as high land and labor opportunity costs; and (3) market failures related to the interaction between cropping and livestock systems in areas where common grazing predominates.

Third, the impact of conservation tillage and mulching was assessed. Using the results of an in-depth case study in El Salvador, a simulation model was built to identify the effects of a set of alternative policy measures aimed to foster a more sustainable and productive maize production system in CA. As well as beneficial effects on soil characteristics and increased land productivity, some negative effects were identified in terms of the increased use of pesticides that could be deleterious to the environment and farmers' health. Diffusion of the technology to other regions could be restricted by the interaction with the livestock system and the malfunction or non-existence of fodder markets.

Evaluating Capacity Development of the Plant Genetic Resources Center in Bunso, Ghana

Samuel Bennett-Lartey, Raymond Vodouhe, and Jamie Watts

This study addressed two themes. First, the development of capacity within the Plant Genetic Resources Center (PGRC), Ghana, to conserve, evaluate, and utilize Ghana's plant genetic resources. Second, the capacity building contributions made to PGRC's development by the International Plant Genetic Resources Institute (IPGRI) and the Genetic Resources Network of West and Central Africa (GRENEWECA). The study aimed to (1) analyze the development of PGRC capacity in human resources and conservations facilities/methods; (2) illustrate and learn from the capacity development experiences of Ghana, to develop other national programs throughout West and Central Africa; and (3) promote the analysis of and improve evaluation skills in capacity development. The evaluation analyzed data from 1980-1999, a time of major growth and change.

An organizational capacity development model developed by the International Development Research Center (IDRC) served as the theoretical basis for the study. This model defines capacity development as the ability of an organization to meet its goals on a sustainable basis and consists of three inter-related components, namely, motivation within the organization, resources and equipment, and the external environment. Capacity development indicators were developed from an international agreement (The Global Plan of Action for the Conservation and Sustainable Use of Plant Genetic Resources for Food and Agriculture, or GPA), which provides a comprehensive framework for priority areas within which capacity must be built.

The case study approach was used for analysis, with a strong emphasis on self-assessment by the organizations involved. Multiple methods were used, including self-assessment workshops for PGRC staff groups and stakeholders and for GRENEWECA steering committee members, interviews of IPGRI senior managers and high-level Ghanaian officials, a personal history of the head of the PGRC, a survey of IPGRI staff, and a review of archival records from all three organizations.

The results demonstrated that capacity has been developed within the PGRC in many areas, namely, staff number and qualifications, budget allocation, and operational autonomy. This led to an increased number of germplasm accessions conserved and the development of programs to promote the use of conserved germplasm for research and in farmers' fields. IPGRI and GRENEWECA have made significant contributions in the areas of training, infrastructure, information services, and more recently, policy and awareness raising. A major strength of IPGRI's contribution has been the continuity of involvement over a prolonged time period. The study also found that contributions to capacity building have been made by other organizations; for example, bilateral donors. The PGRC has also benefited from a strong network of supporters within Ghana, including other research institutions and universities, who are partners in the work of germplasm conservation and use. The study also identified institutional weaknesses in PGRC, GRENEWECA and IPGRI. These related to a lack of vision, policy and a strategy for capacity development. Building a capacity development culture into the organizations has been identified as a priority.

Evaluating Capacity Development in Research and Development Organizations: Emerging Results of a Global Study

Douglas Horton and Nancy Alexaki

Capacity development has moved center-stage in agendas of development organizations. Strengthening the capabilities of individuals, organizations, and institutions is viewed as essential to ensure the sustainability of development efforts and the eradication of poverty. Substantial sums are being invested in the development of organizational and institutional capacities. Yet, the design, management, and evaluation of capacity-development efforts leave much to be desired. Results indicate that capacity-development efforts often fall short of their goals and expectations. Relatively few of these efforts have been systematically and thoroughly evaluated. The complexity and dynamic nature of capacity-development processes complicates evaluation. The familiar challenges facing evaluators of capacity development at the individual level are exacerbated at the organizational level.

A number of organizational or institutional assessment frameworks have been published. However, little is known about their use in evaluating capacity development. Most of the information available in this field is in “gray” or “fugitive” literature.

This paper reports on a project that seeks to contribute to the effectiveness of capacity-development efforts in research and development organizations through the use of evaluation. The project focuses on capacity development at the organizational level, rather than at the micro level of individuals or the macro level of national institutions. It recognizes the multiple perspectives of key actors involved in capacity

development, rather than the single perspective of an externally funded and directed capacity-development intervention. The impacts or contributions of international organizations to capacity development in national organizations are being assessed “from the bottom up.” The project is implemented by capacity-development practitioners and evaluators based in 13 organizations.

An action-research approach is being employed to advance understanding and practice in the evaluation of capacity-development efforts in organizations that conduct research or use research for development. Professionals involved in capacity development are evaluating their own efforts, and in the process, they are developing and refining evaluation methods that may later be suitable for use on a broader scale. The project involved participants from six national and local organizations who are working to develop their own capacity and six international organizations who support these capacity-development efforts (four of the six international organizations are CGIAR centers). Five donor agencies that provide resources for organizational capacity development, also participated in the project.

The paper reviews the current state of practice in evaluating capacity development and presents a framework for evaluating organizational capacity development. Highlights of six evaluation case studies are followed by general conclusions and lessons for improving capacity development efforts and their evaluation.

The Costs of Transforming Public Extension Services towards Participatory Approaches: The Case of Egypt

Gerd Fleischer, Hermann Waibel, and Gerd Walter-Echols

The notion that public extension services in agriculture are no longer adequate to meet the changing needs of farmers, in many developing countries, is becoming increasingly emphasized in both research literature and the strategies of development agencies. The problems encountered with the T&V system have caused considerable frustration among donor agencies and reduced their willingness to invest in large-scale public agricultural extension programs. For some, the solution is delivering information and services through the complete or semi-privatization of public agencies. Others argue that the public sector has to maintain its role in knowledge and information transfer but see the need to change the hierarchical structure and the top down approaches of the public sector towards adopting participatory methods of extension.

This paper compares and contrasts five different agricultural extension projects in Egypt, which are supported by different donor agencies, promoting various forms of participatory methods to agricultural extension and farmer training. Comparisons are being

made on the basis of cost-effectiveness parameters. Furthermore, break-even benefits are calculated based on the effects on farmer's income. Results indicate that using unit costs of farmer training is not a valid basis for comparison but that there is a need to take into account the start-up conditions and the specifics of the training method, which result in different levels of base costs, start-up costs, recurrent costs and farmers' costs. It is also shown that depending on the situation, the break-even benefits are surprisingly low to justify even considerable investments in participatory training and extension. However, in for example a crop like cotton, such approaches are unlikely to be economical viable.

The paper concludes that there is a need for high selectivity and careful planning in public sector agricultural extension projects. However, the study also emphasizes the notion that from an economic point of view, public investments in participatory agricultural extension are likely to be superior to other approaches in extension, if the target is well chosen.

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