



Impact Assessment of Policy-Oriented Research in the CGIAR: Evidence and Insights from Case Studies

November 2008

Consultative Group on International Agricultural Research
SCIENCE COUNCIL

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Dedicated to the memory of Professor Bruce Gardner, 1942–2008, who played the leading role in guiding the studies that form the basis of this report.

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Foreword

Policy-oriented research (POR) has represented an increasing share of research expenditures in the Consultative Group in International Agricultural Research (CGIAR), rising from 9 percent in 1995 to about 18 percent currently. Yet it is a theme where evidence of impacts is scant, primarily because of the methodological problems involved. These considerations led donors to request that the Science Council's Standing Panel on Impact Assessment (SPIA) enhance its activities in this area of impact assessment. In response SPIA initiated in 2005 an exploratory study of POR impacts, to evaluate the existing evidence of both direct and indirect POR outcomes and impacts from different types of CGIAR research. The result of this exercise was publication of a 'Green Cover' scoping report (CGIAR Science Council, 2006).

The study identified 24 *ex post* impact assessments (epIAs) in CGIAR centers that trace the uptake, influence, and/or impact of CGIAR POR outputs. Only three of the 24 attempted to empirically estimate the economic impacts of the POR. Ten studies only went so far as identifying the influence of the POR. The balance only assessed the extent of uptake of the POR outputs. The 24 studies represented less than 4 percent of the 700 studies of the adoption and impact of CGIAR technologies conducted to date.

The three studies that estimated economic impacts of POR conducted by the centers did not identify sufficient economic benefits (about US\$200 million) to justify even the lower-bound estimate of the cumulative investment in POR (US\$800 million) through 2004 in the system. SPIA concluded from this scoping study that there was a need to commission a number of additional case studies of the impact of POR in the centers to augment the evidence, and to further the development of methodologies in this challenging area of impact assessment. In collaboration with the centers, a call for proposals was made in late October 2006.

The call indicated that either of two approaches to conducting POR impact assessment (PORIA) would be acceptable:

1. Starting with CGIAR projects and working up the impact pathway, then finally identifying influence and impact attributable to each project (a 'supply-driven' approach)
2. Starting with an actually implemented policy that addresses an issue that has been the subject of CGIAR research, and working backwards along the impact pathway, identifying CGIAR inputs and influence in the policy process vis-à-vis other suppliers and actors (a 'demand-driven' approach).

Prior to 2004 PORIA work had been exclusively in the former vein. SPIA expressed a particular interest in proposals that attempted the latter approach.

The proposals were expected to address all steps along the impact pathway, including costs and resources devoted to the research, immediate outputs from the research (publications, conferences, and other means of information and advisory dissemination), influence in the policy-making process, and impact of the policies implemented on development goals. Key criteria in the ranking of PORIA proposals were the rigor, originality, and feasibility of the research plan to provide credible estimates in the difficult areas of establishing influence and measuring impacts. The findings of the selected PORIA case studies were expected to provide a clear and well-documented bottom line for the socio-economic value of impacts, a full description and analysis of the path by which center outputs were used to generate influence, and an indication of how that influence contributed to the policy implemented.

By the end of 2006, 11 of the 15 CGIAR centers had submitted a total of 14 proposals for consideration by SPIA. Seven proposals from seven centers were selected and a small grant of US\$15,000 was provided to each successful center to assist with the costs of undertaking the selected PORIA studies. SPIA was assisted in the selection of the projects and in the oversight of the studies by a distinguished advisory panel led by the late

Professor Bruce Gardner of the University of Maryland, Professor Rob Paarlberg of Wellesley College, and Professor Carol Weiss of Harvard University. The studies began with a two-day planning work-shop held at the International Food Policy Research Institute (IFPRI) in Washington DC in February 2007. The wrap-up workshop was held 11–13 December 2007 at the International Rice Research Institute (IRRI) in Los Baños, the Philippines. Various drafts of the case study reports were subsequently peer-reviewed by SPIA and the advisory panel during the course of 2008. With the untimely death in March 2008 of Professor Gardner, who was overseeing all seven case studies, Dr Tom Walker agreed to assume that responsibility from June and SPIA is grateful to him, as it is to Professors Gardner, Paarlberg, and Weiss for their care and attention to the task of seeing these case studies through to completion.

The seven case studies presented here are abridged versions of full reports that have been or are in the process of being published by the centers concerned. Five of the seven went so far as to attempt to measure the economic impact of the policy changes that were associated with the respective POR, and the returns on the POR investments themselves. However, this did not extend to assessing how these economic impacts translated into impacts on poverty, which seems to be par for the course in most impact studies – and PORIAs seem to be no exception. The Center for International Forestry Research (CIFOR) study did assess the environmental externality benefits from the policy changes in addition to the direct economic benefits. This represents a major advance in the scope of PORIA. When we add together the preferred estimates of economic impacts (using the base or conservative scenarios) from the five case studies of US\$750 million to the US\$200 million estimated from earlier studies as cited above, we arrive at a current estimate of US\$950 million for the net present value (NPV) of documented benefits from POR in the CGIAR. While this figure is above the cumulative investment (up to 2004) of US\$800 million in POR, the cumulative investment is now well above the US\$950 million figure. Hence, there remains a need for centers to undertake further PORIA studies if donors are to be satisfied

about the appropriateness of the increased emphasis on POR in the past 20 years.

As with the 24 other PORIA studies reviewed earlier (CGIAR Science Council, 2006), all five of the case studies where economic impacts of POR were assessed involved individual country POR, which has more national than international public good (IPG) attributes. They all also involved project-specific rather than core funding, which no doubt helps explain their national rather than IPG focus. While spillovers to other countries were posited to have occurred in terms of influence, the studies were not able to quantify the extent of benefits beyond the country where the POR was focused. Indeed a long-term country presence by the center seems to be a *sine qua non* of demonstrable influence and impact; and this seems more likely in countries where center headquarters are located, although by no means inevitable, e.g., IFPRI in Bangladesh, Mexico, and Viet Nam.

It seems that assessing empirically the economic benefits of IPG outputs of the type that the Bioversity case study describes remains elusive; although the center is optimistic it will be able to do so in due course. The tractability of credible documentation of impact from POR seems to be directly related to the creation of national public goods rather than IPGs at this stage of PORIA methodology development. It is notable however that these national PORIAs generally indicate comparable rates of return and benefit–cost ratios to the typical impact assessments of biological research, so with more PORIA studies in future, there is every prospect that the cumulative NPVs will exceed cumulative investment, although the jury is still out on this.

Documenting the uptake and influence of POR in the policy environment remains a challenging assignment and one that would benefit from more multi-disciplinary approaches in future. Economists dominated the elicitation of these aspects in the case studies, and could benefit from the expertise of other social and political scientists more familiar with interview techniques, qualitative data analysis, and interpretation and narrative techniques. This could improve the assignment of attribution or contribution and the establishment of appropriate coun-

terfactuals. The other side of the equation is the assessment of the benefits from the relevant policy changes, which seemed less difficult, at least for five of the seven studies. If attribution of some of these benefits to particular POR is not possible, then at least the qualitative analysis or narratives from interviews with key informants can allow the reader to form their own judgments about the respective contributions of the centers versus other research and development (R&D) players. The IFPRI approach of recording verbatim-verified responses of all interviewees in an appendix to the full report represents good practice that others could well emulate. Attributing a certain percentage of the benefits of the policy change to a particular POR seems somewhat arbitrary in those studies that did this. While the concept of viewing POR as a means of hastening the processes of welfare-enhancing policy change has much appeal, as a counterfactual device to measure the impact of POR, translating this into defensible estimates of the precise time saving for empirical benefit estimation remains a challenge.

The WorldFish study would have benefited from a more carefully designed set of baseline studies from which to assess the consequences of a new policy of community-based fisheries management in Bangladesh. This raises the issue of the value and desirability of more explicit use of randomized control trials in PORIA in future, especially those involving action research on policy/institutional innovations in common property management, as the WorldFish study did.

Most studies employed a 'supply-driven' approach to the conduct of PORIA. The set of interviewees were generally dominated by key informants familiar with the policy environment concerned, and in this sense reflected a demand-side perspective; but the studies all began from the POR outputs of the centers and elicited respondents' views on their uptake and influence on policy change *vis-à-vis* other influences. It appears that the supply-driven approach is the preferred one at this stage of the conduct of PORIA.

All studies confirm the importance of appropriately targeting policy audiences in order to generate influence and impact. Sometimes these were non-governmental organi-

zations (NGOs), as with the CIFOR study, while in most others it was a government. Again, a degree of advocacy was needed in addition to uptake of POR outputs in order to have influence. It seems the extent of advocacy in these cases did not jeopardize the reputations of the centers as 'honest brokers,' although this can be a fine line at times. It is here that identification of a local 'policy champion' who understands both the POR and the policy environment can be crucial. Sometimes, as with the Bioversity study, it was arguably the reputation of the center that positioned it to have the influence on the multilateral policy environment, rather than the particular POR involved. This suggests that reputations are arguably IPGs that complement particular POR projects, which produce mostly national public goods. Reputations are built on stocks of knowledge, experience, and interactions over a long period, whereas individual POR are incremental flows or additions to these.

In conclusion, we thank the seven centers for accepting the invitation to be involved in these informative case studies, and especially the center staff and consultants directly involved. The success of the enterprise would not have been possible without the invaluable professional input and administrative support of Tim Kelley of the Science Council Secretariat. We are also indebted to the members of the advisory panel for their very valuable input throughout the process. It is our sense that we have all learned a lot together in a spirit of collaboration and exploration. The synthesis of the studies and the lessons learned from them have ensured that the value of the exercise is much greater than the sum of the parts, which is pleasing to SPIA, as this provides a major rationale for its existence. Yet much more remains to be done on PORIA, both individually by the centers and jointly with SPIA!

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References

CGIAR Science Council. 2006. *Impact Assessment of Policy-Oriented Research in the CGIAR: A Scoping Study Report*. CGIAR Science Council Secretariat: Rome, Italy.

1. Introduction

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Policy-oriented research (POR) in the context of the studies included in this report is research aimed primarily at affecting choices made by governments or other institutions whose decisions are embodied in laws, regulations, or other activities that generate benefits and costs for people who are affected by those governments or institutions. In the Consultative Group on International Agricultural Research (CGIAR), such research is identified first and foremost with social science research, but physical or biological science research projects may also be policy-oriented.

POR has accounted for an increasing share of research expenditures in the CGIAR, rising from 9 percent in 1995 to about 18 percent currently. Yet it is a theme where evidence of impacts is scant. It is presently not possible to pinpoint the reasons for the limited impact assessment activity related to POR. One relates to the difficulty of measuring such impacts quantitatively. With policy outcomes, there often is no objective indicator of innovation source, and there are usually many simultaneous and complementary sources of information, influence, and advocacy behind policy shifts. Further complicating attribution is the fact that relevant policy innovations from research with global public-goods characteristics are rarely directly adoptable by target policy-makers in specific countries. Rather, these innovations diffuse through adaptation and refinement by analysts into the policy recommendations for specific local situations, which then help to inform the decisions of policy-makers. Adoption or influence at each of these stages is far from a linear, binary decision, as use may range from symbolic or selective to strategic.

Given the number of intermediate adoption and adaptation steps, in many cases, attribution of the POR beyond influence is particularly difficult. This is especially the case when 'impact' is defined as ultimate benefits to the poor that result from improved policies, or from the maintenance of

existing beneficial policies as a result of research influence. To get to this further step of 'impact' involves attribution along a very long implementation chain. Counterfactual issues are also complicated, as it is difficult, if not impossible, to conduct socio-economic experiments in the policy sciences. Additionally, research results may simply reinforce the wisdom of current policy settings. In such cases, there is no evident change in policies, yet impacts have occurred ('losses avoided') by not changing policies. Assessing the economic impacts of such confirmatory research is especially difficult to discern, document, and assess.

In a seminal piece on social science research utilization, Weiss (1979) draws attention to the complexity of the impact pathways by means of seven alternative routes (models) ranging from the 'knowledge-driven model' (the classical model – knowledge drives development and use¹) to 'research as part of the intellectual enterprise of society'. Of particular relevance to the POR impact assessment (PORIA) case studies (described later in the report) are:

- The 'problem-solving model' where direct application of the research results are used by policy-makers for a pending decision
- The 'political model' where research results are used as ammunition to support a pre-determined position
- The 'enlightenment model' where research results have a more indirect influence on general thinking and, in some cases, generate findings that may even run counter to prevailing opinion.

Methodological difficulties, however, do not reduce the need for impact to be demonstrated. Indeed, the idea for this study originated at the request of several members of the CGIAR, starting with a formal request at the Annual General Meeting in 2003. The CGIAR and its stakeholders wanted evidence of impact from their growing level of investment in this arena. This is particularly the case if the

potential highly positive complementarities between policy and biologically oriented research are taken into consideration (i.e., a sectoral policy shift may significantly increase the impact of CGIAR biological technology, and a major macro policy shift may impede the viability of some agricultural sub-sectors).

In response to the need for more explicit and tangible evidence of the influence and impact of CGIAR investments in POR, in 2005 the Standing Panel on Impact Assessment (SPIA) initiated a scoping study to assess the extent and nature of existing documented evidence of POR impacts within the CGIAR. The result of that exercise was the publication of a 'Green Cover' scoping study report (CGIAR Science Council, 2006). It found that only three of the 24 PORIA studies conducted up until then provided estimates of the economic impacts of the POR involved, and that their combined cumulative benefits of US\$200 million represented only 25 percent of the cumulative CGIAR investment in POR of around US\$800 million (up to 2004).

SPIA concluded from the scoping study that there was a need to commission a number of additional case studies of the impact of POR in the centers, to augment the evidence and to further the development of methodologies in this challenging area of impact assessment. After a competitive call for proposals from the centers, seven of the 14 submissions were selected for support from SPIA, as described in the Foreword.

The seven selected case studies which form the substance of this report explore the impact pathways whereby the POR outputs found their way into policy processes, the influence they had, and where possible, the impact of associated policy changes on welfare and how much of this might be attributed to the POR itself. The report begins by reviewing methodological approaches to the assessment of the impact of POR against the background of experiences with the case studies. Each of the case studies is then described. A summary of the case studies is shown in Table 1.

Following the case studies, a synthesis is provided. This uses the eight key issues in the design and conduct of PORIA studies identified in the scoping study report to provide an overview of the studies and to distil lessons to guide future endeavors (CGIAR Science Council 2006, Annex B, pp. 33–36). The chapter also examines the conditions that were conducive for the generation of influence and impact in the studies, using the previous experience of the International Food Policy Research Institute (IFPRI) as a template (Ryan and Garrett, 2003).

The report ends with a concluding chapter that highlights the strengths and weaknesses of the studies and where future directions might lead.

References

- CGIAR Science Council. 2006. *Impact Assessment of Policy-Oriented Research in the CGIAR: A Scoping Study Report*. CGIAR Science Council Secretariat: Rome, Italy.
- Ryan, J.G. and Garrett, J.L. 2003. *The Impact of Economic Policy Research: Lessons on Attribution and Evaluation from IFPRI*. Impact Assessment Discussion Paper No. 20. International Food Policy Research Institute (IFPRI): Washington DC, USA.
- Weiss, C. 1979. The many meanings of research utilization. *Public Administration Review*, 39, 426–431.

1 That is, basic research discloses some opportunity that may have relevance for public policy, applied research is conducted to define and test the findings for practical action and, if successful, appropriate technologies are developed to implement the findings and application occurs. While this is the classical model, there are few empirical examples, and none of the PORIA case studies fit this model.

Table 1. Summary information on the scope of the seven PORIA case studies

Center case study	Geographic scope	Constraint/ problem identified	Research (related) output	New policy / practice adopted	Impact pathway description
Bioversity	Global	Exercising national sovereignty over crop germplasm, potentially restricting geneflows	'Trusteeship' model for genebanks; facilitation and honest brokering role; advocacy	An In-Trust Agreement reached and signed	Crop germplasm flows continue; breeders have easy access to unique sources of genes
CIFOR	Indonesia	High environmental costs due to policies and corruption encouraging large forest clearing	Research and communication exposing the political economy of the pulp and paper sector, links between fiber sourcing practices and natural forest clearance	Ministerial Decree adopted requiring mills to source all wood from plantations by 2009	Improvements in sustainability of pulp production practices; regulation of the pulp and paper sector; and due diligence for forestry investments
ICARDA	Syria	Policies restricting fertilizer use (allocation) on barley in arid zones	Research showing benefits of fertilizer in arid zone; recommendation about fertilizer applications in different zones; initiating policy dialogue; advocacy	New fertilizer policy (with credit extended to Zone 2) adopted in 1989	Benefits derived from fertilizer now used on barley in Zones 2 and 3 in Syria
IFPRI	Mexico	Risk of dropping a cash transfer program deemed effective at keeping children in school longer	Evaluation of PROGRESA program of conditional cash transfers for efficacy and impact	Mexican Government continued with PROGRESA program in basically the same form	Faster program implementation; improved program evaluation and project manager training; program continuation beyond political regime changes; spillover to programs in other countries
ILRI	Kenya	Colonial dairy policy protected interests of large-scale dairy producers; criminalized activities of small-scale milk vendors (SSMVs)	SDP produced evidence supporting policy and institutional reform, e.g., vast numbers of SSMV depending on dairying for livelihood	Revised Kenyan dairy policy adopted in 2004; training and licensing of SSMVs	Welfare benefits captured through consumer (via lower milk prices) and producer surplus as well as to SSMVs
IRRI	Philippines	Indiscriminate use of pesticides on rice with harmful effects on health and ecology	Research evidence on the economic health costs from pesticide use in rice	1992–1996 policies regulating highly toxic insecticides in rice; training of health officers	Private health cost savings resulting from pesticide use policies estimated
WorldFish	Bangladesh	Current policy of leasing water bodies to highest bidder results in over-exploitation and exclusion of poor fishers	Research-derived improved inland fisheries management policies and practices tested and extended to 116 water bodies	Awareness of and attitudes towards community-based fisheries management spreading amongst key stakeholders	Higher incomes amongst poor fishing communities and more sustainable production and increased biodiversity

2. Methods of Assessing Policy-Oriented Research: A Review

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*Victory has a thousand fathers but
defeat is an orphan.*

John F. Kennedy

Introduction and Approach

This chapter surveys approaches to the estimation and evaluation of the impact of POR. Estimation involves data-based assessment of effects that POR has had, as compared to a counterfactual situation where the POR had not been carried out. Evaluation involves placing a numerical score, usually a dollar value, on those effects taken together. Financial supporters of POR are particularly interested in knowing whether such research has been fruitful, and the value of the fruits. In choosing among competing requests for support, they would like to be able to assess the likelihood of success *ex ante*. The best source of information on this is likely to be derived from the success of similar research that has been assessed *ex post*. The review that follows focuses on methods for carrying out such *ex post* assessments. The discussion does not treat individual research projects in depth, but does refer to some of the work being done in the seven policy-oriented research impact assessments (PORIAs) sponsored by the Science Council of the CGIAR in 2007–2008.

Meaning of ‘policy-oriented research’. Some narrowing and precision of terms in the preceding paragraph is necessary to define a feasible field of enquiry. ‘Policy-oriented research’ is taken to be research that aims, at least in part, at affecting choices made by governments or other institutions whose decisions are embodied in laws, regulations, or other activities that generate benefits and costs for people who are affected by those governments or institutions. In the CGIAR, such research is identified first and foremost with social science research, but physical or biological science projects may also be policy-oriented. For example, the International Center for Agricultural Research in the Dry Areas (ICARDA) under-

took research on the responsiveness of dryland barley yields to fertilizer application in order to provide better information for the Syrian government, which had limited access to fertilizer for dryland barley production in the belief that such use of fertilizer was unproductive. According to the view taken in this chapter, that research is properly categorized as policy-oriented.

Coverage not limited to international public goods (IPGs). The choices made by governments or similar institutions often involve provision of public goods, in the technical sense of products or services that have characteristics of non-rivalry or non-excludability that result in their not being optimally produced in competitive markets. With respect to international institutions such as the CGIAR, there may be an additional desire to have the POR address public goods whose benefits are not limited to a single country. In practice, any PORIA will be considering policy outcomes that are not international, and even policy-related services that are not fully non-rivalrous or non-excludable. In this chapter the view is taken that POR of this type is appropriately evaluated by the same methods as POR that generates pure international public goods. If the possibilities that other providers could have generated the policy results is properly taken into account – i.e., the counterfactual is well specified – the net benefits or rate of return to POR should not be discounted if its output falls short of being public goods.

Coverage not limited to CGIAR research. The field of application is narrowed by a focus on research that pertains to food, agriculture, rural populations, or natural resources in rural areas. But for purposes of reviewing methods of assessment of policy research, we will also consider experiences with impact evaluation of POR in other areas.

The impact pathway. The components of an assessment of POR are usefully itemized as the elements of a pathway from resources committed to a research project or program to the policy consequences of the research.

In CGIAR Science Council (2006) these components are laid out sequentially as the 'impact pathway,' the main steps of which are: inputs, outputs, dissemination (or uptake), influence, and impact. In assessing POR, two of these steps raise the most difficult problems of evaluation: influence and impact. All the PORIA in the 2007–2008 CGIAR studies devoted most attention, and had most difficulty, with the influence and impact steps. The reports also point, however, to the importance of quantifying the other steps as precisely as possible. The reports tend not to be as clear as they should be on exactly what constitutes the POR being assessed, or on the input question: what the cost of the POR was. Without quantitative information on this, rates of return or benefit–cost ratios (BCRs) cannot be estimated.

Assessment as project evaluation via cost–benefit analysis (CBA). Assessment consists of giving a score to a research project or program, by means of which a set of projects can be ranked relative to one another, and relative to alternative uses of donors' funds. In principle the contents of the assessment can be summarized in a score analogous to that used to rate any investment project, and the most succinct, and usually most appropriate, starting point for such a score is a rate of return to investment. One step removed from the rate of return are the summary statistics of a CBA: quantifying the gains to the gainers, losses to the losers, and the sum of gains and losses (the net social gain or deadweight loss). In what follows a full, multi-year CBA with disaggregation of gainers and losers, especially with respect to poor people as compared to other interests, will be taken as the ideal to which PORIA should aspire.

State of the Assessment Arts along the Impact Pathway

Inputs

The activity evaluated is typically a closely related set of products. The initial element of impact analysis is a specification, as precisely as possible, of that for which we are estimating the impact. Assessment in some areas proceeds most naturally by consideration of single projects or a set of

closely related projects, as in the development of, say, a new variety of insect-resistant wheat. For POR, however, this approach to policy evaluation is typically not promising, and was not easy in any of the seven CGIAR PORIA projects.

On the one hand, if we start with policy-related research activity and ask what its consequences are (the 'supply-driven' approach), any single project is unlikely to have identifiable effects because policies are rarely enacted that are narrowly tailored to a comparable extent. On the other hand, if we start with a policy change and ask what role policy research played in generating it (the 'demand-driven' approach) it is unlikely that a single project or set of closely related ones drove that outcome. The exception in this latter case would be the result of a policy process that explicitly commissioned research to answer a question that the policy addresses. For example, if the Environmental Protection Authority (EPA) bans pesticides that cause cancer in laboratory animals, then research that shows a pesticide causes cancer in laboratory animals will be a direct cause of the EPA policy banning the pesticide. But in CGIAR POR we typically are not in this world. The International Rice Research Institute (IRRI) POR on effects of pesticides fits in this vein but was not commissioned by policy-makers and had to be marketed to them, and in so doing IRRI's voice was complemented by other actors whose influence is not easy to distinguish from IRRI's. The closest approximation to POR on demand is IFPRI's second main activity covered in its PORIA, the assessment of the school feeding incentive program that the Government of Mexico commissioned from them.

How important is precision in measurement of resources committed? Counting the costs of POR would typically be expected to be easier than quantifying the benefits side. At least we know where to look for the costs – inside the institution doing the research and dissemination. Nonetheless, problems arise when only a portion of what the institution does is involved in the POR, as is usually the case. A difficult fundamental problem is that almost always a research project or program is a joint product with other research and associated activities of the institution. This is always the case to the extent that there are

institution-wide costs that are fixed and/or not allocable to particular projects, except in an arbitrary way. To deal with such costs properly requires analysis of the production function of research, notably economies of scale, or not, in a research institution. Evaluations of crop varietal research have not worried about this problem, and it has not been necessary because the benefits estimated have typically been so large that even counting the whole of the institution's costs against them generates high rates of return. We don't know that this will be the case in policy research. The 2007–2008 SPIA PORIA projects, like most prior PORIA, do not seriously address the estimation of costs. Rather, impact assessment is taken to be essentially about the benefit (impact) side. In practice this means we are leaving a complete CBA for later, and are focusing on gross impacts, compared with a rough idea of costs. This will actually work well so long as the benefits are very large compared to any reasonable calculation of costs, as in fact appears to be the case in the 2007–2008 CGIAR PORIA projects whose drafts have reached the benefit-estimation stage.

Outputs (Intermediate)

A substantial component of the impact assessment literature is devoted to specifying intermediate outputs that bear on ultimate impact. Weiss, in *The Many Meanings of Research Utilization* (1979), draws attention to the complexity of the impact pathway by means of alternative routes ranging from direct application (the 'problem-solving model') taken up by policy-makers to indirect influence in which research generates findings that may even run counter to prevailing opinion (the 'enlightenment model'). The 2007–2008 CGIAR projects of CIFOR, IRRI, and ICARDA are examples of this. Spilsbury and Kaimowitz (2002) and Rogers (1988, Ch. 2) elaborate some further complexity in indirect influence, notably decision-makers' search for published research they can cite in support of positions they have already reached, completely independently of that research.

Quantifying output. The kinds of products and services tendered through each of these routes are various. CGIAR Science Council (2006, p. 10) provides a list of outputs, including publications, analytical methods,

training, conferences, press releases, and capacity strengthening as major headings with different kinds of outputs within each category, such as publications ranging from peer-reviewed professional journal articles to policy briefs intended for a lay audience. Practical impact assessment often consists in part of counting up these outputs. But no serious impact analysis can go far with this approach alone. As it has turned out, none of the 2007–2008 CGIAR PORIAs make a serious attempt to quantify output beyond lists of studies or publications. The main aggregator used is cost of the research, and that is used (too) sparingly. A focus on the POR inputs via costs for quantifying the 'output' actually seems to work, in the sense of not raising questions that cast doubt on the findings.

Quality of output. Walter et al. (2003) summarize the findings of a large number of studies of research impact in education, health, social work, and criminal justice. Some of these studies are policy-related only in a broader sense than that defined above, for example, in health where the impact may not be on laws or regulations but on treatment practices followed in a mental health institution. Still, a broadly similar impact pathway, at least up to the point of political influence, appears in this broader context. What is most notable with respect to research output in the studies reviewed is the irrelevance of any quantitative indicator of output as compared to qualitative indicators. Thus, the conclusions Walter et al. (p. 29) draw from their review of 'effective impact' feature clarity ("research must be translated"), credibility, enthusiasm, and research that fits the policy context. In the narrower context of forestry policy-related research, Spilsbury and Kaimowitz (2002) highlight these same characteristics, and add qualities that make findings more palatable for implementation once communicated, most notably 'trialability' (policy being amenable to a pilot program or other relatively inexpensive trial run) and 'reversibility' (the capability of ending a policy change and reverting to the prior situation). These qualities are not easily quantifiable, and the methods used in the 125 empirical papers that Walter et al. reviewed to draw the conclusion that these features indeed are the important ones are not spelled out in their paper.

For purposes of the CGIAR PORIA, the relevant indicator of quality is the extent to which the POR is perceived by policy-makers as being credible. Testimony that the projects obtained this, notably in the case of IFPRI, turns out to be a fairly effective quality indicator.

Dissemination (Uptake)

In order to generate influence on policy-makers, the POR output must reach them and gain their attention. Dissemination is the supply side of this process (taking water to the horse) and uptake is the user's attention to it (the drinking). You can't make the horse drink but you can affect the likelihood that it will. The dissemination side of this process could be considered a service that is part of POR output, and indeed has been described in detail in the CGIAR PORIA.

Uptake. It is less straightforward to assess success in gaining the attention of policy-makers. It is necessary that policy-makers know about the research, but that is not sufficient. They also have to believe it. This involves credibility as described above under quality of output, but more than that. It has to enter the policy-maker's frame of mind or beliefs. This is an aspect of the enlightenment function mentioned above.

Schimmelpfennig and Norton (2003) and Norton and Alwang (2004) develop ideas of applying Bayesian methods that were created to quantify the use of evidence in transforming prior beliefs into posterior beliefs. The beliefs are expressed as subjective probabilities about a state of affairs. In this approach no one has knowledge in the sense of certainty, but actors (here, policy-makers) are rational in their uptake of evidence in modifying their prior probabilities. Empirically, there are two steps that PORIA can usefully investigate: firstly, evidence that policy-makers are paying attention, and secondly, evidence that after paying attention, their views and hence decisions are influenced.

A good example of an attempt to obtain evidence relevant to the first step is Landry et al. (2003) on utilization of university research (not just POR). They interviewed 833 officials from Canadian government agencies and scored their uptake (the term

they use is 'knowledge utilization') from answers to six questions about: whether they saw reports of the research, whether they understood it, whether they participated in events where the research was discussed, whether they had cited the research in their own reports or other documents, whether they attempted to use the results of the research, and whether it influenced decisions in their administrative unit (thus actually incorporating both uptake and influence in their measure). They then explained via multiple regression the knowledge utilization score as a function of characteristics of the research at issue and the university from which it came. The main finding was that characteristics of the research itself in terms of quality or attempts to meet users needs did not matter (in the statistical sense) but that the user's efforts to get the findings, the researchers having been directly linked to the user, the relationship between the user and the research organization did matter. Basically (my summary not the authors), it won't help your impact just to do good work. It will help your impact if you get in bed with the user, but only if asked to.

Where this chapter may help in our 2007–2008 PORIA projects is by providing suggestions about questions to ask policy-makers in documenting the uptake section of the impact pathway. As PORIA researchers, our own uptake of the Bayesian approach would lead to questions that focus on how policy-makers' posterior beliefs differ from their prior beliefs, the intervening information being that provided by the POR under investigation. For example, Gardner (2004) looked at how evidence from POR on the elasticity of export demand for US grain influenced policy-makers' belief in the efficacy of acreage control policies as a means of increasing grain producers' incomes. That paper however, had no evidence on the beliefs themselves, but only on the policy changes that finally occurred (eliminating acreage controls). The case for finding impact of the POR would be far more convincing if the intermediate steps of investigating uptake had been undertaken.

The area of uptake is one where the CGIAR PORIA put considerable effort into interviews with people in the policy process, and to good effect. The interviews were able to

detect the receipt of their messages, and present convincing evidence that the messages were taken seriously, or in some cases perhaps not (e.g., questions raised in the ILRI case study report).

Influence

The impact pathway is at its most complex in the route between output as taken up and influence. There is first the question of what is influenced. The targets include recommendations of policy advisers in governments, decisions of regulatory authorities, the content of laws put up for consideration by legislators, the votes of legislators on such proposals in committees and in legislative packages, the lobbying activities of interest groups, and the votes of citizens in electing legislators. The influence of ultimate interest is that which affects the determination of policies implemented, that is, the decisions of legislators and regulators.

Those are political actions. There exists a huge literature aimed at understanding political action. The question is what elements of that body of knowledge are most helpful in estimating the effects of POR? Focusing on the supply side of influence we have works like Abelson (2002), which focuses on the effectiveness of public policy institutes in the United States and Canada. The main method of analysis is estimated statistical relationships between output measures, such as media citations, and influence measures such as Parliamentary testimonies or appointments with executive officials. This is a narrow focus, which is perhaps the only way to make real scientific progress in this area. But it is also an approach that is not applicable to case-study investigations like those in the 2007–2008 CGIAR PORIA proposals.²

Another body of literature aims at clarifying the path, or maze, through the policy process itself. Sabatier (1991) is an example. If we had solid knowledge of the connections along this path, the influence element in PORIA could be made more tractable. If we knew the cotton price support policy in the United States is determined by what the Cotton Council recommends, then we would know that any POR that addressed cotton would only have impact insofar as it influenced the Cotton Council. But, Sabatier

(1991) is pitched at too high a level of abstraction to be helpful in formulating paradigmatic paths of influence that could be applied to the CGIAR PORIA projects. The further elaboration of some of the themes in Sabatier (1999) unfortunately does not serve to get more concretely to a schema that we could actually use to assist in our projects.

Ideas that can be more helpful in our PORIA studies come from research based on survey questionnaires administered to policy-makers. Two examples pursue the influence of POR. Hird (2005) investigates the influence of state-level nonpartisan policy research organizations on state legislatures, finding the key factors to be trust in the institution, a result echoed at the federal level in Rich (2001). Weiss (1989) investigated Congressional staff use of outside analysis with generally deflationary findings about influence on policy positions but evidence of staff's receptivity to information on aspects of policy details, such as the likely economic effects of a policy option. The aspects of these studies that we may learn from in our PORIA projects are their designs of questionnaires to administer to policy-makers, and how to use the qualitative data that such questionnaires generate. For a sample of literature that opens up that subject (not just on POR) see Caudle (2004) or for more detail Wengraf (2001) or Patton (2002).³

A substantial scholarly literature consists of developing statistical methods that improve on the crude correlations used in studies such as Abelson (2002). Mohr (1996) is an excellent example. He has a sensible discussion of many aspects of the impact pathway but his main focus is the development of statistical (mainly cross-sectional and time-series regression) models that enable analysts to test hypotheses about the causes of policy changes. The data one has to work with from questionnaires about influence are typically qualitative – whether a particular attribute of the political situation, the policy-makers, or the information presented is present or absent, or if present some categorization of that presence. What we are most interested in is the relationship between variables that measure POR output, on the right-hand side, as a factor explaining a measure of influence, on the left-hand side. Was distribution of POR publications to

a legislator, for example, related to a vote by that legislator consistent with findings of the POR? The purpose of variables other than the POR output is to hold other causal variables constant in order that the effects of POR can be more precisely estimated.

Many variables related to POR output and other conditioning factors are qualitative rather than inherently numerical. Using qualitative factors as explanatory variables on the right-hand side of a regression equation, is readily accomplished using dummy variables, equal to 1 if a putative explanatory factor is present, 0 if not. Even for variables that could be numerically scaled, like education, it is often preferable to use several 0–1 categorical dummies rather than years of schooling as a single variable (to avoid the assumption that all years of schooling are equivalent and linearly related to what schooling is intended to represent in the regression).

A 0–1 variable on the left-hand side makes sense conceptually, but creates problems. It makes sense, as an indicator of influence, to give a score of 1 if a policy was enacted; if not, 0. Likewise, if a Congressional Committee voted in favor, or not, or if a government minister read a report, or not. The problem arises because in the regression context, we observe 0's and 1's on the left-hand side, but 0 or 1 is hardly ever the predicted value obtained by plugging in observed values of explanatory variables on the right-hand side of the estimated equation. This is reasonable, and predicted values between 0 and 1 have a reasonable interpretation, as the probability that the outcome coded 1 would occur. Because of this interpretation, linear regressions of the type just described are called the linear probability model.

The problem is how to interpret predicted left-hand side values that are less than 0 or greater than 1? The fact that these outcomes are quite common when a linear probability model is estimated suggests that there is something wrong with the structure of that model. In reality it is not just uncommon but impossible for a probability to be less than 0 or greater than 1. This means it is wrong to think of the probability of enactment, say, as a linear function of explanatory variables. It is not the same

thing for the probability to go from 0.50 to 0.45 as from 0.05 to 0. We handle this problem by estimating a logit or probit model that bounds the left-hand side to between 0 and 1 no matter what the values of the right-hand side variables (for details see, for example, Greene, 2002).

The main obstacle to applying any of the statistical methods of estimating influence in the PORIA projects in the current SPIA set of projects is that statistical methods obtain their evidence of influence by comparing a number of different outcomes, each associated with a set of explanatory variables. Our PORIA projects consider only one or a few influence outcomes, with only one or a few values of explanatory variables. We have essentially case studies, where influence was either 1 or 0 (most likely 1 since our projects focus on successful POR).

In our case studies it appears that the best we can do is to rely on policy-makers who were interviewed to provide the information that would be more objectively generated by statistical studies relating measures of output to a measure of influence. Instead of observing cases where policy-makers read, and do not read, POR output, and then associating the reading or not with their votes, we ask policy-makers whether they have knowledge of the POR output and, if they have, whether it influenced their vote. This puts a huge burden on the policy-makers knowing in some detail what they did and why they did it, and their being frank in providing this information. That makes the approach to policy-makers – questions asked, the way they are asked, when they are asked – crucially important.

As it has turned out, somewhat surprisingly to me, the CGIAR PORIA reports are generally quite convincing about influence in the sense that policy-makers have taken steps congruent with what the POR suggested. The big questions remaining are rather ones of attribution. There are other non-governmental organizations (NGOs), government agencies, and interest groups involved with the most significant policy issues, notably in the IRRI and CIFOR cases. In these projects the interviews helped a lot in judging the case that the POR was a significant contributor. But quantifying the share of credit appears impossible.

Impact

The literature on impact in the policy process often considers its business at an end when a policy is implemented. But of course the kind of impact assessment that has been the bread and butter of social science research in the CGIAR about research that generates technological progress is just getting started at this point. Crop varietal research evaluation has an analogy with influence in politics, namely the explanation of adoption of new technology by farmers. Explaining farmers' choices of crop varieties to plant poses interesting data and analytical problems, and explaining governments' choices of policies poses even more difficult ones. Once we have an on-the-ground change in a farm practice, the analysis of impact is a matter of economic research. What is the cost reduction, how much does output increase, what are the price effects, and as a result what are the gains and losses to producers, consumers, and other economic interests that may be affected? What we want to do in CGIAR PORIA is the analogous economic analysis of a policy change.

Public goods. The impacts that are most prominent in overall assessments of CGIAR or other multinational institutions derive from global public goods. In the policy area there are two elements of interest: policies themselves and the public goods they generate. Policies are not just national laws and regulations but also international agreements such as the outcome of World Trade Organization (WTO) negotiations. An example in the 2007–2008 CGIAR projects is Bioversity's on the In-Trust Agreements (ITAs) that codify access to germplasm held by the CGIAR centers. The ITAs themselves are public goods in the sense of being non-rivalrous (if any individual or country makes use of them, there is no diminution of service available to others) and non-excludable (the service is available on demand to all individuals in the countries party to the agreement). But the impact is not a property of the policy itself, but rather the uses made of it. What difference does it make to countries and individuals?

The quantification of the difference a policy makes is essentially a CBA. In the case of the ITAs the benefits are the value of the germplasm to those who use it, notably farmers,

and those who benefit from the use of it, notably consumers through lower food costs. The costs are the resources used in management and operation of the agreements, and those who bear costs from the use of new germplasm, such as farmers who don't use it but face lower prices as others who do use it expand output. That is, the PORIA at this stage consists of estimation of net benefits of new technology, the methods for which have been developed over many years in the literature on the rate of return to agricultural research. But in PORIA, these benefits are not compared with the costs of creating the germplasm, but rather the expansion of benefits attributable to the POR, though its influence on the ITAs, as compared with the costs of that POR.

Beyond public goods. While the government activities that constitute policy may be viewed as public goods themselves, the results of many policies are not public goods but rather the furtherance of private interests (who often lobby for the policies). The paradigm of impact assessment of these policies is again CBA. An early example of PORIA in this vein is Harberger (1954). He estimated the annual deadweight loss of monopoly (gains of the producers/shareholders minus losses of consumers) at about US\$300 million, which Stigler (1956) compared to the (much lower) cost of economists' research on the social costs of monopoly that might have led to antitrust laws (omitting any consideration of the influence stage).

While all policies further or thwart private interests, some of these interests have a strong public good element, which is expressed by saying that some policies generate positive externalities (or reduce negative externalities). A paradigm case of positive externalities is poverty reduction. If a policy increases the well-being of the poor, economists have long treated the improved state of mind that the non-poor receive as an external benefit. Moreover, the benefit of a reduction in poverty to a non-poor person accrues whether that non-poor person contributed to the poverty reduction or not. Poverty reduction is in that sense a pure public good: none of the non-poor can be excluded from its benefits and poverty reduction is non-rivalrous in that when one

non-poor person enjoys the improvements from a reduction in world poverty, that does not diminish the poverty reduction services available to anyone else.

The prominence of poverty reduction as a goal creates a difficulty for impact assessment via CBA analysis. The most straightforward way to incorporate the external benefit of poverty reduction is to give the gains of the poor a higher weight than other interests in the adding up of benefits and costs. But how big should this higher weight be? The first of the United Nation's Millennium Development Goals (MDGs)⁴ could be taken as a means to cut short this question by taking the view that only poverty reduction matters. The weight given to gains or losses by anyone who earns more than US\$1 a day is 0. Presumably though, we will not go this far in practical PORIA.

In the end what the MDGs suggest is that there is no way to avoid a multi-dimensional impact measure; no single quantitative impact score will be possible. We might say of a policy that it generates an estimated US\$X million in costs of rice to non-poor consumers and US\$Y million in gains to poor rice producers (brings Z thousand rice growers above the US\$1 a day income threshold), but we would not attempt to add the gains up to a single monetary score for the policy. Instead, we will have an impact measure of the form: the policy generated a dead-weight loss of US\$Z₁, a loss to poor consumers of US\$Z₂, and a gain to poor farmers of US\$Z₃.

Non-market benefits. Environmental or other non-market impacts of policies pose similar problems of benefit measurement. The relevant impacts of CGIAR research are mainly environmental and, increasingly nutrition/health benefits. Recently there have been some excellent studies relating to health benefits from IFPRI. One study estimates the long-term benefits of an early childhood nutritional improvement program. These benefits are very hard to estimate because of the many confounding factors that have to be controlled for and the huge data-gathering requirements. In Maluccio et al. (2005), the authors were able to follow the participants and comparable non-participants in a 1969–1977 nutrition improvement program for children aged 0–

36 months in Guatemala, to observe health and other outcomes 25 years later. They found significant, quantifiable gains in subsequent educational achievements and test scores, and especially large gains for women who participated in the program compared to those who did not. And, they had a very careful experimental design, which was convincing in establishing that these differences were attributable to the nutritional program and not to other differences between the participants and non-participants. This is an example of what looks promising as POR with a high benefit–cost ratio. Policy-makers with the evidence of this chapter in hand would have hugely valuable ammunition to support early childhood nutrition improvement. What it would take to nail this point down is a good piece of PORIA. In this case, a crucial and difficult part on the impact side would already have been accomplished in the POR.

Multifaceted non-market benefits. A problem that is more serious for non-market benefits than for economic gains and losses is how to add them up to get an overall indicator of benefits to set against the costs of the POR. This problem arises in the IFPRI study on Guatemala where the benefits are both educational attainment and health-related. One could attempt to measure the additional income earned from more education and better health, and add these up to get a total benefit. But it would be easy to leave relevant non-market benefits out of the accounting.

In PORIA aimed at evaluating a wide-ranging program of POR, the difficulties of measurement and aggregation can become insuperable. For example, if research on improved institutions of governance were to be evaluated by PORIA, in the developing-country context one might want to assess impact with reference to the MDGs. A recent Organisation for Economic Cooperation and Development (OECD) forum reviewed statistics for cross-country studies of this kind, and proposed 48 different indicators for measuring progress in the MDGs, most of them non-monetary and not readily converted to money terms (OECD, 2005, pp. 382–384).

Estimation of policy effects. Having good measures of the variables that constitute benefits and costs is only the first step of

impact analysis. The second step is attributing changes in these variables to the policy being investigated. The attribution needed has two aspects: direct effects of the POR and indirect or induced effects. Consider as an example the ICARDA proposal where the POR is research on fertilizer use on rainfed barley as it influenced Syria's fertilizer allocation policy. The direct effect on impact (assuming the more difficult task of determining influence to be successfully completed) is the yield increases caused by allocating more fertilizer to rainfed barley, which is transformed to a monetary value by calculating the value of additional barley minus the increase in cost of the fertilizer and associated inputs changes. The indirect effects are changes in the price of barley and related inputs and commodities caused by the additional barley. Estimating these effects properly would require comparisons across policy regimes, e.g., where the policy stayed the same. But we don't have this counterfactual. The social science for estimating it would involve cross-sectional regressions where fertilizer use was estimated as a function of prices, policies, and other variables (analogous to the cross-sectional influence studies cited earlier, but here for the impact portion of the pathway). But, analogously to the influence portion of the pathway, what we have in the ICARDA proposal, as in the others submitted to SPIA, is a case study that gives only one observation of impact and related policies.

However, analysis of impact can perhaps proceed more smoothly under this limitation than analysis of influence can do. The reason is that prior economic research on barley production functions, demand functions, and commodity economics generally provides us with elasticities and other parameters that can be used with some confidence to estimate impact. So, in the ICARDA barley case, we can reasonably simulate how much additional barley will be generated by additional fertilizer, and what the price responses will be. It appears to be much more difficult to reasonably simulate further consequences in the influence pathway once we have specified an initial shock to it from the POR, because we lack prior estimates of political behavioral functions analogous to ones we sometimes have for economic behavioral functions. This is why care in designing questionnaires and interview

strategies for investigation of influence is so much more crucial for the influence stage than for the impact stage (at least so long as we focus on economic impacts).⁵

References

- Abelson, Donald E. 2002. *Do Think Tanks Matter?* McGill-Queens University Press: Montreal, Canada.
- Caudle, Sharon. 2004. Qualitative data analysis. pp. 417–438. In: *Handbook of Practical Program Evaluation* (Wholey, J., Hatry, H., and Newcomer, K., Eds). Jossey-Bass: San Francisco, CA, USA.
- CGIAR Science Council. 2006. *Impact Assessment of Policy-Oriented Research in the CGIAR: A Scoping Study Report*. CGIAR Science Council Secretariat: Rome, Italy.
- Gardner, Bruce. 2004. Returns to policy-related social science research in agriculture. pp. 201–222. In: *What's Economics Worth?* (Pardey, P. and Smith, V. Eds). The Johns Hopkins University Press: Baltimore, MD, USA.
- Greene, William. 2002. *Econometric Analysis* Fifth Edition. Prentice Hall Inc: New Jersey, USA.
- Harberger, A.C. 1954. Monopoly and resource allocation. *American Economic Review*, 44, 77–87.
- Hird, John. 2005. Policy analysis for what? The effectiveness of nonpartisan policy research organizations. *Policy Studies Journal*, 33, 83–105.
- Landry, R., Lamari, M., and Amara, N. 2003. The extent and determinants of the utilization of university research in government agencies. *Public Administration Review*, 63, 192–205.
- Maluccio, J., Hoddinott, J., Behrman, J., Martorell, R., Quisumbing, A., and Stein, A. 2005. *The Impact of an Experimental Nutritional Intervention in Childhood on Education Among Guatemalan Adults*. International Food Policy Research Institute (IFPRI): Washington DC, USA. (Unpublished).
- Mohr, Lawrence B. 1996. *Impact Analysis for Program Evaluation*. (2nd edn.) Russell Sage Foundation: Thousand Oaks, CA, USA.
- Norton, George and Alwang, J. 2004. Measuring the benefits of policy-oriented social science research. pp.

- 225–251. In: *What's Economics Worth?* (Pardey, P. and Smith, V. Eds). The Johns Hopkins University Press: Baltimore, MD, USA.
- OECD (Organisation for Economic Cooperation and Development). 2005. *Statistics, Knowledge, and Policy*. OECD Publishing: Paris, France.
- Patton, Michael. 2002. *Qualitative Evaluation and Research Methods*. Sage Publications: Newbury Park, London, UK.
- Rich, Andrew. 2001. The politics of expertise in congress and the news media. *Social Science Quarterly*, 82, 583–601.
- Rogers, James M. 1988. *The Impact of Policy Analysis*. University of Pittsburgh Press: Pittsburgh, PA, USA.
- Sabatier, Paul. 1991. Toward better theories of the policy process. *Political Science and Politics*, 24, 147–56.
- Sabatier, Paul (Ed). 1999. *Theories of the Policy Process*. Westview Press: Boulder, CO, USA.
- Schimmelpfennig, David and Norton, George. 2003. What is the value of agricultural economics research? *American Journal of Agricultural Economics*, 85, 81–94.
- Spilisbury, M.J. and Kaimowitz, D. 2002. Forestry research, innovation, and impact in developing countries – from economic efficiency to the broader public good. *The Forestry Chronicle*, 78, 103–07.
- Stigler, G.J. 1956. *Trends in Employment in the Service Industries*. National Bureau of Economic Research: New York and Princeton University Press: Princeton, New Jersey, USA.
- Walter, Isabel, Nutley, S., and Davies, H. 2003. *Research Impact: A Cross Sector Review*. University of St. Andrews: St Andrews, Scotland.
- Weiss, Carol. 1979. The many meanings of research utilization. *Public Administration Review*, 39, 426–431.
- Weiss, Carol. 1989. Congressional committees as users of analysis. *Journal of Policy Analysis and Management*, 8, 411–31.
- Wengraf, Tom. 2001. *Qualitative Research Interviewing*, Sage Publications: Newbury Park, London, UK.
- Zeza, Alberto and Llambi, L. 2002. Meso-economic filters along the policy chain: understanding the links between policy reforms and rural poverty in Latin America. *World Development*, 30, 1865–84.

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- 1 Professor Gardner completed this second draft of the chapter in November 2007 and was planning to revise it after all the case studies were finally completed. This version benefited from his reading of early drafts of the case studies and comments on the February 2007 first draft from the advisory panel and SPIA. In view of his untimely death, SPIA decided to publish this version with no substantive changes and with only a minimal amount of copy editing.
 - 2 Abelson (2002) found that media attention was only weakly related to governmental attention, comparing a substantial sample of think tanks. He then proceeded through narrative discussion of particular cases to conclude that, for example, the Democratic Leadership Council had a big influence on the Clinton Administration and that generally – but he didn't statistically establish this – it is behind-the-scenes groups that have the most influence even though they may not score high on conventional policy-related output measures. It is like the hypothesis that the big picture of US policy in Iraq is predominantly the result of a group of neoconservatives convincing key White House decision-makers.
 - 3 These references discuss questionnaire design and interview strategy in sensible ways, but I have not found strikingly new and applicable tips that appear outstandingly promising in PORIAs.
 - 4 "Reduce by half the proportion of people living on less than a dollar a day." (see <http://www.un.org/millenniumgoals/#>)
 - 5 An argument can be made that even for economic impacts, the approach of simulating standard economic modeling is less applicable than economists sometimes assume. Zeza and Llambi (2002), for example, argue a case for skepticism about standard modeling based on market failures and imprecise linkages between policies and poverty. Their response to this is not to have no modeling to estimate impacts, but rather to have different and more complex modeling. Once we open the door, as often we must, to uncertainties about what modeling approach is appropriate, simulation as a means of estimating impact becomes more questionable and impact analysis is no longer so different from influence analysis in this respect.

3.1. The Impact of the In-Trust Agreements on CGIAR Germplasm Exchange and the Role of Bioversity International in establishing the Agreements¹

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Introduction

This study analyses the POR and related activities conducted by Bioversity International (Bioversity)² that contributed to the establishment of the ITAs between the Food and Agriculture Organization of the United Nations (FAO) and the CGIAR in 1994 to formalize the legal status of *ex situ* germplasm collections held by the CGIAR genebanks. Given the political environment related to the negotiations of the Convention on Biological Diversity (CBD), which defined genetic resources as sovereign resources, the status of the CGIAR collections as IPGs could have been compromised or lost. Thanks to the ITAs there is now an internationally recognized accord for the multilateral exchange of plant genetic resources (PGR), which in turn has prepared the ground for further multilateral agreements on PGR such as the International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA). Moreover we assessed Bioversity's role, in collaboration with other partners – notably the CGIAR centers and FAO – in the policy-making process and in institutionalizing open access to germplasm from CGIAR centers through the establishment of the ITAs. The analysis confirmed the important role that Bioversity, among other important actors, played in terms of research, leadership, and as a catalyst in the negotiations process.

The CGIAR Plant Genetic Resources *ex situ* Collection and the Need for an International Agreement

Agricultural biodiversity is defined by FAO (1996) as the key element of food and livelihood security improvement, assuring rural development and environmental sustainability as well as establishing the basis for future technological innovations in agriculture. PGRs for food and agriculture, conserved

both *in situ* and *ex situ* represent the ideal way to preserve biodiversity. *Ex situ* conservation however constitutes the most accessible and inexpensive source of PGRs, gaining plant breeders' preferences especially thanks to the evaluative information attached to each germplasm sample (Fowler et al., 2000) (See Gotor et al., 2008 where Bioversity scientific information activities are assessed and evaluated).

According to the FAO 1996 *State of the World Report on Plant Genetic Resources for Food and Agriculture (PGRFA)*, the eleven CGIAR centers that have gene banks hold over 600,000 accessions, representing approximately 10 percent of the six million accessions stored in over 1,300 gene banks around the world.

The CGIAR PGR collection and its growing use as a means of increasing food production, alleviating poverty, and promoting economic growth led, in the 1980s and early 1990s, to questions as to who owns and controls germplasm collections conserved in CGIAR research centers (Siebeck and Barton, 1992). Already in 1981 the Government of Peru during the Third FAO International Conference on Plant Genetic Resources, suggested the establishment of international genebanks under the auspices of FAO (Interview with key informant outcome). At the same time, literature arose devoted ostensibly to the topic of valuing PGR and their use. A fundamental theme underpinning the many contributions during this period was the notion that international cooperation in PGR was necessary to conserve continued production of major food crops in order to increase food production and alleviate poverty (see, for example, Cooper et al., 1994).

However, questions pertaining to the ownership and control of CGIAR collections became a topic of central debate beginning

with the negotiations of the 1983 International Undertaking on Plant Genetic Resources for Food and Agriculture (PGRFA). The International Undertaking was the first comprehensive international agreement dealing with PGRFA (FAO, 1983), which confirmed PGR as a heritage of humanity that should be made freely available to anyone. This international policy was consistent with the common practice and stated internal policy within the CGIAR centers. However, the principle of national sovereignty over PGR arose in an interpretive resolution to the International Undertaking (FAO, 1991) and then was further strengthened by the CBD Article 15, that explicitly recognized the rights of sovereign states over their natural resources (CBD, 1992a).

When Resolution 3 – Nairobi Final Act (CBD, 1992b) came into force countries could begin to exercise their national sovereignty by increasing restrictions on access to PGR. The CBD in fact established a system governing all biodiversity including *ex situ* collections of germplasm that was formally ratified by most countries, but it did not govern the CGIAR collections. The conflict between the well-established practice and internal policy of the CGIAR of making germplasm freely available and the emerging international policy framework establishing biodiversity as a sovereign resource raised questions about the legal status of the CGIAR collections. At the same time, biotechnologies were being developed that, for the very first time, raised the possibility of PGR being developed and managed as private rather than public goods.

The issue of intellectual property ownership over improved materials became a focal point for governments, policy-makers and NGOs alike, and an intense political debate dominated the international scene surrounding PGR. Broadly speaking, these debates were generated by respective groups supporting international and multilateral systems of germplasm material exchange (for example, Peru) and opposing groups claiming national sovereignty over germplasm material (for example, the Philippines). Another view was that since such collections were collected from developing countries and were held in developing countries, an agreement could be negotiated with the

host country to hold such collections only for the benefits of the developing countries. Some regarded the fact that the CBD did not address the governance of the CGIAR collections a weakness, but in any event, without CBD or other governance mechanisms, and in the changed policy environment, the legal status of the CGIAR collections was in doubt.

In order to respond to these emerging issues and to inform the debate, Bioversity-commissioned research by Wolfgang Siebeck and John Barton began to examine the issue of control and ownership of the CGIAR collections. In a paper published in 1992, the authors proposed that the concept of 'trusteeship' be applied as a solution to the issue of ownership of CGIAR collections. In addition to Siebeck and Barton's research, Bioversity also provided technical information during the debate on the fate of PGR and throughout the ITAs negotiations by disseminating technical papers and holding seminars to inform interested parties and reduce the sense of uncertainty brought about by the CBD. Moreover, Bioversity facilitated a dialogue between institutions and partners who otherwise would not have been in contact with each other, but who needed support with any policy solution. These included CGIAR centers, governments of countries hosting CGIAR genebanks, FAO and its constituencies, farmer's rights advocacy groups, and other stakeholders.

This complex and long-running policy debate eventually culminated in the signing of the ITAs in 1994. The ITAs formally established an internationally accepted legal status for the CGIAR collections with the CGIAR holding the germplasm on a trustee basis (as compared to outright ownership) under the auspices of the FAO. The ITAs therefore established a stable policy environment that could help ensure continued flows of germplasm both to and from the CGIAR centers.

As shown in Table 1, 94 percent of the total CGIAR accessions are held in-trust, with ICARDA, CIMMYT, ICRISAT, IRRI and CIAT holding approximately 88 percent of the 601,323 in-trust CGIAR accessions³. This means that the material may be freely shared and each relevant center "...undertakes to make samples of the designated germplasm and related information

Table 1. CGIAR accessions by center and status (1980–2004)

Center	In-trust	Percentage of total in-trust	Non in-trust	Percentage of total non in-trust	Total collection	Total percentage in-trust
ICARDA	127,378	21.2	12,811	36.2	140,189	90.9
CIMMYT	117,852	19.6	2,675	7.6	120,527	97.8
ICRISAT	113,823	18.9	1,042	2.9	114,865	99.1
IRRI	102,752	17.1	5,520	15.6	108,272	94.9
CIAT	64,887	10.8	7,375	20.8	72,262	89.8
IITA	25,789	4.3	1,807	5.1	27,596	93.5
ILRI	18,661	3.1	1,516	4.3	20,177	92.5
WARDA	14,751	2.5	8	0.0	14,759	99.9
CIP	14,418	2.4	643	1.8	15,061	95.7
Bioversity/INIBAP	987	0.2	253	0.7	1,240	79.6
ICRAF	25	0.0	1,760	5.0	1,785	1.4
Total	601,323	100	35,410	100	636,733	94.4

Source: SINGER database. For full names of centers see Acronym list

available directly to users or through FAO, for the purpose of scientific research, plant breeding or genetic resource conservation, without restriction.”

The CGIAR PGR collections are among the largest in the world and the coverage of food crop species in these collections is extensive. The collections cover 2,768 species belonging to 753 different genera. The extent of intra-species diversity contained in the collection can be seen from the fact that the top ten crops, which account for 62 percent of the accessions, have an average of 42,910 accessions per species (Table 2). *Oryza*, *Triticum* and *Hordeum* are the major crops held in-trust, and the IRRI collection of *Oryza sativa* together with CIMMYT’s collection of wheat accounts for 32 percent of the 601,323 In-Trust accessions.

In this context the significance and the value of the CGIAR collections as a freely available international public good is potentially enormous.

Furthermore, the ITAs were an important initial step towards developing the concept of a multilateral global system by applying it in a practical way to CGIAR-held germplasm. The concept was further developed during follow-on negotiations of the ITPGRFA and later became a fundamental part of the

Treaty. ITPGRFA also confirmed the in-trust status of the collections (Fowler et al., 2003). Once the Treaty was ratified, the CGIAR centers would be expected to sign new agreements with ITPGRFA’s Governing Body, which would replace the ITAs and bring the legal status of the CGIAR collections under the auspices of the Treaty. To date, 78 FAO member states have signed the Treaty and 56 have ratified it. The formalization of the status of the CGIAR collections through the

Table 2. CGIAR accessions by genus and species (1980–2004)

Genus	Species	Accessions	Percentage of total
<i>Oryza</i>	<i>sativa</i>	116,316	16.87
<i>Triticum</i>	<i>aestivum</i>	81,464	11.82
<i>Hordeum</i>	<i>vulgare</i>	37,898	5.50
<i>Sorghum</i>	<i>bicolor</i>	36,711	5.32
<i>Triticum</i>	<i>turgidum</i>	31,512	4.57
<i>Phaseolus</i>	<i>vulgaris</i>	30,616	4.44
<i>Cicer</i>	<i>arietinum</i>	29,620	4.30
<i>Zea</i>	<i>mays</i>	25,827	3.75
<i>Pennisetum</i>	<i>glaucum</i>	20,879	3.03
<i>Vigna</i>	<i>unguiculata</i>	18,254	2.65

Source: SINGER database

ITAs and later under ITPGRFA ensured that the collections were recognized as an important part of the multilateral global system for conservation and use of genetic resources for food and agriculture.

Bioversity's Role in Establishing the ITAs

The POR conducted by Bioversity, both in terms of scientific research outputs, in the form of policy papers and such non-research outputs as facilitating negotiations, combined with its role in bridging between diverse parties contributed significantly to the establishment of the ITAs. Without Bioversity's involvement this establishment would have been delayed, possibly affecting the entire system of germplasm multilateral exchange. The basic underlying value of the ITAs is that there is now an internationally recognized accord for the multilateral exchange of genetic resources, and that this accord, in turn, prepared ground for further multilateral agreements on PGR. However, this remains a testable hypothesis that should be assessed empirically by future work.

Methodology Adopted

The following methodology was used to analyse the role and influence of Bioversity, (in collaboration with other CGIAR centers and other players) in establishing the ITAs. Results are based on six different types of sources gathered and then cross-checked or 'triangulated' to assess the extent of consistency among findings. The six sources of information were:

1. Articles written by Bioversity researchers leading up to the establishment of the ITA (Siebeck and Barton, 1992; Cooper et al., 1994; Engels and Siebeck, 1994)
2. Official reports released by key institutions involved in the ITA negotiations (CGIAR TAC and Secretariat, 1994; Crucible Group, 1994; FAO, 1993a, 1993b, 1993c.)
3. Documents by key institutions involved in the development of ITAs (Esquinas Alcazar, 2005; FAO, 1998; Fowler, 2000, 2003; Fowler et al., 2000; CGIAR TAC and Secretariat, 1997).
4. Key informant interviews (described in more detail below)

5. Press reports about CGIAR germplasm movement (*Financial Times*, 21 June 1994; 5 July 1994).
6. Other relevant documents.

Because a relatively small group of actors had in-depth knowledge of the technical and policy issues arising throughout the complex negotiations that preceded the enactment of the ITA, a key informant approach was used for the interviews. Key informants are selected on the basis of their specialized, in-depth knowledge and unique perspectives on a topic. A key informant approach does not attempt to sample randomly from a large population, so that results can be generalized with confidence from the sample to the larger population. A key informant approach is used when there is a limited population of individuals with significant enough breadth and depth of knowledge to speak informatively about what happened and why (USAID, 1996). The key informants in the initial group were identified by the study team as: those specific individuals judged to have specialized and in-depth knowledge about the events that took place around the negotiations that developed the ITAs, because they had been actively involved in the debates. The first step in identifying key informants was to identify the main types of organizations involved in the negotiation process, ensuring that all major categories were included and that possible opposing views were represented. Secondly, a few people were selected to represent each category of informant. In addition, informants were asked during their interviews to suggest other people who could be interviewed, and additional informants were added in response to suggestions made by reviewers of this paper.

Three categories of informants were identified. The first category provided Bioversity's own perspective on its role and performance in the events and the performance of its associate institutions; giving what Arts and Verschoen (1999) refer to as the 'ego-perspective'. The second respondent category was organizations external to Bioversity that were actively involved in the policy-making process at the time of the negotiations and were deemed able to assess Bioversity's influence in the negotiations; they provide what Arts

and Vershoen (1999) refer to as the 'alter-perspective.' The third category comprised organizations with no official or direct role in the negotiations, but with good overall knowledge of the 1994 negotiations and subsequent debates on PGR conservation. The number of individuals interviewed from each organization was determined by two criteria: one being the perceived relative importance of the individual in the policy-making process; the other the realistic possibility of contacting the individual, given that the events being analysed took place up to 13 years in the past and thus many potential interviewees had retired, changed jobs, or would otherwise be difficult to locate given the real time and resource constraints of this study.

Perspectives from interviews were compared between interviews and among the three categories of respondent. A total of 16 key informants were interviewed, several on more than one occasion. Confidentiality was assured to interviewees in order to guarantee candid answers.

The topics explored in the semi-structured interviews were established *a priori* during development of the method and included:

- Role of Bioversity in the debate on PGR
- Role of Bioversity in the System-wide Genetic Resources Programme (SGRP) and the Crucible Group⁴
- Role of Bioversity compared to other players
- Exploration of the counterfactual (i.e., what might have happened without Bioversity's involvement)
- Extent to which the ITAs may have influenced other PGR policies.

However, new themes were also allowed to develop during the interviews depending upon what was identified as a critical event or issue by a key informant. These emerging issues could then be followed up progressively with other interviews.

Results

The analysis process showed that Bioversity's work related to the formalization of the legal status of the CGIAR collections was integral to its mandate as an organization and there was thus no specific inception

point delimiting the commencement of work. The work was executed without a distinct budget or location, and was conducted and implemented by personnel from a broad cross-section of the institution, including those at the highest levels. Major findings arising from the analysis of Bioversity's role include:

1. In a highly polarized debate, Bioversity acted as an honest broker that commanded the necessary degree of trust from the diverse group of participants, some of which derived from Bioversity's long-standing role in PGR networks.
2. The research conducted by Barton and Siebeck that was supported financially and through technical leadership by Bioversity elaborated the concept of in-trust status for germplasm. This concept was successfully applied to the CGIAR collections during the negotiation process to develop a legal framework to govern the collections that eventually became the ITAs.
3. Bioversity provided technical information, based on its own work over many years, and synthesized from the work of other CGIAR centers, and other institutions working in PGRs. Specifically, one interviewee pointed out:

"Bioversity has lessened the tensions along a polarized North–South axis, resulting from the CBD process (1988–1992) by informing the debate with factual information and thus defusing speculation."

Moreover, another key informant highlighted:

"Bioversity, under Dr Geoff Hawtin played a significant role in providing information through publications and dialogue, convening symposia, and providing knowledgeable human resources to be available to countries, regional organizations, and international organizations (primarily FAO and UNEP/CBD)."

A concrete example of Bioversity's role was its management of the SGRP project *SINGER Phase 1*, that resulted in increased transparency of information about the origin and distribution of germplasm accessions held by the CGIAR. Using internet technology, all centers participating in *SINGER* made information about the flows of germplasm into and out of CGIAR genebanks publicly

and freely available. Using this data, Bioversity was able to effectively explain and demonstrate to the countries negotiating the International Treaty what interdependence on PGRs actually means in practical terms.

4. In addition to the research and synthesis of information to inform policy debates, Bioversity also played an important role instigating contact between institutions and partners who would not normally encounter each other or share ideas. For example, in its work with the Crucible Group Bioversity played a leading role in building inter-institutional/ inter-sectorial bridges by widening the original circle of participants and informing the discussions with technical information that was credible and provided in a timely fashion. Bioversity was actively involved in helping to organize Crucible Group meetings and supported the publication of the report. Bioversity's Director General was a member of the Crucible Group Management Committee. Bioversity also remained fully involved in the second phase of the Crucible Group, in an administrative and management capacity and participated heavily in the discussions and report writing. As stressed by one of the key actors interviewed:

"Biodiversity's role in Crucible was very significant – I think that the whole idea of it was got up between Geoff Hawtin and Pat Mooney. Geoff guided it throughout, and would bring us back onto the rails when we wandered off. I can remember a small group of us editing the final report in Rome. Certainly Geoff provided leadership in Crucible (though not uniquely – Pat Mooney's role was at least equally significant)."

5. Bioversity was a constant presence at most, if not all of, the debates and brought rationality, expert knowledge and strong negotiating skills to the tasks in hand. Bioversity was mandated by the CGIAR to represent issues associated with genetic resources policy by virtue of its role as the convening center for the SGRP and the Genetic Resources Policy Committee. This enabled Bioversity to play the leading role in terms of repre-

senting the CGIAR in the policy dialogue and also in developing understanding and commitment among CGIAR centers. As another key informant pointed out: "Bioversity was definitely there in the thick of all the debates and they did bring rationality, expert knowledge and excellent negotiating skills to the tasks at hand. I would say that they had a large influence in hammering out an agreement that all the centers – who held the actual germplasm – could live with and actively support."

The study also dealt with the question as to what might have happened to the ITA negotiations without the participation of Bioversity. Because so many different organizations and individuals played so many different and important roles over time and it is difficult to isolate one contribution from another, respondents and document review lead to the conclusion that the ITAs may well have been agreed in some form without the participation of Bioversity because the will and interest in such an agreement was widely recognized and leadership might have emerged from other quarters. However, thanks to Bioversity the agreements were concluded more rapidly than they might otherwise have been. As reported by a key informant:

"I for one was determined to bring about some agreements that would internationalize the collections and establish a system for the CGIAR that would be coherent and transparent. I have no doubt that I would have pursued that regardless of any obstacles. Undoubtedly the agreements would have come, but how much later, and how much more flawed? I think that these counter-factual questions are not very helpful. Bioversity did a great job and that is what counts."

And:

"As to whether the 'In-Trust' Agreement would have happened without Biodiversity, I'm not sure (in part because I'm not too clear how it happened anyway), but I would have guessed not."

Moreover a respondent emphasized:

"Bioversity was the catalyst to bring the Trust agreements together along with FAO's then legal advisor, Gerald Moore.

Mr Moore brought the legal expertise (along with John Barton) and Bioversity brought the 'ground truth' of germplasm exchange and management, and as an organization of the CGIAR that could bring (as best as possible) the CGIAR centers together in a pact. While there could have been the agreements without Bioversity, I can't really imagine how they would have looked. Something had to be done and it was efficiently done in a timely manner with the Bioversity cooperation with FAO. The result was a position/posture of the CGIAR that it wanted to accomplish a fair and respectful approach to the legal and cultural sides of the heritage of the germplasm."

This conclusion can be justified because Bioversity had already established trust with many diverse participants in the negotiation process because of its long-standing and positive relationship with many people via PGR networks and other mechanisms, and because of the strong leadership of Bioversity's senior management in the political process.

Any delay in the ITA could, in turn, have negatively affected the negotiations of the International Treaty, which is in many ways followed from and was supported by the successful conclusion of the ITAs. The ITAs are the result of a very positive collaboration between FAO and the CGIAR (represented mainly and formally by Bioversity). The ITAs paved the way for the more recent international agreement on PGRFA, the International Treaty without which a multi-lateral system of germplasm exchange might not have been achieved.

As reported in the interviews, without ITAs:
"Germplasm exchanges would have come to an end, because the IARCs could hardly operate outside the international law."

A key informant also stressed:
"I think that there was a real possibility of acrimonious international demands of return of some collections, an increased effort by private companies to take out patents and claim rights over varieties and other forms of entanglements which

could have been nightmarish. I am glad we achieved what we did, when we did."

Moreover:

"It is difficult to describe a situation that did not materialize, but one could think about a chaotic situation: no exchanges of germplasm, and the germplasm collections perhaps not fully dismantled, but surely not funded anymore."

Finally, without ITAs:

"Centers would have developed individual agreements but it would not have been as effective and probably there would have been more instability and chaos in the germplasm community without a common approach. Some countries would have used the discord to stop all exchange."

Assessing the cost of Bioversity's contributions to the development of the ITAs is not straightforward due to the integration of the work into Bioversity's core mission, the fact that different staff played different roles over time and that these roles often evolved in response to emerging issues, and because it is not possible to date the start of Bioversity's involvement. Because of its role, mission and mandate, it always played an integral role in policy discussions related to PRGFA. However, Table 3 presents some of the major cost components of the production of policy outputs related to the ITAs. The cost item that is perhaps most easy to isolate as being directly related to the ITAs is the single consultancy payment of US\$10,000 for the work of Siebeck and Barton that resulted in the important policy paper, and is recorded in Bioversity's Letters of Agreement database. Other costs are based on estimates of the time contributed by individual Bioversity staff derived from interviews and the costs of that time using Bioversity's standard human resource cost figures from 1994 for major staff categories. As shown, Bioversity invested approximately US\$100,000 in the major research and non-research outputs associated with the establishment of the ITAs.

Associating these costs to the actual value of the CGIAR collections, however, is a difficult task. In fact the actual value of the CGIAR collections has never been really assessed.

Table 3. 1994 costs associated with Bioversity’s major policy-related outputs

Research output	Non-research output	Estimated time	Costs (US\$)
Article: Siebeck and Barton (1992)		Fixed-term consultancy	10,000
	1. Networking	6 months, Group Director	35,250
	2. Technical Information		
	3. Negotiation	1 month, Deputy Director General	7,258
		5 months, Director General	36,290
	Facilitating and supporting Crucible Group activities	1 month, Director General	7,258
	Public awareness activities	1 month, Senior Scientist	5,387
		Total	101,443

Literature is providing us example of studies assessing the value of CGIAR activities or the impact of PGR into agricultural productivity. Evenson and Gollin (1997) for instance used production function analysis to evaluate the economic value of IRRI in improving rice cultivars. Over a period of 20 years the whole IRRI impact is estimated to be in the order of around US\$1.9 billion. Moreover, the present value of a single accession implemented successfully into a modern variety is estimated to be nearly US\$50 million, and an estimated 1,000 catalogued accessions are accredited a value of around US\$325 million. One noteworthy example is from Smale et al. (1998) who analyzed the impact of PGR in enhancing agricultural productivity, reducing production fluctuations, and affecting cropped variety diversity in wheat production in the Punjab, Pakistan. Smale et al. assembled genetic resources and diversity data and estimated their marginal contribution to production using Just-Pope stochastic production functions. This approach is elegant in its implementation and offers considerable scope for further enhanced enquiry. The vehicles for implementation – stochastic production frontiers – are attractive because they are constructs with which most agricultural and applied economists are intimately familiar.

However, it remains to be seen how the literature will evolve from the useful benchmark provided by Smale et al. (1998).

Conclusions

This study analyzed the role of Bioversity International in the negotiations of the ITAs signed between FAO and the CGIAR Centers, which concluded in 1994. The ITA applied the concept of ‘trusteeship’ to CGIAR collections, resolved issues related to the legal status of the collections, and confirmed their availability as public goods. The ITAs were the result of a lengthy process of negotiations that had the objective of providing a legal framework for CGIAR germplasm collections that firmly established their global public good status. This negotiation process was in reaction to the larger policy context of the CBD, which established genetic resources as a sovereign resource, and in the face of new technology developments that created greater possibilities than ever before for considering genetic resources to be private goods. Thus there was a felt risk that the CGIAR collections would be lost from the public domain.

Further analysis confirmed the important and leading role that Bioversity played in the process, both by commissioned and in-house research and other active involvement in the policy process. A small investment of approximately US\$100,000 by Bioversity contributed to maintaining safely in the public domain the CGIAR collections. These collections have enormous value for their contributions to plant breeding and increas-

ing productivity, and inestimable value in their potential future uses. The basic underlying value of the ITAs is that there is now an internationally recognized accord, the International Treaty, for the multilateral exchange of genetic resources, and that this accord, in turn, prepared ground for further multilateral agreements on PGR. Future work should formally assess this hypothesis that remains testable and should be assessed empirically.

References

- Arts, B. and Verschuren, P. 1999. Assessing political influence in complex decision-making: an instrument based on triangulation. *International Political Science Review*, 20(4), 411–424.
- CBD (Convention on Biological Diversity). 1992a. Convention on Biological Diversity, Rio de Janeiro, Brazil. CBD: Montreal, Canada.
- CBD (Convention on Biological Diversity). 1992b. Resolution 3 of the Nairobi Conference for the Adoption of the Agreed Text of the Convention on Biological Diversity: Adopted 22 May 1992. CBD: Montreal, Canada.
- CGIAR (Consultative Group on International Agricultural Research) TAC (Technical Advisory Committee) and CGIAR Secretariat. 1988. *CGIAR Policy on Plant Genetic Resources*. Doc. AGR/TAC: IAR/88/4. CGIAR TAC and Secretariat: Rome, Italy.
- CGIAR (Consultative Group on International Agricultural Research) TAC (Technical Advisory Committee) and CGIAR Secretariat. 1997. Report of the Fourth External Programme and Management Review (EPMR) of the International Plant Genetic Resources Institute (IPGRI). TAC Secretariat and Food and Agriculture Organization of the United Nations (FAO): Rome, Italy.
- Cooper, D., Engels, J.M.M., and Frison, E.A. 1994. *A Multilateral System for Plant Genetic Resources: Imperatives, Achievements and Challenges*. Issues in Genetic Resources No. 2. International Plant Genetic Resources Institute (IPGRI): Rome, Italy.
- Crucible Group. 1994. *People, Plants and Patents: The impact of intellectual property on biodiversity, conservation, trade, and rural society*. International Development Research Centre (IDRC): Ottawa, Canada. Available at <http://www.idrc.ca/openbooks/308-9/>
- Engels, J.M.M. and Siebeck, W. 1994. Plant genetic resources issues in international agriculture research: Intellectual Property Rights. Agricultural Biotechnology for Sustainable Productivity (ABSP) Workshop Series, 11–14 July 1994. United States Agency for International Development (USAID): Washington DC, USA.
- Esquinas-Alcazar, J. 2005. Protecting crop genetic diversity for food security: Political, ethical and technical challenges. *Nature Reviews Genetics*, 6(12), 946–953.
- Evenson, R. and Gollin, D. 1997. Genetic resources, international organizations, and improvement in rice varieties. *Economic Development and Cultural Change*, 45(3), 471–500.
- Evenson, R. and Gollin, D. 1998 An application of hedonic pricing methods to value rice genetic resources in India. Pages 139–50 In: *Agricultural Values of Plant Genetic Resources*. CAB International: Wallingford, UK.
- Evenson, R. and Santaniello, V. 1998. The economic value of plant genetic resources for agriculture. *World Conference on Horticultural Research (WCHR)*, 495, 625–631.
- Financial Times*. 21 June 1994. “World Bank accused of attempting raid on gene reserves.” *Financial Times*, London, UK.
- Financial Times*. 5 July 1994. “Free access to plant genetic resources assured.” *Financial Times*, London, UK.
- FAO (Food and Agriculture Organization of the United Nations). 1983. “International undertaking on plant genetic resources” Resolution 8/83 of the Twenty-second Session of the FAO Conference. FAO: Rome, Italy.
- FAO (Food and Agriculture Organization of the United Nations). 1991. Resolution 3/91 of the Twenty-sixth Session of the FAO Conference. FAO: Rome, Italy.
- FAO (Food and Agriculture Organization of the United Nations). 1993a. *Stripe Study of Genetic Resources in the CGIAR*. Prepared for the Mid-Term

- Meeting, New Delhi, India, 23–27 May 1994*. Doc. AGR/TAC:IAR/94/2.1. FAO: Rome, Italy.
- FAO (Food and Agriculture Organization of the United Nations). 1993b. *Progress Report on the Global System for the Conservation and Utilization of Plant Genetic Resources*. Doc CPGR/93/5. FAO: Rome, Italy.
- FAO (Food and Agriculture Organization of the United Nations). 1993c. *Report of the Commission on Plant Genetic Resources, Fifth Session, Rome, 19–23 April, 1993*. Doc CPGR/93/REP. FAO: Rome, Italy.
- FAO (Food and Agriculture Organization of the United Nations). 1996. *State of the World Report on Plant Genetic Resources for Food and Agriculture (PGRFA)*. FAO: Rome, Italy.
- Fowler, C. 2000. Establishing the scope of a multilateral system for plant genetic resources for food and agriculture: implications of crop exclusions. *Biopolicy Journal*, 3,1. Available at http://www.biotech-info.net/crop_exclusions.html, viewed 24 September 2008.
- Fowler, C. 2003. *The Status of Public and Proprietary Germplasm and Information: An Assessment of Recent Developments at FAO*. IP Strategy Today, 7. available at <http://www.biodevelopments.org/ip/ipst7.pdf>, viewed o. 24 September 2008.
- Fowler, C., Smale, M., and Gaiji, S. 2000. *Germplasm Flows between Developing Countries and the CGIAR: An Initial Assessment*. Global Forum on Agricultural Research (GFAR) Secretariat, Food and Agriculture Organization of the United Nations (FAO): Rome, Italy.
- Fowler, C., Moore, G., and Hawtin, G.C. 2003. *The International Treaty on Plant Genetic Resources for Food and Agriculture: A Primer for the Future Harvest Centres of the CGIAR*. International Plant Genetic Resources Institute (IPGRI): Rome, Italy.
- Gotor, E., Alercia, A., Ramanatha Rao, V., Watts, J., and Caracciolo, F. 2008. The scientific information activity of Bioversity International: The Descriptor Lists. *Genetic Resources and Crop Evolution*, 55(5), 757–772.
- Siebeck, W. and Barton, J. 1992. The implications of applying the legal concept of trust to germplasm collections at CGIAR research centres. *Diversity*. 8(3), 29–35.
- Smale, M., Hartell, J., Heisey, P.W., and Senauer, B. 1998. The contribution of genetic resources and diversity to wheat production in the Punjab of Pakistan. *American Journal of Agricultural Economics*, 80(3), 482–493.
- USAID (United States Agency for International Development). 1996. *Conducting Key Informant Interviews*. USAID Performance Monitoring and Evaluation Tips Number 2. USAID: Washington DC, USA.

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 - 2 For convenience, 'Bioversity International' is used in the text even though the activities to which we refer may have occurred during the time of one of its predecessor organizations: International Board for Plant Genetic Resources (IBPGR), 1974–1991; and International Plant Genetic Resources Institute (IPGRI) 1991–2006. With effect from December 2006, IPGRI and INIBAP have operated under the name 'Bioversity International,' Bioversity for short. This new name echoes the strategy of Bioversity International, namely improving people's lives through biodiversity research.
 - 3 Non In-Trust material cannot be sent outside a CGIAR genebank to a country other than the source country (donor or country of origin) except with special permission from the entity that originally provided the germplasm to the CGIAR genebank.
 - 4 The Crucible Group was comprised of 28 individuals including representatives of grassroots organizations, agricultural researchers, intellectual property specialists, trade negotiators, and agricultural policy analysts from South and North. They met to discuss the issue of the intellectual property protection of PGR. The Group aimed to bring together individuals with widely differing views to produce a report in which consensus views were expressed when possible, but on issues where the participants did not agree, could provide an opportunity for each 'side' in the debate to put forward their best arguments – sharpened as a result of the discussions – with a view to letting the reader of the report decide for themselves.

3.2. Assessing the Impact of CIFOR's Influence on Policy and Practice in the Indonesian Pulp and Paper Sector

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Introduction and Description of Research

This study¹ examines POR conducted by the Center for International Forestry Research (CIFOR) that was used in a wide array of civil society advocacy of the fiber-sourcing practices of the Indonesian pulp and paper sector, so as to influence practices and regulation of the sector. This is a unique case for impact assessment, as the intermediate audience of NGOs is an unusual target audience for POR.

CIFOR had an active research program on *Underlying Causes of Deforestation* that ran from 1993–2003. While other institutions had done research on direct causes of deforestation (natural forest clearance), this program had a unique focus on analyzing extra-sectoral determinants of natural forest clearance. Case studies were conducted in 13 countries, including Indonesia, as part of the program they aimed to induce “changes in policies and means for their implementation” by both the private sector and governments.

The case study in Indonesia initially focused on determinants of natural forest clearance, and particularly on the role played by small-holders, but soon took a new path. Following several years of research on improving the environmental sustainability of silvicultural practices, CIFOR scientists began to observe a perplexing trend; while Indonesia's pulp and paper producers were developing some areas of plantations to feed their pulp mills, the mills were expanding at a faster pace than these plantations were being developed, with substantial fiber shortfalls likely to result.

This became the impetus for a case study of the ‘political economy’ of the pulp and paper sector, which revealed:

- Pulp mills had received very large subsidies from the ‘reforestation fund’
- Subsidized interest rates were provided by state banks

- Forested land was provided at virtually no cost to selected elites with strong connections to the Suharto regime
- Risk guarantees leveraged additional funding from national and international investors, while poor due diligence and a weak regulatory environment allowed opportunities for the exploitation of information asymmetries. In turn, this created incentives for pulp and paper companies to continually expand capacities at their mills.

The analysis provided data that documented how, once mills were established, stated plans to establish plantation fiber supplies were not followed, and most fiber was harvested from natural forests² for extended periods of time. Prior to the release of this study, no independent researcher had been able to amass quantitative evidence of the economic performance and viability of the pulp industry.

Findings were analyzed in the context of forestry-related conditions attached to the International Monetary Fund (IMF)'s loan agreement in the wake of the Asian financial crisis. These conditions were intended to promote sustainable management of Indonesia's remaining natural forests. Formulated with technical assistance from the World Bank, the conditions included a number of policy reforms principally aimed at raising efficiency levels in the country's timber concession system and plywood industry.

To help mitigate natural forest clearance effects and financial volatility, selected key ‘policy options’ identified by the study included (Barr, 2001):

1. A moratorium on new pulp and paper processing capacity expansions
2. Elimination of the wood supply subsidy to Indonesia's pulp industry
3. Enforcement of the Indonesian government's 1998 moratorium on the allocation of new forest conversion licenses

4. Introduction of a credible independent monitoring program of plantation development
5. Enforcement of improved due diligence practices on the part of financial institutions funding pulp and paper projects.

The first output from this line of research was a paper entitled “Profits on paper: the political economy of fiber, finance and debt in Indonesia’s pulp and paper industries,” which was released with a summary via the Bloomberg newswire in November 2000 (Barr, 2000). Follow-on media work included three articles in *The Asian Wall Street Journal*, as well as a cover page article in *The International Herald Tribune*. In September 2001, CIFOR and the WorldWide Fund for Nature (WWF) also published the results, along with complementary chapters on the broader effects of structural adjustment in Indonesia’s forestry sector, in a book entitled *Banking on Sustainability: Structural Adjustment and Forestry Reform in Post-Suharto Indonesia* (Barr, 2001). Dissemination activities continued over the years that followed, with presentations at 28 different seminars and conferences in 10 different countries. These included donor fora, pulp industry meetings, finance industry meetings, academic seminars, and media events. This assessment focuses on research resulting in outputs produced between 2000 and 2005.

Methodological Approach

The present case study takes an iterative approach to identify prospective channels of influence, assess the importance of CIFOR’s contributions, establish plausible counterfactuals, and identify attributive impact. It first identifies impact hypotheses through interviews with the scientists involved. Subsequently, key informants were identified to explore these pathways. Based on these findings, trends in the evolution of sustainability commitments in the pulp and paper sector are reviewed, as is the role of CIFOR’s findings. The value of improvements due to advocacy is subsequently calculated. As a final step, counterfactual assumptions rooted in the interview responses are used to calculate benefits attributable to the research.

A total of 31 key informant interviews were conducted between February and October 2007, with representatives of 16 distinct organizations. These informants included 11 representatives from an assortment of four NGO groups involved in advocacy over the Indonesian pulp and paper sector, 10 officials involved with international financial institutions, three informants from private sector financial institutions, two key Indonesian Ministry of Forestry officials, three representatives drawn from the two major Indonesian pulp and paper companies, and two independent academics.

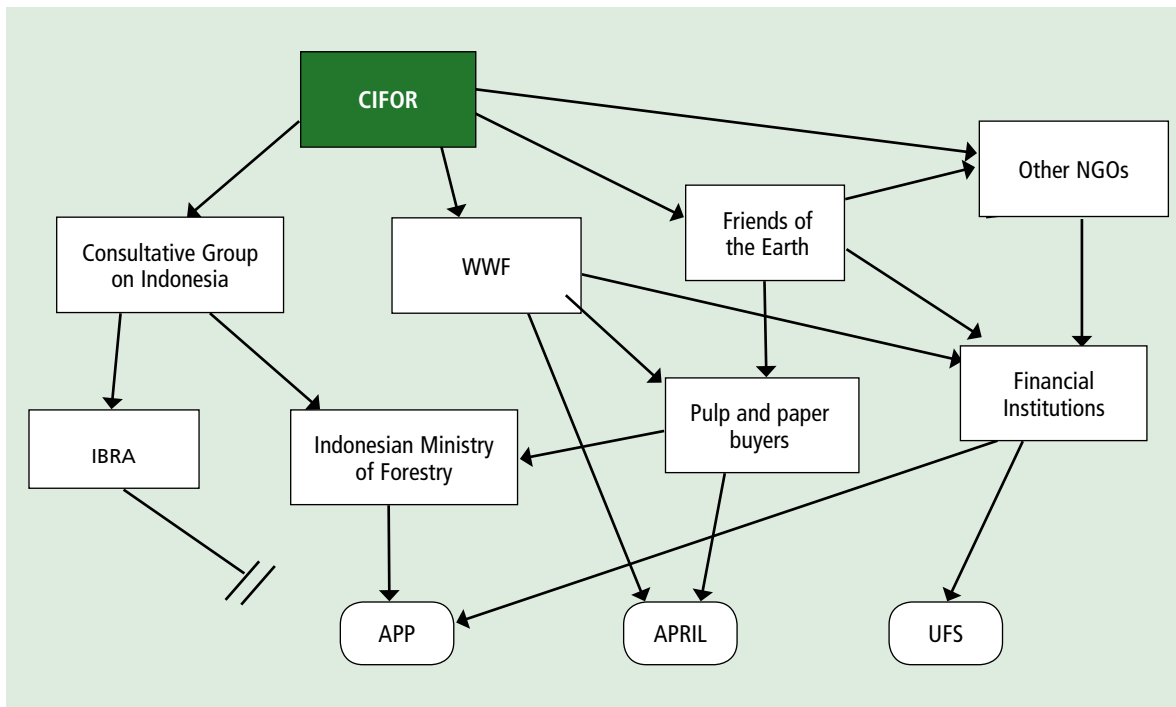
Given the uncertainty associated with attribution and valuation for this case, a range of assumptions is applied to generate plausible economic values attributable to CIFOR’s research. For each parameter there is a main, a conservative, and a liberal estimate, which will be employed in three scenarios.

Impact Pathways

Hypothetical impact pathways were elicited from CIFOR scientists involved in the research through a series of interviews. Three distinct clusters of impact pathways were identified (Figure 1).

Improvements to the sustainability of pulp production practices by Asia Pulp and Paper (APP) and Asia Pacific Resources International Limited (APRIL). The visibility of the research and the detailed data it provided were quickly utilized by WWF, Friends of the Earth, Environmental Defense, and other NGOs that quickly began to cite the study’s findings in their campaigns. This credible ammunition’ allowed the NGOs to strengthen their negotiating position on demands for environmental improvements to fiber-sourcing practices.

Improved regulation of the pulp and paper sector in Indonesia. Due to the damage caused to the reputation of the Indonesian paper industry, the Indonesian government was compelled to mitigate reliance on natural forest for fiber. Thus, a Ministerial Decree on the “Acceleration of plantation development and pulp and paper industry raw material supply” was adopted, which requires specific improvement in fiber-



Notes: IBRA = Indonesian Bank Restructuring Agency
UFS = United Fiber Systems

Figure 1. Key impact pathways for CIFOR’s research on the Indonesian pulp and paper sector

sourcing practices by 2009. This Decree has been subsequently interpreted in Ministerial Statements to require that each of Indonesia’s pulp mills needs to source all of its wood from plantations by 2009.

Improved financial due diligence for forestry investments. This work may have also played a role in leading many investment institutions to undertake improved due diligence related to their forestry investments.

Attribution of CIFOR’s Contributions³

Key informants from WWF Indonesia, WWF US, Friends of the Earth England, Friends of the Earth Finland, and Friends of the Earth, Indonesia (Wahana Lingkungan Hidup Indonesia, WAHLI) credit the research with substantial contributions to their advocacy campaigns, and support the notion that the research was essential to obtain environmental commitments during the negotiation of debt agreements for APP, and that the APP experience provided a platform for campaigns about APRIL. While informants stated prior awareness of unsustainable fiber-sourcing policies by the companies,

they lacked specific figures, and understanding of causes of investment in pulp sector overcapacity. In the absence of the data from CIFOR’s research, rebuttal of company claims would have been difficult. Given existing capacity at the time, all stated that there would have been a significant lag before similar information could have been generated.

Indonesian Ministry of Forestry

Informants report that the Profits on Paper report (Barr, 2000) was one of several influences that drew attention to the need to develop plantation-based fiber supplies for the pulp industry, but that growth in general attention to conservation issues was important as well. One important driver of increased attention to conservation was the increased environmental standards of international pulp buyers, as due to concerns about the sustainability of its pulp production, Indonesia was losing access to international export markets. The Decree was largely a response to NGO pressure to rehabilitate the international image of the Indonesian pulp and paper sector. The Decree has had some success in prompting

the industry to develop plantations more quickly. Its effects include increased planting rates. In addition, micro-delineation has slowed to some degree the ability of the pulp companies to clear natural forested areas.⁴

APRIL

Company officials report that APRIL has increased commitment to environmental sustainability substantially as a result of NGO campaigns that built on CIFOR's research. The *Profits on Paper* report and the 'APRIL Fools' campaign by Friends of the Earth England Wales and Northern Ireland (FOE-EWNI) highlighted the need to improve sustainability. Informants credit CIFOR with prompting nearly every improvement in social and environmental sustainability made since the release of the report. They also state that CIFOR is part of the company's "balanced scorecard" performance appraisal system on environmental metrics.

APP

A key informant from APP described how the company has greatly increased planting rates, such that 300,000 ha of total planting were targeted for 2007, of which 230,000 ha are new. The company is currently seeking to improve its ability to identify conservation set-asides through a 'high conservation value' identification toolkit for forests. The influence of CIFOR and the NGO advocacy that built on CIFOR research was important in initial environmental commitments by the company, including High Conservation Value Forest (HCVF) assessment in the four concessions where the approach was 'piloted'. It was reported that Ministerial Decree on acceleration of plantation development has been very influential, as APP has made a "very big push" to accelerate planting rates in order to have a plantation-based fiber supply ready by the target date.

Other Informants

Other officials dealing with potential investments in new pulp capacity and their regulation, including informants from the US Treasury, the World Bank Group, and the European Union Forest Law Enforcement Governance and Trade Initiative substantiated the influence of CIFOR on slowing the expansion of pulp processing overcapacity, in particular on a potential new mill for United Fiber Systems (UFS).

Estimating Effects on Natural Forest Clearance

Increased Conservation Set-asides

APP and APRIL have undertaken specific conservation commitments, stimulated as a consequence of NGO advocacy. APP undertook, under Letter of Intent with WWF, HCVF assessment of four concessions, which led to the stated protection of 107,000 hectares of forest (APP, 2007). To incorporate the fact that it is not clear what proportion of these areas would have been cleared in the absence of HCVF commitments, the present analysis assumes that only 50 percent of the preserved area has not been harvested as a result. Sensitivity analysis will be conducted with assumptions of 25 percent and 75 percent. The analysis for APP set-asides assumes that forest loss continues at rates observed to date – 5 percent annually, with sensitivity analyses at 3 percent and 7 percent.

APRIL officials credit NGO advocacy with virtually all improvements in sustainability made since 2001. Data provided by the company indicate that conservation set-asides were rising as a proportion of concession area even prior to the research. Yet, the rate of increase has risen subsequently from an average increase of 0.71 percent of concession area per year between 1997 and 2001 (14.0–19.7 percent) to an average increase of 1.4 percent from 2001–2007 (19.7–28.2 percent), an increase that is statistically significant, according to application of the Chow trend test ($\alpha = 0.01$).

For both companies, the main assumed rate of loss in the absence of HCVF commitments is 20 percent of the total maximum area protected *per annum* until the area is lost. The conservative scenario lowers this to 15 percent, whereas the liberal scenario raises it to 25 percent. According to these scenarios, the actual peak natural forest clearance avoided as a result of advocacy ranges between 33,000 and 102,000 ha.

Averted Natural Forest Clearance Effects of Accelerated Plantation Development

The rate of plantation establishment has risen quickly since initial discussions of the Decree in 2002 and its issue in 2003. Prior to the Decree, the annual rate of new plan-

tation establishment was increasing at a moderate average rate of 2,880 additional hectares of expansion *per annum*, or a 5 percent average increase in the rate of expansion *per annum*. In the years after CIFOR's research, annual first-rotation planting rates have risen by an average of 17,400 hectares or 25 percent of the 2001 value per year, a statistically significant increase according to the Chow test ($\alpha = 0.01$).

The contribution of the Decree to the accelerated plantation establishment rates is difficult to discern. APP's reports mention the Decree (APP, 2007), and interviews report that it has set an important internal target for the company. APRIL officials affirmed less influence. CIFOR's influence directly and via the Decree is assumed to account for 35 percent of the acceleration in first-rotation planting observed since the Decree's issuance for APP and APRIL, the two companies that account for 90 percent of the pulp production capacity directly targeted by the 2003 Decree.

Accelerated plantation development is beneficial because it may help to avert natural forest clearance through increased availability of plantation-based fiber supplies, which substitute for fiber consumed at the expense of natural forest. To explore the effects of increased planting rates, planting and age class data provided by the companies have been compiled for 1997–2006, based on company presentations (APP, 2007), data provided to CIFOR, data reported in *Sustainability Reports* (APRIL, 2003; 2004; 2006) and Barr (2001), and were adjusted to reflect first- and second-rotation planting. To reflect a gradual shift towards shorter rotation lengths (due to improved genetic material), a 7-year rotation is assumed for initial plantings, and a 6-year rotation is assumed for replanting.

Under the 'with Decree scenario' the average annual rate of first-rotation plantation establishment is extrapolated to expand linearly at the average rate observed for 2001–2006, until there is sufficient area to support a production capacity of 5,000,000 air-dried tons of pulp. This is compared with a scenario of growth in annual establishment equal to the average rate of increase for 1997–2001, so as to quantify the increase in plantation area attributable to accelera-

tion in the rate of plantation expansion. For the purpose of this analysis, the main assumption is that 35 percent of the acceleration has resulted from these influences. Sensitivity analysis is conducted with values of both 20 percent and 50 percent.

The quantity of plantation-based wood available and the associated averted natural forest clearance was calculated (see Raitzer and Kelley, 2008). It is estimated that between 4.1 and 9.9 million cubic meters of wood consumption from clearing of natural forest areas is averted annually as a result of the assumed contributions of research and advocacy to the acceleration of plantation development. As a result, between 32,000 and 76,000 ha of natural forest areas will no longer be cleared by 2013.

Averted Capacity Expansion

A third set of averted natural forest clearance effects results from the averted expansion of pulp processing capacity. While a precise estimate is not possible, interviews indicate that one specific mill has not been established as a result of increased attention to fiber supply issues. Analysis of the effects of this influence uses estimates of potential fiber supply shortages that the mill would have faced in 2008 and 2009, based on growth projections reported in an assessment provided by Jurgens et al. (2005). The result is that between 1.5 and 4.4 million cubic meters of wood will not be consumed from the natural forest, which means that between 11,000 and 34,000 ha of natural forest clearance will be avoided for an additional 3 years.

Valuation Framework

A valuation framework can be developed based on the fact that Indonesian pulp producers do not need to pay the full market price, let alone social cost, for wood consumed from natural forests in their concessions. Current royalties are approximately US\$4 per cubic meter of wood, whereas international market prices, net of harvesting and transport are US\$30 for pulpwood. This constitutes an implicit subsidy⁴ to the pulp concessionaires, which implies that the marginal value of the wood produced is less than the marginal cost of its production. This implicit subsidy is in addition to external

environmental costs that consumption imposes on the rest of society. Figure 2 depicts this effect graphically. A socially optimal market equilibrium would occur at P_s and Q_s . Implicit subsidies that lower the price of mixed hardwood shift the supply curve down, and the non-inclusion of environmental costs shifts the supply curve further down, relative to the curve where supply equals marginal social costs. Subsidies to fiber-processing capacity, such as subsidized finance and other capital subsidies highlighted by Barr (2001) have shifted the input demand curve to the right, so that a new equilibrium occurs at P_p and Q_p . This results in deadweight losses of triangle abc , the area between the values that consumers place on production and the marginal social cost incurred.

By reducing the pulp industry's reliance on mixed tropical hardwood from natural forests, the equilibrium quantity of natural forest wood consumed is reduced from Q_p to Q_o . The economic surplus gain resulting from the shift is represented by the trapezoid $cdfb$. Of this, the parallelogram $cdeg$ can be approximated with available data.

Reduction in Consumption of Implicit Subsidy

An implicit subsidy of US\$7 per cubic meter is estimated, based on the difference between plantation production costs for

a cubic meter standing volume (US\$11) and the actual royalty paid (US\$4).

Valuation of Averted Natural Forest Clearance

To apply the framework presented above, the divergence between the marginal social cost of natural forest conversion and the unsubsidized marginal private cost of conversion should be estimated, in addition to the reduced consumption of implicit subsidies. This divergence results from the loss of non-market values with public good characteristics, which are not reflected in the profit function of an individual firm. The present analysis attempts to identify values for climate, watershed, and biodiversity services. Given the uncertainties associated with non-market valuation, the present analysis can only offer rough and indicative values based on previous literature.

Watershed Services

Natural forests provide water regulation, storage and quality enhancement, which benefit agriculture, fisheries and human health, to values ranging from US\$15 to US\$850 per ha *per annum* for tropical forests (SCBD, 2001). In the present analysis, it is assumed that the additional watershed benefits of forest cover equate to US\$30 more per ha *per annum* than would be the case under a mixture of scrubland, agricul-

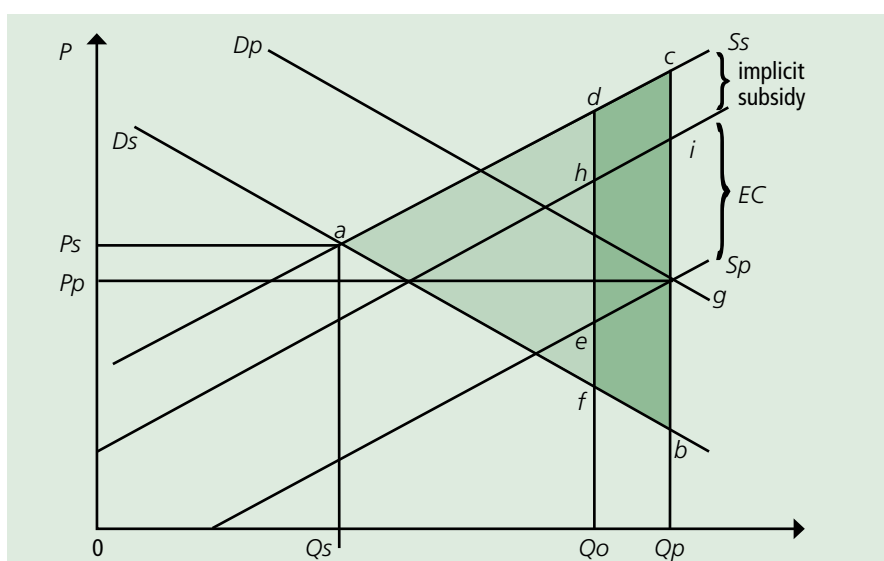


Figure 2. Economic surplus framework for valuation of reduced consumption of wood from natural forests in the presence of externalities and implicit subsidies

ture, and grassland in the main scenario. Sensitivity analysis will be employed with values of US\$20 and US\$40.

Carbon Sequestration

Forests offer carbon sequestration in above-ground biomass, as well as through retention of carbon below ground. Palm et al. (1999) observe carbon stocks in primary Indonesian forests at levels as high as 373 tons per ha. For this analysis, an average carbon stock level of 200 tons per ha will be assumed, and avoided release will be averaged over the 20-year period of analysis for analytical simplicity as 10 tons per ha from above-ground biomass in the main estimate (7.5 and 12.5 tons under sensitivity analysis). Given that one ton of carbon equates to 3.67 tons of carbon dioxide upon oxidation, this means that 37 fewer tons of carbon dioxide are released from biomass for every ha of forest conserved in the main scenario (28–46 tons under sensitivity analyses).

This is in addition to avoided release from below ground biomass for peatland concession areas. Tropical peat contains 600 tons of carbon per ha for each meter of peat depth (Page et al., 2002), which is gradually released as the peat dries after forest clearance. Estimates from Hooijer et al. (2006) on carbon dioxide emission from drained peatlands of 48 tons of carbon dioxide per ha for peatland forest conversion will be used, while under sensitivity analysis, values of 36 and 60 tons annually will be applied. In addition, potential carbon release from fire is estimated to be averaged at 12 tons, based on assumption of a 0.5 percent fire risk and estimates from prior fires in peatlands (Parish and Canadell, 2005). Sensitivity analysis will employ assumptions of 6 and 24 tons, respectively.

It is difficult to reliably value averted carbon emissions from forests, because as such they are not eligible for financing in current carbon markets. For reference, the 2006 prices of carbon for certified emission reduction of one ton of carbon dioxide ranged from US\$7 to US\$14 (Capoor and Ambrosi, 2007). In terms of marginal damage, Tol (2005) finds a mean reported value of US\$25 per ton. A price of US\$5 is used in this analysis based on this set of abatement and damage costs.

Thus, the total average sequestration and averted emission of carbon dioxide is calculated to be 37 tons per hectare *per annum* valued at US\$185 for forest on mineral soils, and 97 tons valued at US\$485 per ha *per annum* on peat soils of more than one meter depth, for the main scenario. Under a conservative sensitivity analysis, these values drop to US\$140 and US\$350, whereas a liberal set of assumptions raises them to US\$230 and US\$650.

Biodiversity

The value of biodiversity essentially embodies the value of information generated through evolutionary processes over several billion years. Tropical moist forests contain as much as half of all terrestrial biodiversity, and Indonesian moist forests are considered biodiversity 'hotspots'. Kumari (IIED, 2003) calculates the bioprospecting value of Malaysian forest biodiversity for pharmaceutical use, and determines an annual value of US\$50 per ha for a combination of middle-range assumptions. Adams et al. (forthcoming) find an annual value of US\$60 per ha based on willingness to pay for conservation in the Atlantic rainforest of Brazil. Both are partial measures, and could be considered additive. In this analysis, an annual value of US\$50 per ha is applied for the main scenario, with US\$25 and US\$75 applied in sensitivity analysis.

Total Values

As presented in Table 1, the total environmental costs of natural forest clearance under the main set of assumptions is calculated to be US\$265 per ha *per annum* on mineral soils and US\$565 on peat soils, due to their high level of carbon storage. A conservative set of assumptions results in values of US\$185 and US\$395, whereas liberal assumptions result in US\$345 and US\$765. These estimates are dominated by carbon values, which is in accordance with much of the literature on the economic values of forest environmental services (IIED, 2003).

Given the large difference in values between forests on peatlands and on mineral soils, to calculate the overall benefits of the areas of avoided natural forest clearance obtained earlier, it is necessary to identify the proportion of forest conserved on peatland. This

Table 1. Non-market external economic benefits from forests, as estimated in the present analysis for Sumatra and Kalimantan

	Annual economic values per hectare					
	Main scenario		Conservative assumptions		Liberal assumptions	
Biodiversity	50		25		75	
Water regulation	30		20		40	
	Mineral soil	Peatland	Mineral soil	Peatland	Mineral soil	Peatland
Carbon sequestration	185	485	140	350	230	650
Total value of external benefits	265	565	185	395	345	765

is estimated on the basis of the proportion of deep peat soils in APP and APRIL’s concessions. Data obtained from WWF indicate that 54 percent of the area of the concessions for which peat statistics are available is on sites with greater than one meter of peat depth. Information provided by APRIL indicates that 40 percent of the concession area is located on deep peat soils. The present study calculates a weighted average external environmental cost of clearing of US\$400 per ha *per annum* on the basis of an assumed 45:55 ratio of peat to mineral soils under the main scenario. If calculated as a 20-year net present value (NPV) with a discount rate of 5 percent and an assumed average natural forest wood yield of 130 cubic meters per ha (after losses from bark, wastage, and transport), this equates to US\$40 of external costs per cubic meter delivered to the mill gate. For comparison, conservative assumptions yield average external costs of US\$280 per ha cleared, whereas liberal assumptions result in a US\$534 annual average cost per ha.

Benefits Attributable to CIFOR

The economic benefits calculated thus far represent the effects of much more than just CIFOR’s research, and the ‘without CIFOR’ counterfactual still needs to be generated to identify what benefits would have been likely to be generated with all of the other players still active, but CIFOR’s research removed. This counterfactual will be applied to identify what proportion of these benefits should be attributed to CIFOR, and uses the following base assumptions of advancement of benefit flows:

- Increase in conservation set-asides – 3-year advancement
- Increased acceleration of plantation development – 2-year advancement
- Averted development of UFS mill – 1-year advancement.

For avoided natural forest clearance, the basic valuation framework consists of

$$EV = \sum_{t=s}^n \frac{b(f_{ct} - f_{at})}{(1 + r^t)}$$

where:

- EV = discounted external economic value
- B = annual external benefit per ha of forest
- f_{ct} = counterfactual forest lost in year t
- f_{at} = actual forest lost in year t
- s = start year of benefit period
- n = end year of benefit period
- r = discount rate

As noted above, these benefits are in addition to those that arise from avoided consumption of implicit subsidies. This is calculated via the following formula:

$$EV = \sum_{t=s}^n \frac{i(p_{at} - p_{ct}) * (d_{pw} / d_{nw})}{(1 + r^t)}$$

where:

- i = the implicit subsidy per cubic meter of wood from the natural forest
- p_{at} = the predicted increased volume of plantation wood, which will substitute for natural forest in year t
- p_{ct} = the counterfactual increase in volume of plantation wood, which will substitute for natural forest in year t
- d_{nw} = density of natural forest wood
- d_{pw} = density of plantation wood

Identifying Relevant Costs

The direct costs of CIFOR's research on the Indonesian pulp and paper sector are relatively small, as much of the research is based on 'desk studies' and key informant interviews. However, as Raitzer and Kelley (2008) note, it may not be appropriate to evaluate the returns of investments in very specific research activities that are impact 'success stories,' as the failure rate of research is often rather high. For this reason, a range of costs is used in calculations. The main scenario uses a value of US\$500,000 *per annum* for the research cost – an estimate that is 10 times higher than the direct research costs encountered for the studies – so as to encompass potential associated efforts that lack quantifiable impact. The 'liberal' scenario uses calculations based on the direct costs of the research activities, whereas 'conservative' estimates apply half of the entire budget of the former *Underlying Causes of Deforestation* program for costs.

Research Benefit Estimates for 'Main Scenario'

Over a 20-year timeframe, US\$133 million of benefits is generated by US\$3.4 million of investment, with a BCR of 39:1, and an internal rate of return (IRR) of 65 percent. The benefits attributable to CIFOR comprise roughly half of the total improvements resulting from advocacy. The largest proportion of the benefits accrues from advancement of 80,000 ha of conservation set-aside by 3 years. Benefits realised through 2006 total nearly US\$21 million, and arise from the advancement of conservation set-asides, with a BCR of 6.2:1.

Research Benefit Estimates under the 'Conservative Scenario'

Over a 20-year timeframe, US\$19.1 million of benefits are generated by US\$5.0 million investment, with a BCR of 3.8:1, and an IRR of 27 percent. Benefits attributable to CIFOR comprise roughly one quarter of the benefits resulting from advocacy. The largest portion of the benefits accrues from advancement of 55,000 ha of conservation set-aside by 3 years. Benefits through 2006 are estimated to be slightly lower than the program costs applied.

Research Benefit Estimates under the 'Liberal Scenario'

Under these more speculative assumptions, over a 20-year timeframe, US\$583 million of benefits are generated by US\$390,000 of investment, with a BCR of 1512:1, and an IRR of 170 percent. Roughly two-thirds (69 percent) of the total benefits from advocacy are attributed to CIFOR. The largest proportion of the benefits accrues from preservation of the area of natural forest for which accelerated plantation development has substituted. Benefits realised through 2006 total US\$65 million, and arise from the advancement of conservation set-asides, with a BCR of 169:1.

Discussion

Although the range of benefits is rather wide among the scenarios, the benefit values of the research are consistently much higher than the costs incurred. Projected benefits comprise between 75 percent and 90 percent of the values estimated, which makes the estimates somewhat more uncertain. However, there has scarcely been sufficient time for the very first plantations established since the research to come to maturity, as only 7 years have passed since the release of the initial CIFOR report. Thus, reliance on projections is somewhat unavoidable, as even the natural forest clearance avoided to date creates benefits that flow well into the future.

Other Impact Pathways

It should be noted that even the most conservative of these estimates only partially accounts for the many impact pathways of CIFOR's pulp and paper research. For example, the series of Ministerial Decrees on acceleration of plantation development, first applied to the pulp sector in 2003, was gradually expanded, so that by 2005, it encompassed all "primary wood product industries." This means that there may be many more averted natural forest clearance effects beyond the pulp sector.

More generally, key NGO informants report that they have improved the evidence that they use, partially as a result of experience

with CIFOR's research. Both WWF and FOE-EWNI and WALHI representatives report increased attention to the generation of credible evidence for advocacy, and in some cases even have begun to fund academic research. Such a shift may not only help to make advocacy more effective, but may improve the quality of information generated for policy discussions.

Nature of Economic Benefits Assessed

The benefits generated principally result from improved levels of non-market environmental services, and as such help to contribute to the environmental sustainability mandate of CIFOR and the CGIAR. To date, remarkably few studies have documented the environmental benefits of international research, either within or beyond the CGIAR system. The dominant portion of these benefits relate to climate change, which is poverty-relevant, as recent analyses suggest that the poor in developing countries are likely to be the group that is most adversely affected by climate change (IPCC, 2007).

Conclusion

The present study has explored a case example of POR contribution to improved environmental benefits. Despite prior findings from the political science literature, which suggest that POR is likely to be of limited efficacy in driving improved practices in a short to medium timeframe, the present case study finds likely returns that exceed those most commonly documented for agricultural research successes. Although there is considerable uncertainty regarding a number of the parameters involved, these indicative results offer an interesting example of how contribution to improvements regarding policies with large social costs, even if relatively minor, can have very large benefits.

References

Adams, C., da Motta, R.S., Ortiz, R.A., Reidd, J., Aznar, C.E., and Sinisgalli, P. In press. The use of contingent valuation for evaluating protected areas in the

developing world: economic valuation of Morro do Diabo State Park, Atlantic Rainforest, São Paulo State (Brazil). *Ecological Economics*.

APP (Asia Pulp and Paper). 2007. Sustainable Pulpwood Plantation Sinar mas Forestry. Presentation 15 August 2007, APP Office, Pekanbaru, Indonesia.

APRIL (Asia Pacific Resources International Limited). 2007. Concession data for CIFOR. Excel file containing data on conservation set-asides.

APRIL (Asia Pacific Resources International Limited). 2006. APRIL 2006 *Sustainability Report: Driving a Sustainable Culture*. Asia Pacific Resources International Limited (APRIL): Jakarta, Indonesia.

APRIL (Asia Pacific Resources International Limited). 2004. APRIL 2004 *Sustainability Report: Moving Forward*. Asia Pacific Resources International Limited (APRIL): Jakarta, Indonesia.

APRIL (Asia Pacific Resources International Limited). 2003. APRIL 2002 *Sustainability Report: Building for Sustainable Growth*. Asia Pacific Resources International Limited: Jakarta, Indonesia.

Barr, C. 2000. *Profits on Paper: the Political Economy of Fiber, Finance and Debt in Indonesia's Pulp and Paper Industries*. Center for International Forestry Research (CIFOR) and WWF-International Macroeconomics for Sustainable Development Program Office: Bogor, Indonesia.

Barr, C. 2001. *Banking on Sustainability: Structural Adjustment and Forestry Reform in Post-Soeharto Indonesia*. Center for International Forestry Research (CIFOR) and WWF-International Macroeconomics for Sustainable Development Program Office: Bogor, Indonesia.

Capoor, K. and Ambrosi, P. 2007. *State and Trends of the Carbon Market 2007*. The World Bank: Washington DC, USA.

FAO (Food and Agriculture Organization of the United Nations). 2004. *Global Forest Resources Assessment Update 2005: Terms and Definitions* (final version). Forest Resource Assessment Working Paper 83. FAO: Rome, Italy.

Hooijer, A., Silvius, M., Wosten, H., and Page, S. 2006. *PEAT-CO₂: Assessment of CO₂ Emission from Drained*

- Peatland in Southeast Asia*. Delft Hydraulics Report Q2943. Delft Hydraulics: Delft, The Netherlands.
- IIED (International Institute for Environment and Development). 2003. *Valuing Forests: A Review of Methods and Applications in Developing Countries*. Environmental Economics Programme, International Institute for Environment and Development (IIED): London, UK.
- IPCC (Intergovernmental Panel on Climate Change). 2007. Summary for policy-makers. Pages 7–22. In: *Climate Change 2007: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change* (Parry, M.L., Canziani, O.F., Palutikof, J.P., van der Linden, P.J., and Hanson, C.E., Eds). Cambridge University Press: Cambridge, UK.
- Jurgens, E., Barr, C., and Cossalter, C. 2005. Brief on the planned UFS pulp mill project for South Kalimantan, Indonesia. Forest and Governance Program Series No. 3/2005. Center for International Forestry Research (CIFOR): Bogor, Indonesia.
- Page, S.E., Siegert, F., Rieley, J.O., Boehm, H-D.V., Jaya, A., and Limin, S. 2002. The amount of carbon released from peat and forest fires in Indonesia during 1997. *Nature*, 420, 61–65.
- Palm, C.A., Woomer, P.L., Alegre, J., Arevalo, L., Castilla, C., Cordeiro, D.G., Feigl, B., Hairiah, K., Kotto-Same, J., Lasco, R., Mendes, A., Moukam, A., Murdiyarso, D., Njomgang, R., Parton, W.J., Ricse, A., Rodrigues, V., Sitompul, S.M., and van Noordwijk, M. 1999. *Strategic Information on Changes in Carbon Stocks and Land-use*. Alternatives to Slash and Burn Programme: Bogor, Indonesia.
- Parish, F. and Canadell, P. 2005. Vulnerabilities of the Carbon–Climate System: Carbon Pools in Wetlands/Peatlands as Positive Feedbacks to Global Warming. Mimeo. Asia-Pacific Network for Global Change Research (APN): Kobe, Japan.
- SCBD (Secretariat of the Convention on Biological Diversity). 2001. *The Value of Forest Ecosystems*. CBD Technical Series No. 4. Secretariat of the Convention on Biological Diversity (SCBD): Montreal, Canada.
- Raitzer, D.A. 2008. *Assessing the Impact of CIFOR’s Influence on Policy and Practice in the Indonesian Pulp and Paper Sector*. Impact Assessment Paper. Center for International Forestry Research (CIFOR): Bogor, Indonesia. 85pp.
- Raitzer, D.A. and Kelley, T.G. 2008. Benefit–cost meta-analysis of investment in the international agricultural research centers of the CGIAR. *Agricultural Systems*, 96(1–3), 108–123.
- Tol, R.S.J. 2005. The marginal damage costs of carbon dioxide emissions: an assessment of the uncertainties. *Energy Policy*, 33(16), 2064–2074.
- WTO (World Trade Organization). 2006. *World Trade Report 2006: Subsidies, Trade and the WTO – Defining Subsidies*. WTO: Geneva, Switzerland. http://www.wto.org/english/res_e/booksp_e/anrep_e/wtr06-2b_e.pdf (14 Jul. 2008).

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- 1 This study is reported in full in: Raitzer (2008).
 - 2 The internationally accepted definition of ‘natural forest’ as: “a forest composed of indigenous trees and not classified as forest plantation” (FAO, 2004) is used in this study.
 - 3 Raitzer (2008) includes a description of the chronology of events from forestry conditionalities imposed by the 1998 IMF loan ‘bailout’ agreement through to recent environmental commitments by the companies, which helps to contextualize the following sections.
 - 4 The definition of ‘subsidy’ used in economics is applied here, which includes the provision of government goods at below market prices. This differs from the narrower definition used by the World Trade Organization’s *Agreement on Subsidies and Countervailing Measures*, which is premised on a “financial contribution by a government or any public body” that requires a charge on the public account (SCM Article 1.1; cited from WTO, 2006).

3.3. Returns to Policy-oriented Agricultural Research: The Case of Barley Fertilization in Syria

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Introduction

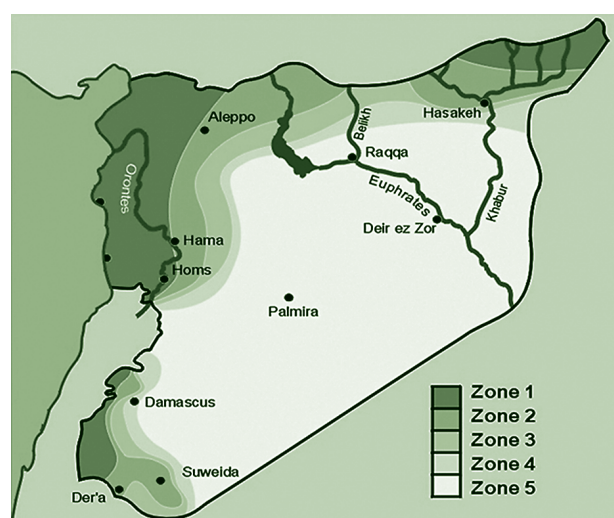
The use of fertilizer on barley in Syria is an example of the lack of an enabling policy environment constraining the widespread adoption of successful technologies. Barley is a major feed crop in Syria, contributing 2.2 percent of the total value of plant production and 9.6 percent of the total value of cereals in 2005. Barley area accounts for 27 percent of the total cropped area and 40 percent of the total cereal area. It represents 96 percent of the area of rainfed forage crops. Although barley is better adapted to dry areas (200–350 mm annual rainfall), its yield levels were very low because of the limited use of improved inputs, such as fertilizers. The non-availability of fertilizers except those distributed by the government and the government's selective strategy of only allocating fertilizer to strategic and irrigated crops were perceived as the major constraints to the wide adoption of barley fertilization.

POR needs to be viewed in the context of the overall economic policy environment in Syria. Until recently when it began to liberalize its economic policy, Syria had a centrally planned economy with the government closely involved in all production and distribution activities, including inputs. Fertilizer supply was fully under the control of the government, who decided its allocation by crop and by agro-ecological zone. Before 1989, barley was excluded from fertilizer allocation because of perceptions of high risk and low economic returns. The ICARDA–SMAAR research project was designed to address the profitability of fertilizer use in barley production and to provide evidence that could be used to influence the government's allocation policy. The objective of this paper is to support empirically the attribution of the barley fertilization policy changes to the collaborative ICARDA/SMAAR research project. The impact of this POR on the barley market is estimated and lessons learned from this experience are drawn.

Farming Systems and Agro-ecological Zones of Syria

Although generally dry, Syria is a country that encompasses a great diversity of agro-ecological conditions and agricultural production systems. The country is divided into five Agricultural Stability Zones according to the expected incidence of annual rainfall and their resulting suitability for rainfed crop production (Figure 1).

Barley is grown exclusively as a rainfed crop in Zones 2, 3, and 4 on about 1.5 m ha on average annually across the three zones. Zone 2 has an annual rainfall of 250–350 mm in not less than two-thirds of the years. In this zone, it is possible to harvest two barley crops every three years and to grow wheat, legumes and summer crops. The 2,473,000 ha of Zone 2 represent 13.4 percent of the country area. Zone 3 covers an area of 1,306,000 ha occupying 7.1 percent of the total country area. The main crop in this zone is also barley, but legumes could be grown. Zone 4 is a marginal zone



Source: Syrian Ministry of Agriculture and Agrarian Reform, 1999

Figure 1. Agricultural Stability Zones in Syria

for agricultural production between the arable zones and the desert, with annual rainfall of 150–200 mm.

The area of barley harvested depends on the erratic rainfall in this dry area. Highly variable crop area and yield lead to substantial output variability. Barley area reached a record high of 2.9 m ha in 1989 when the government encouraged continuous barley cultivation to increase production. At that time, barley was sown even in the drier parts of marginal areas where it encroached on rangeland areas. Since 1989, barley area has declined to its current level of about 1.3 m ha. The reduction in barley cultivated area was caused by:

- Irrigated wheat expansion in Zone 2
- Farmers shifting from annual crops to perennial fruit trees (especially olive)
- Continuous barley being unsustainable because of pest and disease pressures causing farmers to revert to barley–fallow rotations
- The enforcement of a ban on barley cultivation in Zone 5 (*Badia*) since 1996.

Despite the declining trend in barley area since 1989, productivity and total production initially rose until 1997 (Figure 2).

Between 1961 and 1989, barley area was expanding at an annual rate of 4.4 percent and annual production was rising by 2.4 percent, while yields were declining at a rate of 1.9 percent *per annum*. In contrast, barley area has been declining rapidly at an average rate of 5.5 percent *per annum* since 1990. During this period, annual yields grew at a positive rate of 1.5 percent, while production was declining at 4.1 percent per year. This yield increase is attributed mainly to the rapid diffusion of barley fertilization, especially in Zone 2.

The Policy-Oriented Research Project

The POR project was initiated in 1984 and continued until 1989 as collaborative research between ICARDA and the Syrian Soil Directorate with the objective of convincing policy-makers to modify allocation policy on fertilizer. The project aimed to produce sufficient and rigorous evidence to convince policy-makers to allocate fertilizer to barley, and to initiate a policy dialogue

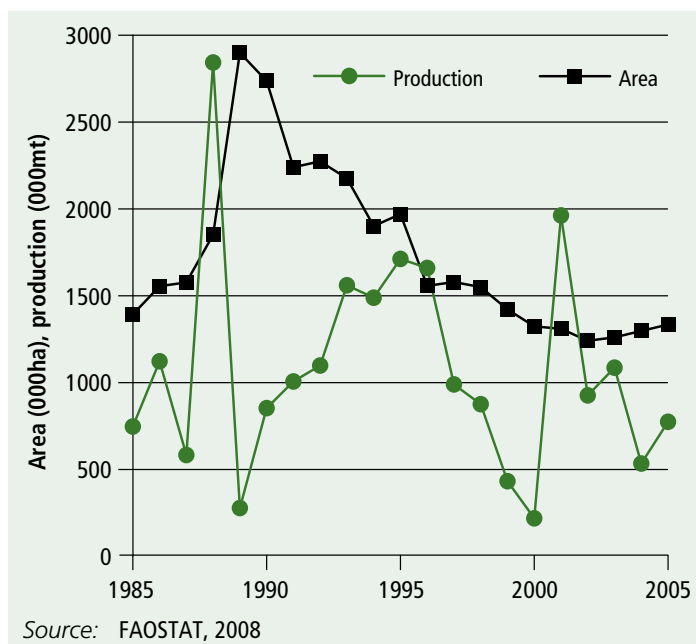


Figure 2. Barley area and production in Syria (1985–2005)

that eventually led to the policy change. The project also served to promote barley fertilization, especially in Zone 3.

The project was interdisciplinary and included both agronomic trials and farm surveys as well as economic and risk analyses of fertilizer use on barley in drier areas. Under the auspices of the project, several workshops on fertilizer use on barley were launched jointly with the Soil Directorate and involved researchers and government and extension staff.

Every year the results obtained from this project were discussed in an annual national coordination meeting in the presence of large number of people influential in Syrian agriculture including the Minister of Agriculture and the Director General of ICARDA. The main outputs of the research project were:

1. Appropriate fertilizer application recommendations on barley for each zone in low-rainfall areas.
2. Analysis of the risk of fertilizer use on barley in low-rainfall areas
3. A national economic decision (optimization) model as a tool for policy-makers to allocate limited fertilizer supplies in Syria more economically and efficiently (El-Hajj et al., 1990).

As the response to fertilizer is significantly influenced by the amount of rainfall, the recommended level of barley fertilization is specific to the Stability Zone. For Zone 2, the POR recommended 40 kg N per ha and 40 kg P₂O₅ per ha compared to 20 kg N and 20 kg P₂O₅ for Zone 3. No fertilizer is recommended for Zone 4, where almost one-third of all the barley is grown, because of low and erratic rainfall in this zone. The recommended fertilizer rates for barley are the lowest among all crops. For instance, the recommended N fertilizer rate for wheat is 1.5–2.0 times that for barley.

Fertilizer Allocation Policy in Syria

Fertilizers as well as most other agricultural inputs are allocated to farmers by the government, based on planned crop area and priority for strategic crops (Shideed et al., 2008). The implication of this allocation policy was that irrigated crops and rainfed wheat in the high-rainfall zones received most, if not all their fertilizer requirements. Barley, a rainfed crop grown in the driest zone, was thus excluded from fertilizer allocation until 1989.

About 60 percent of the country's fertilizers requirements are produced locally and the balance is met by imports. The Agricultural Cooperative Bank (ACB) distributes both imported and locally produced fertilizers to farmers directly and through cooperatives. The ACB is both provider of loans and distributor of inputs. The quantity of fertilizers and other inputs is pre-determined according to a recommended crop plan and formalized by issuing a crop license to every farm at the beginning of each cropping year. Such plans were mandatory and subject to severe penalties for non-adherence. Recently, and with the reduction in government restrictions since 1999, these crop plans are becoming indicative but continue to be used to determine the total quantity of inputs a farmer receives from the ACB. Fertilizers loans are provided to barley farmers in Zone 2 by ACB at 4 percent interest rates. No loans are provided for barley fertilizers in Zone 3, while no fertilizer is allocated to barley farmers in Zone 4.

The government sets fertilizer prices based on fertilizer import costs and domestic

production or procurement price. Imported fertilizer is sold to farmers on a cost-recovery basis (1 percent above landed value) while the farmers' price of locally produced urea is set not to exceed 10 percent of its cost of production. However, since 2003, urea sales to farmers have been subsidized.

Barley Pricing Policy in Syria

The government determines the barley procurement (official) price in advance, based on estimated cost of production and expected yield plus a margin of profit. In most years (e.g., 1997–2002), the procurement price is above the world price. According to this policy, the government procures barley from farmers directly at this supported price level and rations it to livestock owners at a predetermined price. This price is usually about 10 percent above the procurement price (to cover transaction costs), but is lower than the market price level by up to 17 percent, as was the case in 2000. Farmers with livestock are allowed to keep part of the barley they grow for their livestock.

In the past, the government imposed taxes on barley imports to protect local production and producers. In 1999, the government partially liberalized barley trade policy by removing barriers on barley imports including import taxes to encourage barley imports to substitute for the drastic reduction in local production in response to severe drought. At the same time, the government eased its requirements for barley procurement. The higher market price encouraged farmers to sell their produce in the market to the private sector rather than to government authorities. In 2004, only 50 percent of barley production was sold through government channels.

Perceived Influence of POR

In measuring the contribution of research to changes in policy, one of the critical issues is how to assess the causality between research and the implementation of the policy (Norton and Alwang, 1998). To establish the policy influence, this study follows the approach used by Ryan (1999). This approach involves interviewing partners, stakeholders

and policy-makers about their perception of how the policy change has taken place and the role of the different institutions involved in the change.

A partner and stakeholder survey was undertaken in the summer of 2007. Eighteen people were interviewed from partner institutions responsible for the research, stakeholders in the research project, and those involved in the policy-making process. The interview covered the policy-making process on crop fertilizer use, the institutions involved, the evolution of barley fertilization policy, the relationship between research and the policy-making process and the perceived role of the POR project in changing barley fertilizer policy in Syria (for details, see Shideed et al., 2008).

The main outcome of the survey is the clear attribution of the policy change to the influence of the POR (Table 1). The role of research partners in the Soil Directorate was critical as allocation of fertilizer is based on scientific results that originate from this Directorate.

All respondents indicated that the involvement of ICARDA in barley fertilization has helped in speeding up the policy decision by at least 10–15 years. Half of the respondents

believed that the policy change would have not happened without the joint research involving ICARDA. The other half suggested that an alternative non-scientific policy would have been made without the research, but only after a long period of time. The impact pathway is depicted in Figure 3. For a detailed discussion, see Shideed et al., 2008.

Specifying the Counterfactual and Attribution

When documenting the impact of the POR, it is important to establish the counterfactual in the absence of the POR in barley. The most important aspects of the counterfactual are related to farmers' practices before the policy change and to how fertilizer policy in Syria would have evolved in absence of the POR.

There is evidence that some adoption existed in Zone 2 even before the policy change in 1989. Based on farm survey information, more than half of the farmers interviewed in Zone 2 reported application of fertilizers to barley before the policy change in 1989 (Mazid, 1994). But existing fertilizer use was limited in terms of area coverage and level of application in 1989. In contrast, adoption

Table 1. Summary of the responses obtained from the stakeholder interview

Question or issue related to ICARDA study	Number of responses	
	Positive (yes)	Negative (no)
What role did Syria/ICARDA collaborative research play in barley fertilization decision under rainfed conditions?	17	1
Did you see the involvement of an International Research Organization (e.g. ICARDA) was important and/or necessary to reach the barley fertilization policy?	18	0
Did barley fertilization policy (as you see it) have positive or negative effects on the economy?	17	1
Do you think that the barley fertilization policy would have been achieved anyway (even without the research results of Syria/ICARDA collaborative research)?	9	9
Do you think that ICARDA involvement in barley fertilization research helped in speeding up the policy decision?	15	3
Are there other aspects of barley fertilization under rainfed conditions that need new research?	9	6
Do you think that the use of research results has continued as a reliable information source for policy in fertilizers allocation?	17	1
How do describe the effectiveness of the Syrian research and extension systems in communicating research results to policy-makers?	11	2

Source: Compiled by authors from stakeholder interviews.

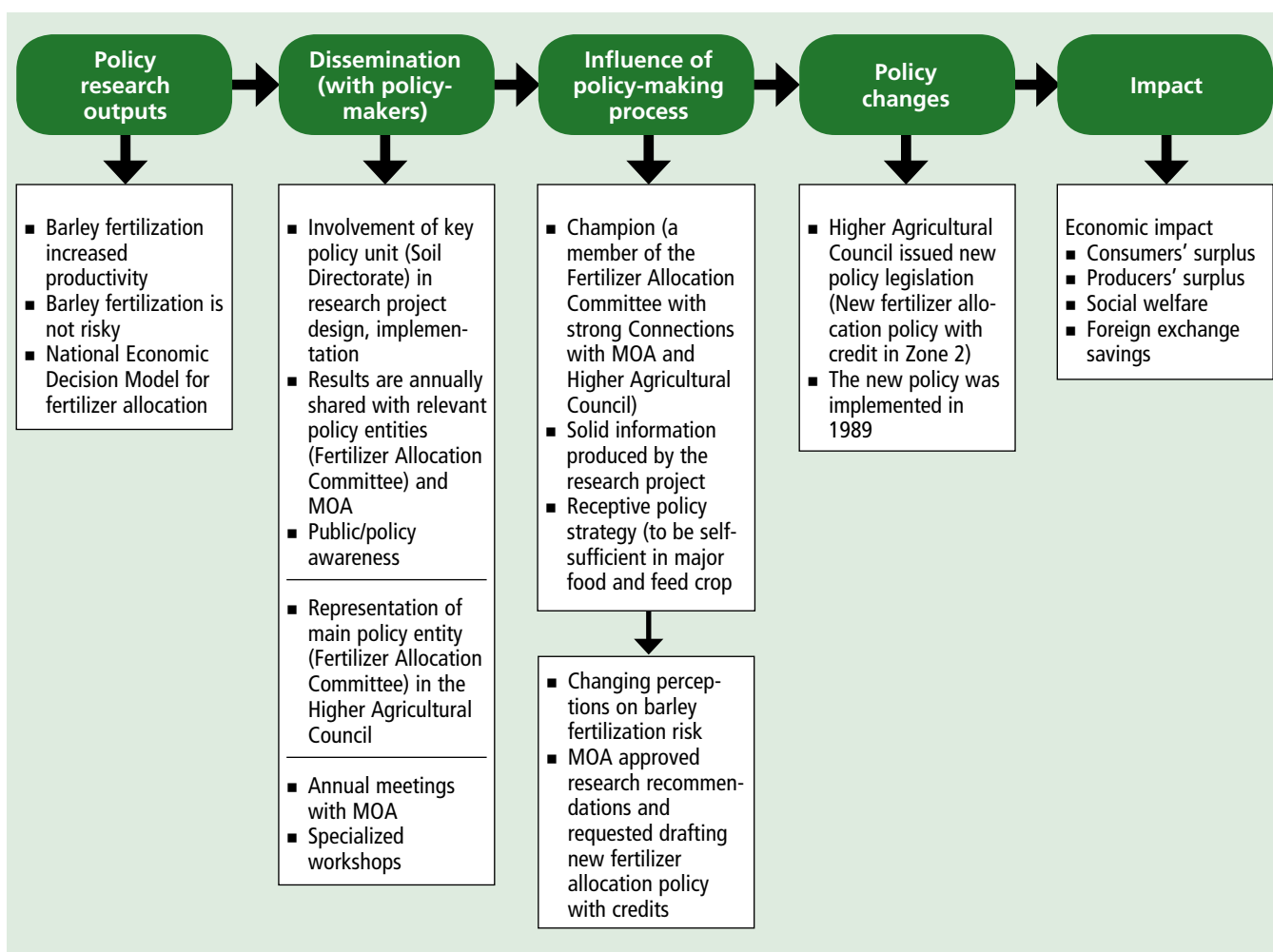


Figure 3. Impact pathways of barley fertilization research

was negligible in Zone 3 before the policy change because of low rainfall. Because the government was the only source of fertilizer during that time, some farmers were apparently shifting some of the fertilizer allocated to other crops to their barley. Although data on rates and extent of barley area fertilized is unavailable, barley fertilization before the policy change was likely to have been inadequate and to have covered only part of the barley area where it was most needed. In principle, the impact of the POR is given by the difference between the benefits from barley fertilization with the policy change and the benefit without the policy change. Without the policy change, the benefits from barley fertilization equal the gains in barley output given the existing level of fertilization without POR minus any losses in yields of other crops (if any) resulting from shifting their fertilizer to barley. With the policy change, the benefits equal the gains

from barley fertilization associated with adoption after the policy change plus the gains from restoring pre-policy yield losses of other crops made possible by the policy change. Whether there were losses in yields of other crops resulting from an illegal shift of their fertilizer to barley depends on the economic optimality of the recommended fertilizer rates of other crops¹.

Assuming that the recommended level of fertilizer on other crops was more than optimal, marginal losses to other crops may be less than marginal gains from barley. Therefore, the benefits attributed to POR equal the gains from barley fertilization associated with adoption after the policy change minus the difference between the gain from barley fertilization and the losses to other crops. For lack of data, this difference cannot be determined. However, this difference cannot be more than the benefits

of applying fertilizer to the pre-POR level (i.e., benefits gained from 60 percent adoption in 1988). Therefore, the benefits attributed to POR can be approximated by the gains from barley fertilization associated with adoption after the policy change, minus the benefit from barley fertilization at pre-POR level. This will then be a conservative or a lower-bound estimate of benefits attributed to POR, taking into consideration the possibility that the optimal level of fertilizer on other crops may have been less than the recommended levels.

How would the fertilizer policy in Syria have evolved in absence of the POR? Some respondents in the stakeholder survey predicted that the fertilizer allocation policy would have been changed, but with a long delay due to factors other than the research, e.g., farmers' pressure. They estimated the delay would have been 10–15 years or more. Consequently, the impact of the POR is estimated as the impact of barley fertilization between 1989 and 2016 (see Shideed et al., 2008 for a detailed discussion of ministerial policy change over time and its relationship to the ICARDA–SMAAR research project).

Documenting the Impact of POR: The Theoretical Framework

In this study, we assessed the returns to POR in the output market based on the economic surplus model commonly used in the impact assessment literature. Social returns to POR are measured as the change in social welfare resulting from barley fertilization and defined as the sum of the changes in consumers' and producers' surpluses resulting from the shift in the barley average and marginal cost (supply) curves of individual farmers. The study follows the model developed and applied by Akino and Hayami (1975).

As shown in Figure 4, d and S_o represent the observed demand and supply curves (after the policy change) and S_n represents the supply curve that would have existed in absence of the POR (and policy change). The equilibrium price that would have cleared the quantity (Q_n) is P_n . Syria is considered a small-scale producer of barley with trade restrictions on barley for most of the years during the 1980s and 1990s, i.e., a closed economy. Assuming that barley in Syria is

not traded internationally, the shift of the supply curve from S_n to S_o would result in lower equilibrium price (P_o) and larger quantity Q_o . The change in consumers' surplus is given by area abc + area $bP_nP_o c$, the producers' surplus by area acO – area $bP_nP_o c$, and social benefit by area abc + area acO . This model is modified to accommodate the barley pricing policy in Syria until 1999 based on Gardner (1987), Alston et al. (1988), and Alston et al. (1995) as depicted in Figure 5.

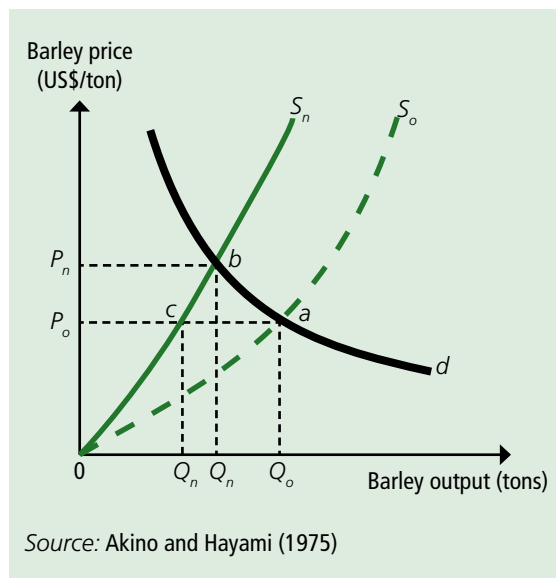


Figure 4. A simple model of estimating social returns to POR

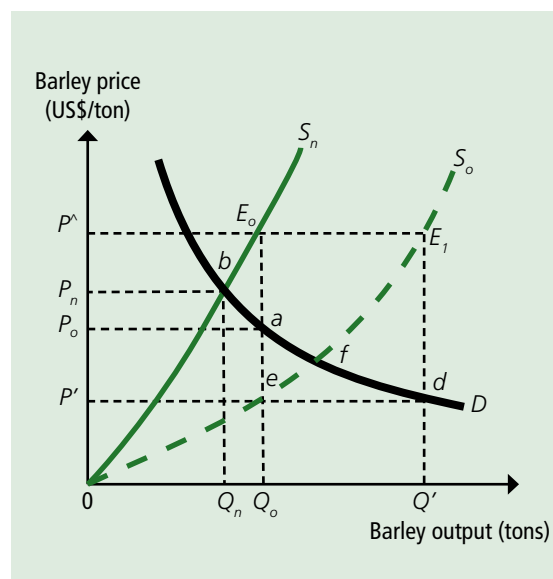


Figure 5. Benefit from POR under procurement price policy

The period of analysis begins in 1984 when the POR was initiated. Benefits began in 1989 when the government began allocating fertilizer to barley producers in Zone 2 and 3. The basic case, as defined by the counterfactual, spans 33 years and represents the actual policy environment in Syria during the period of analysis, i.e., producer procurement price and administered –fixed– consumer barley prices up to 1999 followed by free market pricing to 2003 that is assumed to continue until 2016.

Parameters and Data

Based on the economic surplus models depicted in Figures 4 and 5, values for price elasticities of supply and demand are needed to generate estimates of the returns to collaborative ICARDA–SMAAR research project. A price elasticity of supply of 0.395 was estimated from a constant elasticity supply function founded on time-series data on barley output produced and procurement price for the period of 1985–2005. A similar regression was used to obtain the price elasticity of demand from data on the total country commodity balance and barley consumer price during the same period. An estimate of –0.495 was obtained.

The rate of the shift in barley production depends on the yield gain from fertilizer application and the rate of adoption of the fertilization as measured by the percentage of area fertilized and is given by the following equation (Allen, 1975):

$$k_t = [1 - (y_t^{\wedge} / y_t^{\circ})] a_t \quad (1)$$

Where:

y_t^{\wedge} is the yield of unfertilized barley in year t , y_t° is the yield of fertilized barley in year t , and a_t is the proportion of total barley acreage fertilized as a result of the policy change. Thus, the term $[1 - (y_t^{\wedge} / y_t^{\circ})]$ measures the yield gain as a result of barley fertilization using the POR recommended fertilizer rate while a_t measures the diffusion rate of barley fertilization caused by the policy change (i.e., the ratio of barley area fertilized to total barley area).

The response of barley yield to nitrogen and phosphate fertilizer and rainfall was estimated by Mazid et al. (1999) using on-

farm, fertilizer-trial data from the collaborative ICARDA–SMAAR research project. A quadratic function was used to predict the yields of barley with and without the recommended rates of fertilizer separately for Zones 2 and 3 (Shideed et al., 2008). In Zone 2, the yield gain associated with the recommended barley fertilization rate of 40 kg N + 40 kg P₂O₅ ranged from 31 percent to 43 percent and averaged 33.5 percent. Similarly, the application of the recommended rate of 20 kg N + 20 kg P₂O₅ in Zone 3 results in 20–88 percent increase in barley yield with an average yield increase of 30 percent.

The estimated cumulative adoption rates of fertilizer use (the proportion of farmers applying fertilizer) on barley in Zones 2 and 3 are based on Mazid et al. (1999). Barley fertilizer is not recommended in Zone 4 due to the low and erratic rainfall. In fact, the collaborative ICARDA–SMAAR research project did not recommend the fertilization of barley in this zone. Based on an adoption survey in 1993, nearly 85 percent of the adopters in Zone 2 apply fertilizer to all their cultivated barley. But in Zone 3, only 15 percent of the adopters apply fertilizer to their whole barley area (Mazid, 1994) due to the sparse rainfall, lack of credit to purchase fertilizer, and low barley productivity. To extrapolate the change in the proportion of fertilized barley area over time, we assume that both the proportion of farmers applying fertilizer and the proportion of fertilized land changed at the same rate (Shideed et al., 2008). The aggregate adoption intensity, i.e., the proportion of fertilized barley area in each zone, is then calculated as the product of proportion of farmers applying fertilizer and the proportion of fertilized land.

The cost of the project was relatively small, and the project was built on ICARDA research on barley fertilizer in dry areas. Research operations were funded from research grants received by ICARDA in 1985 (US\$0.2 million from the United Nations Development Programme – UNDP), in 1986 (US\$0.3 million from UNDP), in 1987 (US\$0.418 million from UNDP and Near East Foundation – NEF) and in 1988–1989 of US\$0.091 million from NEF. Human resource costs for national agricultural research system (NARS) collaborators were estimated following the approach described by

Aw-Hassan and Shideed (2003). Other secondary data on costs were assembled from the Syrian Ministry of Agriculture and Agrarian Reforms (2006).

Results and Discussion

The estimation of the benefits from the barley POR followed a dynamic approach to clearly reflect the pricing policy switch of 1999. In the first period of 1989–1999, the returns to research were estimated using the model with procurement price policy illustrated in Figure 5. During the second period (since 2000), the welfare impacts are based on the model represented in Figure 4 as explained earlier. The change in consumers' surplus, producer's surplus, and economic surplus (consumers' plus producers' surpluses) and net economic surplus (economic surplus minus research, adoption and extension costs) are summarized using the NPV and the average annual flow in real 2003 dollars in Table 2. A discount rate of 5 percent comparable to the borrowing rate in Syrian commercial banks was used to calculate NPV. In addition, estimates of the IRR and BCRs are also presented in Table 2.

Based on the economic surplus model estimates, the NPV of the change in consumers' surplus exceeded US\$37 million with an average annual flow of US\$1.34 million (Table 2). The NPV of the change in producers' surplus approached US\$37.76 million (Table 2). Net economic surplus was equivalent to US\$73.42 million. The IRR to investment in research and extension was 70 percent. These are respectable levels of returns to research and compare to returns obtained elsewhere, e.g., sorghum research in the Sudan (Ahmed, et al., 1995) and the rates of return to research and extension for crop genetic improvement reported by Evenson and Rosegrant (2003). However, the BCR to the POR in barley of 41 is significantly below that reported by Ryan (1999) for the case of rice policy changes in Viet Nam where estimated BCRs ranged from 56 to 187.

Since the Syrian government policy objective is based on food/feed security and import substitution, an important impact indicator of the policy change is the savings in foreign currency that would have been spent on

barley imports. The accumulated savings, in the form of import substitution due to increased domestic barley production valued at import prices, from 1989–2016 were about US\$54.5 million with an average annual flow of US\$1.9 million (Table 2).

Several factors explain these high estimated levels of benefits. First, the barley sector in Syria is fairly large in terms of area and output. Second, diffusion of fertilization was rapid especially in Zone 2 reaching a ceiling of 90 percent within few years, and the yield gains were high despite the variability of yield over time. Third, the flow of benefits continued for a reasonably long period of time (28 years). Finally, the research duration was short (only 4 years) for the low cost of only US\$0.22 million a year on average.

Conclusions and Lessons Learned

The POR aimed to create the enabling policy environment for adoption of barley fertilization in Syria. The returns to POR in Syria are substantial, having generated a high rate of return to investment in public research. Based on economic surplus model

Table 2. Welfare changes associated with the POR on barley fertilization in Syria

Welfare indicator ¹	NPV (US\$ million)	Average annual flow (US\$ m)
Change in consumers' surplus	37.5	1.4
Change in producers' surplus	37.8	1.4
Economic surplus (CS+PS)	75.3	2.7
Net economic surplus ²	73.4	2.6
Foreign currency savings	54.5	1.9
Internal rate of return	70.2	–
Benefit–cost ratio ³	41.0	–

1. Benefits began in 1989 and continued to 2016. The period of 1989–1999 is under the procurement price policy.
2. Net economic surplus is equal to economic surplus (CS+PS) minus research, fertilizer and other adoption and extension costs.
3. The BCR is derived by dividing the NPV of the gross economic surplus [(CS+PS) minus fertilizer and other adoption costs and extension costs] by the NPV of the research cost. Discount rate used in computing NPVs is 5 percent.

estimates, the lower-bound estimate on the IRR to investment in POR, the dissemination and adoption is 70 percent, and the NPV of the policy change attributed to POR exceeds US\$20 million.

This study has generated several important lessons:

1. Policy-makers only partially adopted the results of the POR. Particularly, the reallocation of fertilizer among crops was not adopted by policy-makers as suggested by the national economic decision model. The government rejected reallocation of fertilizer from wheat and cotton to other crops as these crops were considered strategic commodities. This finding indicates that there may be limits to policy influence when research findings confront deep-seated commitments, such as the notion of strategic crops for food security in Syria.
2. The design of the POR project reflected the importance of having the relevant and effective national institution as a partner in the POR. The involvement of the Soil Directorate significantly leveraged influence through the leading role of the 'champion' to effectively and timely communicate the results of POR to policy-makers. Besides facilitating policy influence, this collaboration also accelerated policy change.
3. Not only building the mechanism of policy influence in the project design and implementation and but also matching the ability of POR to develop sound research outputs squarely addressing the concerns of policy-makers sets the stage for successful POR.

Although this case study represents an *ex post* analysis with a time lag long enough to realize the impact of the POR, it has its complications in attributing the achieved benefits to the POR because of the changes in other government policies. Also, the use of fertilizer on barley before the policy change complicated further the calculations of benefit stream due to lack of data on the extent of the impact on other crops before the policy change. These complexities required modifications of the conventional economic surplus model to appropriately represent reality. Therefore, this case study is a contribution to the limited empirical

literature dealing with returns to research under policy distortions.

References

- Ahmed, Mohamed, M., Masters, W.A., and Sanders, J.H. 1995. Returns from research in economies with policy distortions: Hybrid sorghum in Sudan. *Agricultural Economics*, 12, 183–192.
- Akino, M. and Hayami, Y. 1975. Efficiency and equity in public research: Rice breeding in Japan's economic development. *American Journal of Agricultural Economics*, 57(1), 1–10.
- Allen, P.G. 1975. Efficiency and equity in public research: Rice breeding in Japan's economic development: Comments. *American Journal of Agricultural Economics*, 57(4), 730–733.
- Alston, J.M., Edwards, G.W., and Freebairn, J.W. 1988. Market distortions and benefit from research. *American Journal of Agricultural Economics*, 70(2), 281–288.
- Alston, J., Norton, G., and Pardey, P. 1995. *Science Under Scarcity: Principles and Practice for Agricultural Research Evaluation and Priority Setting*. Cornell University Press: Ithaca, USA and London, UK.
- Aw-Hassan, A. and Shideed, K. 2003. The impact of international and national investment in barley germplasm improvement in the developing countries. In: *Crop Variety Improvement and its Effect on Productivity: the Impact of International Agricultural Research* (Evenson, R. E. and Gollin, D., Eds). CABI International: Wallingford, UK.
- El-Hajj, K., Saade M., and Meda, L. 1990. Economic analysis for fertilizer allocation strategies in Syria: Fertilizers requirement and allocation strategies of main crops in Syria. International Center for Agricultural Research in the Dry Areas (ICARDA): Aleppo, Syrian Arab Republic. (In Arabic).
- Evenson, R.E. and Rosegrant, M. 2003. The economic consequences of crop genetic improvement programmes. In: *Crop Variety Improvement and its Effect on Productivity: the Impact of International Agricultural Research*

- (Evenson, R. E. and Gollin, D., Eds.). CABI International: Wallingford, UK.
- FAO (Food and Agriculture Organization of the United Nations). 2008. FAOSTAT. <http://faostat.fao.org>
- Gardner, B.L. 1987. *The Economics of Agricultural Policies*. Macmillan Publishing Company: New York, USA.
- Mazid, A. 1994. Factors influencing adoption of new agricultural technology in dry areas of Syria. PhD thesis: University of Nottingham, UK.
- Mazid, A., Bailey, E., and Jones, M. 1999. *The Effect of Fertilizer Use on Rain-Fed Barley: A Case Study from Syria*. ICARDA Social Science Paper No. 8. ISBN 1024-8005. International Center for Agricultural Research in the Dry Areas (ICARDA): Aleppo, Syrian Arab Republic.
- Norton, G.W. and Alwang, J. 1998. *Policy for Plenty: Measuring the Benefits of Policy-Oriented Social Science Research*. Impact Assessment Discussion Paper No. 6. International Food Policy Research Institute (IFPRI): Washington DC, USA.
- Ryan, J.G. 1999. *Assessing the Impact of Rice Policy Changes in Viet Nam and the Contribution of Policy Research*. Impact Assessment Discussion Paper No. 8. International Food Policy Research Institute (IFPRI): Washington DC, USA.
- Shideed, K., Mazid, A., Ahmed, M.A.M., and Zahir, Z. 2008. Policy influence and returns to policy-oriented agricultural research: the case of barley fertilization in Syria. International Center for Agricultural Research in the Dry Areas (ICARDA) and the Syrian Ministry of Agriculture and Agrarian Reform (SMAAR): Aleppo and Damascus, Syrian Arab Republic. 58 pp. (Unprocessed manuscript).
- SMAAR (Syrian Ministry of Agriculture and Agrarian Reform). 1999. The Annual Agricultural Statistical Abstract. SMAAR: Damascus, Syrian Arab Republic.
- SMAAR (Syrian Ministry of Agriculture and Agrarian Reform). 2006. The Annual Agricultural Statistical Abstract. SMAAR: Damascus. Syrian Arab Republic.

1 For lack of data and previous studies, this paper cannot establish whether recommended levels of crop fertilization in Syria were economically optimal.

3.4. IFPRI and the Mexican PROGRESA Anti-Poverty and Human Resource Investment Conditional Cash Transfer Program

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Introduction

This chapter summarizes the much longer study in Behrman (2007)¹, the objective of which is to characterize the influence and impact of IFPRI in relation to the Mexican PROGRESA/Oportunidades² anti-poverty and human resource program with its conditional cash transfers (CCT) – conditional on specific investments in education, health and nutrition that was initiated in 1997. The apparent influence and impact of IFPRI on PROGRESA/Oportunidades is explored by considering four questions:

1. Was the PROGRESA program design influenced by prior IFPRI research?
2. Why was IFPRI chosen to undertake the initial impact evaluation of PROGRESA?
3. How did the IFPRI evaluation of PROGRESA contribute to the program?
4. Were there spillovers of the IFPRI evaluation of PROGRESA?

Conversations with the IFPRI about evaluation were initiated late in 1997 and resulted in a signed contract in the third quarter of 1998 for the IFPRI evaluation in 1998–2000.

The Mexican PROGRESA/Oportunidades Anti-Poverty and Human Resource Investment CCT Program

During the 1994/5 transition from the administration of President Carlos Salinas to President Ernesto Zedillo, the Mexican economy experienced a severe economic contraction. Policy-makers were very concerned about negative implications of this shock for the poor, but had a variety of views about what policy responses were appropriate. Some argued for strengthening existing programs, including 15 food subsidy programs – four general (e.g., tortilla subsidies for all purchasers) and 11 targeted towards different populations. Others argued for new approaches that were:

- Better-targeted towards the poor
- Less costly in terms of administration
- More transparent and less subject to corruption
- Based on the insights of academic research relating to the synergies among various forms of human resource investments, the nature of intra-household allocations, and the basic transfer characteristic of infra-marginal food provision
- Subject to systematic evaluations.

Out of these discussions, a new anti-poverty and human resource investment program, PROGRESA, was designed as a major component of Mexican anti-poverty strategy. In August 1997 it was introduced, initially in small rural communities, but has since expanded to cover about 30 million poor Mexicans in all but the most populous urban areas. A small group of Mexican social scientists, usually characterized as headed by Santiago Levy (an economist who was Undersecretary of Finance at the time of the development of PROGRESA) and the late Jose “Pepe” Gómez de León (a demographer who headed, Mexico’s National Commission on Population (CONAPO) and was the first National Coordinator of PROGRESA) but with important participation of others such as Evelyn Rodríguez (who worked with Levy in the Finance Ministry) and Daniel Hernández (who worked with Gómez de León at CONAPO, was the first Assistant National Coordinator of PROGRESA and succeeded Gómez de León as National Coordinator of PROGRESA), are generally perceived to have been instrumental in the development and initial implementation of PROGRESA.

PROGRESA is known for its efforts to enhance the human resources of younger Mexicans through CCTs rather than in-kind provision of particular foods (e.g., milk, tortillas) that dominated prior programs; its efforts to ensure participation and some empowerment of more vulnerable members

of poor households (e.g., women, infants, children); and its systematic efforts at evaluation. The CCTs are made to mothers. They are conditional on such behaviors as children and adolescents attending school, infants receiving micronutrient supplements, mothers attending sessions on nutritional and health practices, and all family members having regular health and nutritional check-ups. PROGRESA incorporated data collection and systematic evaluation as integral components from the start, with an initial experimental design in rural areas that had:

- Random assignment for the first 20 months of treatment among 506 rural communities (320 with treatment starting in early 1998, 186 initial controls with treatment starting in late 1999)
- Over 24,000 households and over 120,000 individuals in the evaluation sample over the 1997–2000 period
- Subsequent control samples selected through propensity score matching in both rural and urban areas.

Indeed, one major reason that PROGRESA/Oportunidades is so well known has been the centrality of its efforts to seriously evaluate from the start. IFPRI was contracted by PROGRESA to undertake the initial evaluation of PROGRESA in 1998–2000, followed by a series of contracts for subsequent evaluations by the Mexican Instituto de Nutrición y Salud Pública.

While there are no estimates of the overall BCRs of PROGRESA/Oportunidades, there are estimates of BCRs through schooling attainment, which are of substantial interest given the relative importance of CCTs related to schooling in the overall program. These estimates assume that program benefits arise from increases in future earnings as a result of increased schooling, ignoring other potential impacts of the program such as improved health and nutrition. Estimates of the resource costs of the program include program administrative costs (costs of transferring benefits, conditionality, and targeting) and private costs associated with participation in the program as well as distortion costs of raising public funds to finance the program³. All costs and benefits are discounted to the start of the program. The benefit–cost estimates of 6 years of exposure to PROGRESA/Oportunidades indicate program benefits that are several times

higher than program costs under most scenarios for rates of return to schooling attainment (6, 8, and 10 percent) and potential discount rates (3, 5, and 10 percent). Given that there are probably productivity gains from improved health and nutrition due to the program in addition to the productivity impacts of schooling, these estimates probably understate the BCRs (even fairly narrowly defined), perhaps by about 30 to 50 percent. From a broader perspective, almost surely the benefits to Mexico were much greater because of positive spillovers in helping to institute a culture of serious policy evaluation, which was formalized with the institution of Consejo Nacional de Evaluación de la Política de Desarrollo Social (CONEVAL, the National Council of Social Development Policy Evaluation). From a still broader international perspective, both the concept of CCT programs and the systematic evaluation of such programs have been advocated by such international organizations as the World Bank and the Inter-American Development Bank (IADB). They also have been considered, and in some cases implemented, in a number of other countries in Latin America, Asia, and Africa, as well as in the United States (e.g., New York City). The World Bank, for example, has prepared one of its major Policy Research Reports on CCTs. PROGRESA/Oportunidades also has been praised by leading economists and others in major English-language print and electronic media, as well as in a number of journals in various other languages. These journals characterize the program very positively as “pioneering,” “a successful model”, and “newest and most innovative social policy” and emphasize the critical role of evaluation (with explicit emphasis on IFPRI in a number of cases).

Challenges in Identifying the Influence and Impact of IFPRI on and through PROGRESA/Oportunidades

In the abstract, BCRs or IRRs can be used to estimate the impact of any actual or prospective project, activity, or investment, including the IFPRI relation to PROGRESA/Oportunidades. The benefits include the weighted sum of all impacts of the project, with the weights reflecting the present discounted value of the resource gains/savings of various impacts. The costs include

the present discounted value of the weighted sum of all resources used by the project directly or indirectly, private, or public. While the benefit–cost estimates cited earlier suggest that the gains almost surely outweighed the costs for PROGRESA/Oportunidades, they do not directly inform the benefit–costs for the IFPRI influence and impact on the program.

For most CGIAR institutions, a stereotypical example of a project to be evaluated would be the development of a new higher-yielding variety. In this case:

- The direct impact of what is being produced might be measured by the added product due to the higher-yielding variety
- The prices of those impacts might be measured by prices on the world market for that product
- The resources used are those directly devoted by the institution to develop the new variety, plus those used by others to utilize the new variety (e.g., added farmer time or complementary inputs to produce the new variety), plus the distortion costs of raising public resources for such a purpose
- The prices of most of those resources might be measured by world market prices
- The project life might be on the order of magnitude of a decade or so, given probable developments of superior new varieties in the future.

There are a number of issues that have to be dealt with in such estimates. But as a first approximation in many cases for most of the CGIAR institutions such estimates are relative straightforward conceptually. Most direct impacts and resources used have fairly good price measures, and the time period is likely to be relatively short so that it is unlikely the estimates will be changed radically by different choices of discount rates.

But for IFPRI, which is attempting to produce information that leads to better policies rather than to new crop or livestock varieties, estimating BCRs is likely to be more challenging than for most other CGIAR institutions for several reasons. Firstly, while there are likely to be relatively good prices with which to value new varieties, generally it is far from clear how to value directly changed or new policies. Instead, it is gener-

ally necessary to go beyond changed policies to evaluate the impact of changed policies on outcomes of indirect, though perhaps more primary interest, such as income or consumption. Secondly, it is rare indeed, and perhaps never happens, that IFPRI's research alone results in any particular policy change. Instead, IFPRI's research is likely to contribute, together with the research of other institutions and individuals, to a changing environment of understanding as to how various policies work, and which work better than others. Thirdly, even if IFPRI research does have a direct impact on the development of new policies in particular contexts, policy-makers rarely cite their sources, so evidence of such links is hard to come by. Fourthly, for many important aspects of food and nutritional policies, important components of the effects of interest pertain to the health and productivity over the life cycle of unborn children, infants, and small children. This means that a long time horizon must be used, which makes it all the more difficult to estimate the impacts and to value them, and also makes the results much more dependent on the discount rate. For instance, a US\$1000 benefit in 30 years has a present discounted value of US\$412 with a 3 percent discount rate, but only US\$57 with a 10 percent discount rate. Fifthly, some of the benefits are extremely difficult to price – most notably, averted mortality. For such reasons, obtaining estimates of the impact and influence of IFPRI on PROGRESA/Oportunidades is very challenging, but the rest of this chapter summarizes the extensive efforts to do so that are detailed in Behrman (2007).

Information Sources used to Characterize IFPRI's Influence and Impact

Six types of source were used to obtain understanding of IFPRI's impact and influence:

1. **Documents written by key actors in the development of PROGRESA prior to its establishment.** Because the key architects of PROGRESA were researchers, examination of their research papers before the program may reveal the impact of IFPRI and IFPRI-related researchers on ideas related to the development of PROGRESA. Of particular potential value are the papers on poverty

programs in Mexico written by Levy and various studies by Gómez de León.

2. Documents that discuss the development of PROGRESA, but that were written after its initiation by key actors in its development and by other knowledgeable informants and observers. These include accounts by some of the key actors mentioned in the Introduction and papers by two Mexican social scientists, Rosa María Rubalcalva (2007) (who worked with Gómez de León at CONAPO) and John Scott (1999) (an economist at Centro de Investigación y Docencia Económicas (CIDE) in Mexico City).

3. In-person, telephone or e-mail interviews with 39 key informants who were directly involved, international organizations that facilitated and used such evaluations or are knowledgeable about the topic of this study. These 39 informants are a subset of the 57 informants who were approached for such interviews. Those who were interviewed include most of the major participants in the program and its evaluation. The procedure that was followed for these interviews was that each individual received an e-mail asking if I could interview them on five specific questions. For a subset of the most critical informants, I proposed meetings in Mexico City (Daniel Hernández, Mónica Orozco, Evelyne Rodríguez), Washington (Santiago Levy) or Lima (Nora Lustig) to discuss the questions sent in advance. In these cases, I attempted to follow very strictly the format of the questions in the original e-mail, with some addition requests for clarification but without attempting to ask any leading questions. Immediately after each interview the interviewee received a summary of the interview and was asked to confirm or suggest modifications in the record. In all cases confirmation was received, mostly with some small modifications or added thoughts. For all of the others the e-mail enquiry encouraged an e-mail response or, if they preferred, a telephone interview. In all but four cases, e-mail responses were provided. The four exceptions were interviewed by telephone and immediately sent summaries and asked for confirmation and modifications. All were confirmed, some with modifications. The appendices and Section 5 in Behrman (2007) give the names and positions of those from whom interviews were requested, the questions that were asked

and the transcripts of their answers, as well as tabular summaries of the interviews.

4. Documents written by PROGRESA staff during the IFPRI evaluation period. These are primarily studies written by Gómez de León with collaborators, but also include a letter from Hernández to IFPRI at the conclusion of the IFPRI evaluation.

5. Reports in the press and other media about PROGRESA/Oportunidades and related materials. These include accounts in various media and some particularly visible articles (e.g., Becker 1999 in *Business Week*, Krueger 2002 in the *New York Times*, and the *Economist*, 2005, Friedland 1999 and Fukuyama 2007 in the *Wall Street Journal*).

6. Other relevant documents. These include the transcript of a Brookings Institution (2007) Workshop/Press Conference on Levy's (2006) book on PROGRESA/Oportunidades, an IADB (2002) press release on the award of the largest IADB loan to date to Oportunidades, and selected e-mails relating to PROGRESA.

Apparent Influence and Impact of IFPRI on PROGRESA/Oportunidades

The conclusions that come from investigation of the information include:

1. IFPRI did not directly participate in the PROGRESA design. It would be misleading to claim that a major part of the PROGRESA program benefits should be attributed to IFPRI's critical role in the design process. Nevertheless, prior IFPRI research and work by its evaluation team members either directly (in the sense of direct citations) and indirectly (in the sense of contributions to evolving conventional wisdom) on topics including food subsidy programs, nutrition, health, gender, intra-household allocations and related policies apparently played some role in the design process. Therefore, it might not be misleading to attribute a small part of the PROGRESA benefits to better design based on IFPRI's prior research contributions on a number of related topics.

2. IFPRI presented several advantages:

- In terms of type of organization (neither appearing to be a captive of national

interests nor identified with structural adjustment or multilateral lending)

- By reputation and credibility for solid scientific analysis of relevant policy-related issues, enhanced by the addition of some prominent academic researchers
- Through aspects of management including flexibility, reliability and relatively low costs.

These advantages were perceived to offset the disadvantages, in the eyes of some Mexican entities, of not being Mexican and the logistic and communication difficulties of not having a Mexican base. The advantages gained from IFPRI's prior contribution to the knowledge on which the designers of PROGRESA built, and underlie some of the benefits of IFPRI's involvement in the evaluation. The perceived package of advantages apparently dominated whatever PROGRESA considered the next-best option, so that early on in the conversation between IFPRI and PROGRESA about the evaluation, the focus seemed to be primarily on making mutual adjustments so that the evaluation contract could be worked out, rather than strong debates about whether it should be worked out.

3. Key persons. People involved in the development and implementation of PROGRESA, as well as most of those interviewed, representatives of international organizations, and of the more general media, all seem to agree that the IFPRI evaluation team did make a significant contribution to the short-run and longer-run sustainability and expansion of the program. The team also contributed to details of the evaluation and program modifications – probably beyond what might have occurred with some alternative evaluator for reasons that were anticipated in the selection of IFPRI. While it undoubtedly remains the fact that the basic success of PROGRESA is due primarily to those in Mexico who developed, nurtured, and implemented the program, it also seems plausible that some small share of the credit might be attributable to the IFPRI evaluation.

4. Substantial spillover effects. These have occurred both in Mexico and internationally as a result of the evaluation of PROGRESA, on the culture of policy evaluation in general and on CCT programs in particular. It

seems that some significant share of this is due to IFPRI being engaged in the evaluation because that involvement probably added considerably to both the Mexican domestic and the international awareness of, and receptivity to, what had been learned about evaluation processes and what had been learned about CCTs through the IFPRI evaluation of PROGRESA.

Thus the evidence suggests that IFPRI probably did have an important significant impact on the direct and indirect outcomes of PROGRESA/Oportunidades, even if this impact was a small percentage of the total PROGRESA/Oportunidades impact. Further evidence is provided by simulations of the BCRs for IFPRI's involvement in Table 1, which is divided into five parts:

1. Impact only through reducing delays in program implementation. The analysis suggests that this effect might be important both because of technical advice obtained from IFPRI, and because the increased credibility of evaluation studies by IFPRI (as opposed to feasible alternatives) helped facilitate political agreement for program expansion. In the conservative assumptions in Table 1 this effect is assumed to be that program expansion was 3 months faster in 1999–2000 than it would have been had IFPRI not been involved in the evaluation. The sensitivity of the simulations to more moderate assumptions that: a. the delay would have been 0.5 years, and b. the delay would have continued for a few years after 2000 until 5.0 million students were beneficiaries without IFPRI's involvement was explored⁴.

2. Impact only through improving evaluation and program details and informal training. The analysis also suggests that the IFPRI evaluation team helped to improve the evaluation design, improved the program, and engaged in informal training through interacting with the PROGRESA team. In the conservative assumptions in Table 1 this effect is assumed to account for 0.03 of the present discounted value of the PROGRESA benefits for the 1998–2000 period. The sensitivity of the simulations to more moderate assumptions that: a. the effect was 0.06 instead of 0.03, and b. the effect continued until 2006 through the Fox presidential administration, was explored.

3. Impact only through increasing the probability of program continuation after the election of 2000. The analysis suggests that this effect might be important again both because of technical advice obtained from IFPRI and because the increased credibility of evaluation studies by IFPRI (as opposed to feasible alternatives) helped facilitate political agreement for program continuation. In the conservative assumptions in Table 1 this effect is assumed to be that program continuation from 2000 through 2012 was 0.05 more probable because of IFPRI’s involvement in the initial evaluation than it would have been if some other feasible entity had undertaken the evaluation. The sensitivity of the simulations to more moderate assumptions that: a. the impact of IFPRI on the continuation probability was 0.10, and b. the impact on this probability continued through two more presidential administrations until 2024 was explored.

4. Impact only through spillovers. The analysis suggests that this effect might be important, once again both because of technical advice obtained from IFPRI and because the increased credibility of evaluation studies by IFPRI (as opposed to feasible alternatives) helped facilitate dissemination knowledge of and advocacy for CCTs modeled on PROGRESA. In the conservative assumptions in Table 1 this effect is assumed to be that if the spillover impact of PROGRESA were

equal to 0.25 of the present discounted net program benefits (i.e., net of program resource costs) at the start of 1998 for the 1997–2000 period, and that IFPRI’s involvement in the initial evaluation accounted for 0.10 of this spillover (or $0.025 = 0.10 \times 0.25$ of the present discounted value of the net program benefits)⁵. The sensitivity of the simulations to more moderate assumptions that the spillover impact of PROGRESA was equal to 0.50 of the present discounted net program benefits, or that IFPRI’s involvement in the initial evaluation accounted for 0.20 of this spillover is explored.

5. Impact through all four of these channels. Because the four groups of simulations described above each assume that, in turn, there is only one impact for the total resource costs for IFPRI’s involvement, the total impacts of all four is the sum of the impacts of the four individual cases.

The other critical assumptions underlying the simulations in Table 1 are also conservative (though, again, with exploration of moderate assumptions):

1. The direct benefits per child from PROGRESA are for the schooling component of the program for a 6 percent rate of return to schooling (the lowest rate included in the alternatives mentioned above) and an impact of 0.83 grades (the lower impact considered in

Table 1. Benefit–cost ratio (BCR) estimates

		Estimated BCR
1. Impact only through reducing delays in program implementation		
	Conservative assumptions	16.4
	Moderate assumptions	1733.0
2. Impact only through improving evaluation and program details and informal training		
	Conservative assumptions	5.8
	Moderate assumptions	303.9
3. Impact only through increasing probability of program continuing after election of 2000		
	Conservative assumptions	57.1
	Moderate assumptions	5991.6
4. Impact only through spillovers		
	Conservative assumptions	4.9
	Moderate assumptions	1133.5
5. Impact with all effects		
	Conservative assumptions	84.3
	Moderate assumptions	9162.0

the alternatives considered above). For the moderate case an 8 percent rate of return to schooling (the middle rate included among the alternatives considered above) is assumed.

2. The discount rate is assumed to be 5 percent for the conservative case. For the moderate case a 3 percent discount rate is assumed.
3. Other returns such as the one to improve infant nutrition, that have been estimated to increase the present discounted value of life-time earnings by 2.9 percent, are not included in the conservative assumptions. For the moderate case this effect is assumed to increase the earnings/productivity returns by a fifth of the rate of return of schooling (i.e., 1.6 percent).
4. The total number of children who benefited after 2006 is assumed to be about 5 million per year under the assumption that there is no further expansion of student beneficiaries beyond the levels experienced in 2004–2006.
5. Because it is not clear how to measure the resource costs of the IFPRI contribution to the environment in which PROGRESA was developed, even though IFPRI seems to have made a real contribution at this stage, it is not included in the benefits for the purpose of these simulations.
6. The real resource cost of IFPRI's involvement is assumed to be the contractual payment to IFPRI for the evaluation; plus some direct core funds that IFPRI paid for preparation of the application for the contract; with a 25 percent addition for the distortion costs of raising these funds. When discounting the conservative case it is assumed that these costs were spread evenly over 1998–2000. This assumption about costs is conservative again because it assumes that if IFPRI had not undertaken the evaluation, the gains due to IFPRI's participation would not have been realized and if some other entity had undertaken the evaluation, the resources saved from IFPRI not participating would have been the entire IFPRI costs. This implies that the costs of the other entity undertaking the evaluation would have been zero. It also is conservative in that it assumes that costs were as large in 1998 as in the

following two years, even though the contract for the project was only signed in the third quarter of 1998. For the moderate case, it is assumed that the additional marginal cost of IFPRI above that which would have been required for whatever alternative the evaluator would have undertaken if IFPRI had not done so would have been 50 percent of the resource costs instead of 100 percent^{6, 7}.

Table 1 presents in the first row of each of the five options the conservative estimates and in the second row the estimates with the moderate assumptions. The BCR estimates obviously are sensitive to the assumptions that are made about such matters as discount rates and rates of return to schooling because the estimated benefits are obtained over the future working life of students who are in school when they are program beneficiaries. They also are sensitive to the particular assumptions made about the four impacts considered:

- How much and for how long IFPRI's involvement accelerated program expansion
- How much and for how long IFPRI's involvement increased the evaluation, quality, improved program details, and provided informal training
- How much and for how long IFPRI's involvement increased the probability of program continuation after the 2000 election
- How big and for how long have the spillovers been and what share of them can be attributed to IFPRI's involvement.

But even under the most conservative assumptions made here, the BCR estimates suggest that the benefits were high relative to the resource costs of the IFPRI evaluation of PROGRESA for each of the four types of benefits considered. These simulated effects are greatest under the assumptions of this table for the increase in the probability of program continuation after the 2000 election, secondly for the acceleration of enrollment, thirdly for the evaluation and program improvements, and fourthly for the spillovers⁸. But these estimates suggest that any one of these effects in isolation would justify the program, even under the conservative assumptions. The simulated BCRs under the conservative assumptions, for

example, are 4.9 for the spillovers alone and 5.8 for the evaluation and program improvements alone, and much bigger for the other two impacts alone. And the BCR is much larger if all four effects are considered – 84.3 under the conservative assumptions. Moreover, if indeed, as I believe, the moderate assumptions generally are more plausible than the conservative ones, then the benefits exceeded the costs by much more. The IFPRI evaluation of PROGRESA/Oportunidades, thus, apparently resulted in a substantial international public good with a high return on the resources used to undertake this evaluation.

References

- Becker, Gary S. 1999. Bribe Third World Parents to Keep Their Kids in School. *Business Week (Industrial/Technology Edition)*. 22 November 1999, p. 15: New York, USA.
- Behrman, Jere R. 2007. *Policy-oriented Research Impact Assessment (PORIA) Case Study on the International Food Policy Research Institute (IFPRI) and the Mexican PROGRESA Anti-poverty and Human Resource Investment Conditional Cash Transfer Program*. IFPRI Impact Assessment Discussion Paper No. 27. International Food Policy Research Institute: Washington, DC, USA.
- Brookings Institution. 2007. Wolfensohn Center for Development, transcript from discussion Monday, 8 January, 2007 with Santiago Levy, former Mexican Deputy Minister of Finance, about his new book *Progress Against Poverty: Sustaining Mexico's PROGRESA-Oportunidades Program*. Washington DC, USA. <http://www.brookings.edu/comm/events/20070108.htm>
- Economist*. 2005. New Thinking About an Old Problem. *The Economist*, 15 September 2005: London, UK.
- Friedland, Jonathan. 1999. Signs of 'Progresá' – Politics out of Welfare and Focus on Neediest, Zedillo Plan Switches Targets from Votes and Cities to Neglected Hinterland, For Mother, with Incentives. *Wall Street Journal*, 15 October 1999, pp. 1, 6: New York, USA.
- Fukuyama, Francis. 2007. Commentary: Keeping Up With the Chavezes. *Wall Street Journal*, 1 February, 2007: New York, USA.
- Inter-American Development Bank (IADB). 2002. "IADB Approves Its Largest-ever Loan for Mexico: \$1 Billion for Expansion of the PROGRESA Poverty-Reduction Program: Resources To Consolidate Successful Mexican Program and Expand Coverage to Urban Areas." Press Release, 16 January, 2002. Inter-American Development Bank: Washington DC, USA.
- Krueger, Alan B. 2002. A Model for Evaluation the Use of Development Dollars South of the Border. *New York Times*, 2 May 2002, p. C2: New York, USA.
- Levy, Santiago. 2006, *Progress Against Poverty: Sustaining Mexico's PROGRESA-Oportunidades Program*. Brookings Institution: Washington DC, USA.
- Rubalcava, Rosa María. 2007. PROGRESA-Oportunidades: un programa social con compromiso demográfico y perspectiva de género. *Políticas Sociales y Género. Tomo 2: Problemas Sociales y Metodológicos. Serie Dilemas de las Políticas Públicas en Latinoamérica*. Facultad Latinoamericana de Ciencias Sociales (FLACSO), México DF.
- Scott, John. 1999. *Análisis del Programa de Educación, Salud y Alimentación I (PROGRESA): México, Experiencias Exitosas de Combate a la Pobreza Rural: Lecciones para una Reorientación de las Políticas*. Estudio del Red Internacional de Metodología de Investigación de Sistemas de Producción (RIMISP) – Food and Agriculture Organization of the United Nations (FAO), Informe Final, Centro de Investigación y Docencia Económicas (CIDE): México DF.

1 This paper is an abridged version of Behrman, Jere R., 2007, *Policy-oriented Research Impact Assessment (PORIA) Case Study on the International Food Policy Research Institute (IFPRI) and the Mexican PROGRESA Anti-poverty and Human Resource Investment Conditional Cash Transfer Program*. IFPRI Impact Assessment Discussion Paper No.27. International Food Policy Research Institute (IFPRI): Washington, DC, USA, to which the reader is referred for details and references.

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- 2 PROGRESA is an acronym for the original name of the program (Programa de Educación, Salud y Alimentación, Program for Education, Health and Nutrition). When the Fox Government came into power after the 2000 election, the program was modified in some details (e.g., coverage of upper secondary schooling, extension into more urban areas) and renamed 'Oportunidades.' The program continues in basically the same form today.
 - 3 The budgetary costs of the program are not the same as the resource costs both because they include considerable transfers and because they do not include private costs.
 - 4 The idea behind the latter is that the more rapid expansion path facilitated by IFPRI's involvement continued until the program reached its apparently stable enrollment level at about 5.0 million student beneficiaries in 2004.
 - 5 The author's perception of the sense of at least some of those at the IFPRI workshop in "Impact Assessment" on 6 November 2007 as well as of Harold Alderman's (Lead Human Development Economist at the World Bank) comment on this study is that, in light of the considerable international attention that PROGRESA and the IFPRI evaluation of PROGRESA has received about policy evaluation and CCTs that is discussed above, as well as the contribution to the scholarly literature on development that is reflected in part in the citations to Google Scholar, is that this is probably a very conservative assumption (and possibly the most conservative assumption underlying Table 1).
 - 6 John Hoddinott (Senior Research Fellow at IFPRI) suggested in his discussion of this paper at the IFPRI Conference of 6 November 2007 that actual resources devoted to the IFPRI evaluation probably were greater than covered by the contract with PROGRESA because the evaluation team members devoted more than contracted time and effort to the project, perhaps in part because of the excitement of the project, squeezing the time out of other professional and personal activities. While this may be a somewhat offsetting consideration, it still would seem likely that the conservative estimate of the real resource cost of using IFPRI versus some unnamed counterfactual evaluator used in these simulations is, if anything, an overstatement of the additional real resource costs due to IFPRI doing the evaluation.
 - 7 The evaluation resource costs are assumed to be independent of whether the program in fact expanded more or less rapidly than envisaged at the time that the terms of that contract were established. This raises a more general question about the relation between scale and evaluation costs and benefits. For a given population heterogeneity, in some important respects many evaluation costs are likely to be about the same independent of the population size (e.g., sample sizes to measure desired effect sizes at given significance and power levels are independent of the population size, as are likely to be some of the other resource costs of analyses of evaluation data). For such reasons, there are likely to be scale economies in undertaking evaluations for programs that affect larger populations. But typically larger populations tend to be more heterogeneous and logistics and administrative arrangements for them are more complicated, which tend to work in the opposite direction. My intuition is that there probably are scale economies, but exploring such a possibility is beyond the scope of the present study.
 - 8 See note 7 above, This simulation probably is based on the most conservative assumption. If the domestic Mexican and international spillovers were about as large as the direct Mexican benefits – which is not a crazy possibility – then, to illustrate, under the otherwise conservative assumptions this impact would be second rather than fourth among those considered in the table.

3.5. Policy Change in Dairy Marketing in Kenya: Economic Impact and Pathways to Influence from Research

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Introduction

In Kenya, informal milk markets account for nearly 86 percent of milk supplies to consumers (Omore et al., 2004). The supply chain actors in these markets include small-scale producers, mobile milk traders, milk bar operators, and milk transporters. This indicates a dominance of small-scale milk vendors (SSMVs) in the supply chain. There are also indications of increasing demand for milk and dairy products in developing countries. For example, annual per capita milk consumption in Kenya is now estimated at 145 liters (SDP, 2005), and this is believed to be more than five times higher than milk consumption in other countries in East Africa.

Although most milk in Kenya passes through informal market channels, previous government policies did not adequately address the concerns of the farmers, traders, and consumers who make up these channels. The old colonial dairy policy, which criminalized the activities of SSMVs, was largely designed to protect the interests of large-scale dairy producers based on concerns about safety and quality. Prior to a policy change in 2004 that is the focus of this study, small-scale dairy producers and traders were often harassed as large, powerful dairy market players, linked to those in authority, sought to increase their relatively small market share. The activities of SSMVs were not recognized and they could not trade unless licensed, yet the existing regulations made no provisions for licensing or engaging them. Kenya Dairy Board (KDB) was the main regulatory and enforcement body.

The revised 2004 Kenya dairy policy allowed the KDB to engage SSMVs through training and licensing as well as milk promotion. It was informed by the research and development activities of a program called the Smallholder Dairy Project (SDP). The SDP was a collaboratively implemented, integrated livestock research and development project

whose broad objectives focused on research and advocacy for review of an outdated dairy policy to officially recognize the existence and operations of SSMVs. The SDP was implemented by ILRI, the Kenya Agricultural Research Institute (KARI) and the Ministry of Livestock and Fisheries Development (MoLFD), and funded by the UK Department for International Development (DFID).

This *ex post* assessment of the impact of the revised Kenyan dairy policy outlines the policy change process, investigates induced behavioral changes at the levels of field regulators and SSMVs, and estimates economic impacts on producers, SSMVs, and consumers. It also provides a strategic assessment of the research and coordinating roles played by partners in a complex project that involved many people and organizations, and estimates how much of the overall gains can be attributed to this research and coordination component.

Objectives

This study was designed to evaluate the impact of a revised Kenyan dairy policy that encouraged relevant government agencies to engage with SSMVs, and in particular, to explore and analyze the role that research/coordination played in contributing to the policy change and the net benefits to the investment in the policy research component. Specific objectives include:

- Describe and better understand the policy, institutional, and behavioral changes that have occurred in Kenya's dairy sector; identify and learn lessons about how they occurred, and identify what role the research and coordination component of SDP played.
- Quantify transaction costs and evaluate how reduced transaction costs have impacted the prices paid by consumers and the prices received by producers.
- Measure the overall economic benefits of the policy change to consumers, producers, and SSMVs.

- Present a counterfactual situation, depicting what might have happened if SDP had not been implemented and dairy policy had not changed.

Methods, Data, and Sampling Framework

This study assesses the influence of the research on policy change and estimates the economic impact of the policy change. It describes the pathway from research to economic impacts on ultimate beneficiaries. SDP's learning process lessons are described in detail in Leksmono et al. (2006), and are therefore only summarized in this assessment, while an equilibrium displacement model is used to estimate welfare impacts of the revised Kenyan dairy policy. Field interviews were conducted in the Nairobi area and in Nakuru in August 2007, with a sample of 61 milk traders (30 from Nairobi and 31 from Nakuru) and 5 field regulators (3 from Nairobi and 2 from Nakuru). We also interviewed policy-makers, SDP researchers, and NGOs. The interviews with milk traders and field regulators were conducted between 1 and 10 August. Additional interviews with policy-makers and SDP researchers were conducted in June and July 2007, and in January 2008. Sample size and strategy were arbitrary, but were based on the need to collect information from as many traders as possible, given constraints of time and funds.

Research, Advocacy, and POR Inputs in SDP

During the initial research phase of SDP (1997–2000), the main objective of the project was to characterize the production environment and to develop 'best-bet' technologies that would enable small-scale milk farmers to overcome farming problems and improve their livelihoods (Leksmono et al., 2006). A rapid appraisal exercise was carried out in mid-1998, with the aim of examining the dairy production systems. This was followed by an economic and structural analysis of dairying. These analyses provided dairy stakeholders with an overview of the Kenyan dairy sector at that time, placing SDP in an informed position to contribute to ongoing discussions to influence changes in the Kenyan dairy policy.

The final phase of SDP (2000–2005) focused on policy-level outputs and more active engagement with policy-makers. Following a 'snapshot review' in 2000, which reported favourably on SDP's progress but noted that uptake of technologies at farm level was difficult in the prevailing policy environment, it was recommended that SDP develop a strategy for the reform of dairy policy, using evidence-based SDP research findings, in order to increase impact. SDP strategy for influencing policy focused on: research findings on the informal milk market, its importance for livelihoods, and ways of addressing public health concerns. Part of SDP's policy-influencing strategy was to foster links with civil society organizations (CSOs), KDB, SSMVs, and farmers to harness capacity to engage in policy advocacy in a way that the SDP-implementing institutions alone could not.

POR Output and SDP Research Findings

A review of SDP publications between 1997 and 2005 revealed 10 SDP research reports, 38 conference presentations (including 1 poster), 9 extension papers (some additionally published in Kiswahili or Kikuyu), 4 journal publications, 10 policy briefs, 1 International Service for National Agricultural Research (ISNAR) briefing paper, and 1 doctoral and 2 masters theses. Relevant SDP evidence supporting policy and institutional reform as gleaned from these documents include the following:

- Nearly 800,000 smallholder households depended on dairying for their livelihoods.
- At least 86 percent of marketed milk was sold through the informal sector as raw, unpasteurized milk.
- The informal market paid significantly higher prices to farmers, and sold milk to consumers at about half the price of processed, packaged milk.

SDP determined that the informal sector accounted for a large proportion of jobs in dairy marketing and processing, and that in the larger economy smallholder dairy farming also supported over 350,000 full-time wage positions including employment in milk collection, transportation, processing and sale. These findings on employment creation attracted the interest of government agencies and people involved in designing Kenya's Poverty Reduction

Strategy Paper (PRSP), some of whom, as a result, would later become strong advocates for the legalization of SSMVs. The number of farmers, SSMVs, and consumers dependent on informal milk marketing and the employment-generation potential proved crucial in influencing behavioral and policy change in the Kenyan dairy sector.

Policy Influence in the Kenyan Dairy Policy Change Process

While the history of liberalization in the Kenyan dairy sector goes back a long way, this summary focuses on the SDP era, which coincided with government efforts to make amendments to existing legislation – namely the 1958 Dairy Industry Act. In 1996, the government set up the Dairy Industry Act Review Task Force whose mandate was to propose amendments to the 1958 Act to reflect the liberalized policy environment in the dairy sector. The policy of ‘liberalization’ would rescind the monopoly status of the government owned-Kenya Cooperative Creameries (KCC), which was the sole buyer of raw milk and the sole seller of processed milk. KCC would henceforth compete with other large processors, but not with SSMVs. The activities of the Task Force were initially independent of SDP, and the review of the Act initially focused on KDB reorganization.

A draft revised policy document was prepared in 1997 and submitted to the MoLFD policy committee in 1998. In 1999, the MoLFD accepted the revised policy document, and in 2000, the revised draft bill from the Task Force. The two documents were harmonized in May 2000 and presented to the KDB and the Parliamentary Committee on Agriculture, Lands and Natural Resources in August/September 2000. In March 2001, stakeholders revised the bill and policy document, which were resubmitted to the Parliamentary Committee later that year. In 2003, the revised bill and policy documents were resubmitted to the reconstituted Parliamentary Committee, following elections in late 2002. Paid advertisements were placed in local newspapers touting the benefits of legalization, but these were met with rebuttals in the same media by large processors, culminating, by late 2003, in the ‘milk wars’. In May 2004, SDP and partners organized the Dairy Policy Forum, a consultative conference of stake-

holders at which it was agreed that the policy of engagement with SSMVs would be supported. Consequently, the MoLFD issued a set of dairy industry regulations (Legal Notices 101, 102, and 103) in September 2004, designed to streamline licence application processes for SSMVs. KDB officials used the impetus provided by these regulations to institute training, certification, and licensing requirements for SSMVs.

Behavioral Change among Field Regulators and SSMVs

In late 2004, field regulators instituted some changes in enforcement activities, following specific instructions from KDB and Public Health Department officials. Previous activities were limited to policing and impounding milk and milk containers from SSMVs because SSMVs were not allowed to engage in retail trade. Nowadays, their task is to ensure that licensed outlets and premises operated by SSMVs meet conditions on milk hygiene, testing requirements, sanitation of premises, and how to comply with these conditions. Some regulators also issue milk movement permits to mobile traders and assist the licensing process by enabling relevant paperwork. They have undergone formal training to obtain required skills on regulation.

Some of the regulators have not strictly followed the new requirements or instructions and believe that most trained and licensed traders do not strictly adhere to the new requirements. Infractions include the continued use of plastic containers instead of aluminium ones, the use of unhygienic premises, excessive adulteration, and illegal handling during transportation and distribution. While some regulators helped SSMVs to gradually comply with the requirements of the new regulation, others have meted punishments such as confiscating illegal containers and products, charging SSMVs to court, and in the most extreme cases, revoking licences. Before the new policy, violations by SSMVs were mostly punished by arrests; now, unlicensed and untrained SSMVs may be offered advice on how to get training and licensing. Shortage of regulatory staff has led to lax enforcement. Regulators do not accept that illegal payments were rife before or after the

policy change, but they suggest that legalization of the activities of SSMVs has made such payments much less likely.

Most of the respondents started their businesses in 2004 or earlier, i.e., before the policy change, and were therefore familiar with the policy enforcement environment before and after the policy change. Almost 50 percent of SSMVs were producer-traders, sourcing milk from their farms. The remainder were almost evenly divided among traders who were non-producers, transporter-traders, and milk bars, with most of their milk coming from other milk traders. Respondents were familiar with the new requirements on milk handling and quality control, and 85 percent of them had received training on milk handling and quality control, mainly between 2005 and 2007. Most SSMVs were licensed and the most common licences were milk bar licences (49 percent), milk movement permits (44 percent), and mini-dairy licences (15 percent). Approximately 23 percent of respondents had more than one operating licence. For example, typical SSMVs obtained milk movement permits which allowed them to transport milk to licensed milk bars that they co-owned with other SSMVs.

Since the new policy came into effect 40 percent of SSMVs reported that they have been harassed by KDB agents and other regulators in 2005 or later. The most common form of harassment was by confiscation of milk, but nearly 10 percent of SSMVs reported bribing their way out of a potential arrest situation. Nearly all licensed SSMVs who had been in operation before the policy change reported that there has been a change in the behavior of regulators toward them since licensing, noting that they were now allowed to operate so long as they complied significantly with all requirements.

Policy Impact on Transaction Costs: A Model of Equilibrium Displacement

Implementation of the revised Kenyan dairy policy would reduce transaction costs and hence, market margins. This study investigated the distribution of gains arising from reduced transaction costs using an equilibrium displacement model. We extend

Gardner's (1988) program effects model to include the impact of a reduction in the cost of marketing goods and services in the Kenyan dairy market (see Figure 1), to explain the notion of equilibrium displacement.

The model assumes that the market is competitive, with linear demand and supply functions. The supply of marketing goods and services is less than perfectly elastic, resulting in a normal supply curve. In Figure 1, we illustrate the impact of change in the Kenyan dairy policy on welfare gains by consumers, producers, and SSMVs. We posit a two-market scenario, a 'retail' market with demand for milk D_r and supply of marketing goods and services S_n , and a farm-level market, with derived demand for milk D_f and supply of milk S_f . We define market margin M as the difference between D_r and D_f , and assume that it comprises a fixed portion and a portion that varies with quantity. In the pre-policy change environment P_r is the price of milk in the retail market, P_n is the cost of supplying marketing goods and services in the retail market, P_f is the farm

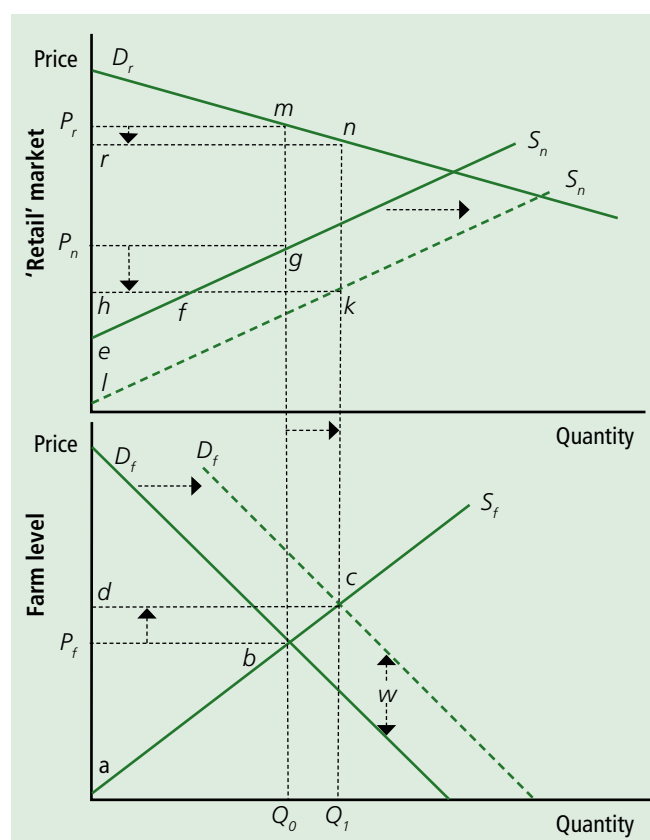


Figure 1. Distribution of returns from implementing the new Kenyan dairy policy

price for milk, and Q_0 is the initial milk quantity that clears the market.

To demonstrate the impact of the policy change, consider that the policy of training and licensing of SSMVs leads to a reduction in transaction costs or market margin arising from significantly lower political rent payments and milk losses. There is a reduction in the cost of supplying milk and milk products to the retail market, leading to a downward shift in the supply curve for marketing goods and services, and consequently a new derived demand curve. The proportional upward shift in derived demand reflects a reduction in the market margin M , by a cost w , which is measured as the vertical distance between the D_f and D'_f . There is an accompanying decrease in retail price, an increase in farm price, and an increase in quantity of milk supplied from Q_0 to Q_1 . Thus, there are unequivocal increases in consumer surplus by the area $P_r mnr$, producer surplus by the area $P_f bcd$, and surplus accruing to SSMVs by the area $efkl$, while losing the smaller $P_n gfh$. The welfare changes can be easily estimated.

We present an analytical model following Freebairn et al. (1982), slightly revised to exclude cost reductions at farm and input supplier levels. The competitive model of the post-policy change environment is presented as:

$$Q = \alpha_0 - \alpha_1 P^r \quad (1)$$

$$M = \beta_0 - w + \beta_1 Q \quad (2)$$

$$P^r = P^f + M \quad (3)$$

$$Q = \phi_0 + \phi_1 (P^f - P^i) \quad (4)$$

$$P^i = \delta_0 + \delta_1 Q, \quad (5)$$

where:

Q = the quantity of milk at the farm level (which clears the market at equilibrium),

P^r = milk price in the retail market,

P^f = milk price at the farm level,

M = the retail–farm price margin, and

P^i = the cost of non-farm inputs per unit farm output.

Equation (1) is the retail demand schedule, equation (2) is the SSMV schedule or market margin equation, equation (3) is the price

link equation, equation (4) is the farm supply schedule, and equation (5) is the input supply schedule. Algebraic solutions to the system of equations above (see Freebairn et al., 1982 for an intuitive insight into the derivations) are provided to estimate changes in surpluses to consumers as $\Delta CS = \phi_1 W / H$; marketers as $\Delta SSMVS = \beta_1 \alpha_1 \phi_1 W / H$; farmers as $\Delta PS = \alpha_1 W / H$; and input suppliers as $\Delta ISS = \delta_1 \alpha_1 \phi_1 W / H$,

where:

$W = Qh + \alpha_1 \phi_1 h^2 / 2H$ is aggregate welfare change,

$h = w$ is cost reduced by the policy, and

$H = (1 + \alpha_1 \beta_1) \phi_1 + (1 + \phi_1 \delta_1) \alpha_1$.

The parallel supply shift presented in Figure 1 represents a simplification; in reality shifts in supply could also be convergent or divergent.

Policy Impact and Changes in Market Margin

It is difficult to accurately identify and account for all relevant transaction costs. Therefore this study expressed transaction costs in terms of retail–farm price margins. The study used recall information from SSMVs due to lack of information on actual prices paid and received during the periods before and after the policy change. Results for daily milk purchase and sale prices are presented in Table 1.

The study used September 2004 as the policy change date, and asked SSMVs to recall transactions in the immediate pre-policy change days, and then compare those to similar transactions in August 2007. In the Nairobi area, there was a Ksh0.80 per liter decline in margin that may be attributed to the new policy's effect of reducing market margins. In Nakuru, the decline in margin attributed to the impact of the new policy was Ksh0.27 per liter. Tests revealed that in Nairobi, post-policy change margins were significantly lower than pre-policy change margins (Mann-Whitney $Z=1.36$; $P=0.087$). However this was not the case for Nakuru. Consequently, we estimated separate measurements of welfare for Nairobi and economy-wide. Over all locations, the study found a Ksh0.54 per liter reduction in margin, equivalent to 9 percent of the pre-policy change margin. While the decline

Table 1. Average daily prices of milk and market margins before and after the policy change

	Nairobi price (Ksh/liter)			Nakuru price (Ksh/liter)		
	Purchase	Sale	Margin	Purchase	Sale	Margin
Average for all SSMVs						
Before policy change	15.35	21.48	6.13	14.42	20.85	6.42
After policy change	16.60	21.93	5.33	15.81	21.96	6.15
Reduction in margin attributed to policy change			0.80			0.27
Average margin over all locations and trader types, before policy change						6.26
Average margin over all locations and trader types, after policy change						5.72
Over all average reduction in margin attributed to policy change						0.54

Source: Survey data, 2007

in market margin may have a time dimension accounting for other factors such as fuel costs, the simplistic framework applied assumes that such costs are minimal, and hence attributes all margin reductions to the policy change.

Welfare Changes Attributed to Revised Dairy Policy

We used the economic model outlined above to estimate changes in surpluses that accrue to consumers, farmers, SSMVs, and input

suppliers. We then compared the aggregate of these changes to project costs in order to also estimate the profitability of a POR project: the SDP. We used values presented in Table 2 to estimate welfare changes economy-wide and for the Nairobi area.

We used SDP data for raw milk production in Kenya, updated in 2005 (SDP, 2005). Farm and retail prices were obtained from the surveys. Following Salasya et al. (2006), we used housing as a non-farm input, and expressed the cost of housing obtained from

Table 2. Variables for estimating economy-wide and Nairobi area welfare changes attributed to the new dairy policy

Variable description	Symbol	Value (economy-wide)	Value (Nairobi area)	Source of information
Raw milk production	Q	4016 million liters	493 million liters	SDP (2005), Nairobi data recalculated using SDP consumption data, and Nairobi population
Retail price	P_r	Ksh21.57/liter	Ksh21.70/liter	Study survey
Farm price	P_f	Ksh15.58/liter	Ksh15.97/liter	Study survey
Non-market input cost per unit of output	P_n	Ksh7.06/liter	Ksh6.90/liter	Estimated using data from Salasya et al. (2006) and updated SDP milk production data
Elasticity of milk demand at retail	r	-0.97	-0.97	Salasya et al. (2006)
Elasticity of milk supply at farm	e_f	0.35	0.35	Salasya et al. (2006)
Elasticity of marketing services supply	e_m	2	2	Freebairn et al. (1982)
Cost reduction due to changes in transaction costs	w	Ksh0.54/liter	Ksh0.80/liter	Study survey

that study (Ksh1313 per month) per unit of raw milk produced *per annum*. We used own price elasticities of demand and supply from the same study. We found no comparable previous studies measuring elasticities of marketing services and marketing inputs, but Freebairn et al. (1982) mention evidence of highly elastic long-run supply curves, thus using a value of 2 or ∞ for illustrative purposes. Results are presented in Table 3.

Total benefits accruing to the sector from the policy change are estimated at Ksh2,174.88 million (equivalent to US\$33.5 million at an exchange rate of US\$1 = Ksh65) *per annum*. More than half of the benefits accrue to producers and consumers. Nairobi area welfare gains account for approximately 18 percent of the economy-wide gains.

The NPV of the stream of net benefits was calculated for the economy-wide model. We assumed that research costs (US\$5 million) were equally spread over the first 8 years, corresponding with the life of the project and ending with the year 2004 when the policy change was effected: total DFID funding for SDP was US\$2.5 million over an 8-year period, plus an estimated US\$2.5 million from in-kind contribution by SDP partners. Benefits were assumed to start accruing in year 2005 and, for the purpose

of this analysis, to the year 2039. However, in the year when benefits start accruing, we impute additional costs of training and licensing of SSMVs, cess fees, and other statutory costs, amounting to Ksh864 million *per annum* (ILRI, undated, for cost estimates). Because the system was designed to be sustainable, costs of training and certification would be borne by SSMVs. Based on discussions with KDB officials we estimated that 50 business development services (BDS) providers (the target figure for KDB) would train approximately 160 SSMVs per week. SSMVs pay Ksh1000 for training (Ksh8.3 million *per annum*). Trained SSMVs pay an annual license fee of Ksh3,500 (Ksh29.12 million *per annum*). SSMVs and producers pay cess fees to KDB at Ksh0.20 per liter (Ksh803.17 million *per annum*). Alongside the policy change is a continuing requirement that KDB collects a tax on all milk sold. This tax is called a cess fee, and may be collected at the farm level. However, because small-scale producers are not easily tracked, unlike large producers, KDB officials sometimes collect cess fees at bulking and collection points where SSMVs operate. This adds a tax burden on SSMVs. Finally, SSMVs pay other statutory costs, including municipal/council fees, commerce fees, and health inspection fees of Ksh2,811 (Ksh23.39 million *per annum*).

Table 3. Distribution of gains from the policy change

Change in benefits (Ksh m)	Reduction in transaction cost at SSMV level			
	Economy-wide		Nairobi area	
	Ksh (m)	US\$ (m)	Ksh (m)	US\$ (m)
Annual benefits to consumers	520.84	8.01	95.01	1.46
Annual benefits to producers	1042.62	16.04	193.78	2.98
Annual benefits to SSMVs	280.60	4.32	48.67	0.75
Annual benefits to input suppliers	330.82	5.09	58.63	0.90
Total annual benefits	2174.88	33.46	396.09	6.09
Annual expenditure on SDP (1997–2004)	40.63	0.63		
Annual costs of training and licensing (2005–2039)	37.42	0.58		
Annual cess fees (producers and SSMVs, 2005–2039)	803.17	12.36		
Other annual statutory costs (2005–2039)	23.39	0.36		
Benefits minus costs (economy-wide)	1270.27	19.53		
NPV@1.99%	28,288	435		
NPV@5.00%	14,979	230		
NPV@15.00%	3,051	47		
Internal rate of return (IRR) = 55%				

We use interest rates of 1.99 percent (real interest rate in Kenya; base year 2007), 5 percent, and 15 percent, the higher rates to account for inherent risks in some projects. At 1.99 percent interest rate, NPV equals Ksh28,288 million, Ksh14,979 million at 5 percent, and Ksh3,051 million at 15 percent. SDP costs are easily recouped, the NPV being greater than zero under all three interest-rate scenarios. This project will continue to be worthwhile until the cost of capital exceeds 55 percent (equivalent to IRR). The annual benefits to SSMVs from the policy change of Ksh280.60 million fall far below the estimated total annual costs of fees, training etc. of Ksh864 million. Hence if a significant portion of these costs, especially cess fees, are assessed at SSMVs levels, SSMVs would be worse off as a result of the policy change, which is contrary to what was intended by SDP and advocacy partners. This raises questions about the appropriateness of the cost-sharing arrangements in the implementation of the regulatory changes.

We re-estimated welfare benefits of the POR using new estimates of margin reduction derived from Salasya et al. (2006) – 38 percent of the pre-policy change marketing margin, which amounts to Ksh2.38 per liter in this study. The model is highly sensitive to changes in costs. Hence, total annual benefits resulting from the margin change amounted to Ksh9,639.62 million (US\$148 million). These large differences in welfare benefits reaffirm the need to precisely estimate marketing margin changes that are attributed to the revised policy.

Creating a Counterfactual and Attributing Impact

When policy-makers and researchers were asked how long it would have taken for the policy change to occur without SDP, the former SDP Project Manager stated that without SDP it would have taken nearly 20 years for SSMVs to be engaged by regulatory bodies. An SDP researcher noted that some changes would have occurred given the strong vested interests in the dairy sector and the raging debate, but the change would have been uncertain and ill-informed. SDP provided the evidence, which catalyzed, speeded up, and swayed the debate in one direction. Attributing the benefits of policy change in a multi-institution effort is not a

trivial exercise. The policy change is technically still in process, both with regards to the final parliamentary passage of the main regulation and to implementing current training and licensing activities. Consequently, the problem of attribution is compounded by an outcome that is yet unclear and not easily measurable.

Finally, to present a measure of economic impacts without SDP, we present estimates of NPV, first assuming that the Kenyan policy review and legalization of SSMVs would have been delayed by 20 years without SDP, and a more conservative estimate of 10 years, with benefit streams extrapolated through 2039. A simplifying additional assumption is that there is no additional investment or benefits until the year in which legalization occurs (i.e., 2014 or 2025). The differences in NPV are presented in Table 4.

Table 4 shows that NPV continues to be positive even as legalization is postponed beyond 2004 when SDP influenced policy change. Secondly, the directly attributable impacts of SDP, as measured by the differences in outcomes with and without SDP, are also positive, suggesting that legalization is essentially beneficial.

Summary and Conclusions

This study built upon and benefited from a recent analysis of policy change processes in the Kenyan dairy sector, that included where and how research results informed these changes and who used them. These ‘process’ lessons were complemented with an *ex post* economic analysis of benefits and costs of the SDP policy-related efforts.

SDP produced a significant volume of evidence that was used to influence the policy change process at various stages. Although the Kenyan dairy policy document and bill have been in parliamentary process for more than a decade, written ministerial subsidiary regulation plus KDB reorganization provide ample regulatory authority for engaging SSMVs, and this significant shift in dairy regulation was traced to September 2004. The study found significant evidence of behavioral change among regulators and SSMVs that has led to positive economic

Table 4. Differences in NPV (with and without SDP)

Time delay	Interest rate (%)	NPV (without SDP)		NPV (with SDP – without SDP)	
		Ksh million	US\$ million	Ksh million	US\$ million
10 years later (i.e., legalization occurs in 2014)	1.99	18,329.35	281.99	9,959.57	153.22
	5.00	8,060.72	124.01	6,917.92	106.43
	15.00	787.42	12.11	2,263.61	34.82
IRR (%)	108				
20 years later (i.e., legalization occurs in 2025)	1.99	9,901.65	152.33	18,387.27	282.88
	5.00	3,644.45	56.07	11,334.19	174.37
	15.00	176.07	2.71	2,874.96	44.23
IRR (%)	62				

benefits across Kenya. The study showed that market margins in Nairobi area were significantly different from margins in Nakuru. Policy impacts in Nairobi may have led to significantly lower margins in the post-policy change environment.

Welfare benefits arising from the policy change were high, and were also captured by both consumers (through lower milk prices) and producers. A cost–benefit analysis revealed that the policy change was highly profitable, with a high positive NPV. In addition, the very high IRR value suggests that positive net benefits will continue to be gained by many actors in the dairy sector for years to come. However, the government must devise a fairer way of distributing the cost of cess among consumers, producers, and SSMVs, rather than assessing a significant portion at the level of SSMVs.

References

- Freebairn, J.W., Davis, J.S. and Edwards, G. W. 1982. Distribution of gains in multi-stage production systems. *American Journal of Agricultural Economics*, 64, 39–46.
- Gardner, B.L. 1988. *The Economics of Agricultural Policies*. MacMillan Publishing Co: New York, USA.
- ILRI (International Livestock Research Institute). Undated. Promotion of up-
take of new institutional approaches and appropriate technology to transform informal milk markets in East Africa. International Livestock Research Institute (ILRI): Nairobi, Kenya.
- Leksmono, C., Young, J., Hooton, N., Muriuki, H. and Romney, D. 2006. *Informal Traders Lock Horns with the Formal Milk Industry: The Role of Research in Pro-Poor Dairy Policy Shift in Kenya*. ODI Working Paper No. 266. Overseas Development Institute (ODI): London, UK and International Livestock Research Institute (ILRI): Nairobi, Kenya.
- Omoro, A., Muriuki, H.G.M., Kenyanjui, M., Owango, M., and Staal, S. 2004. *The Kenyan Dairy Sub-Sector: A Rapid Appraisal*. SDP Research and Development Report. Smallholder Dairy Project (SDP): Nairobi, Kenya.
- Salasya, B., Rich, K., Baltenweck, I., Kaitibie, S., Omoro, A., Murithi, F., Freeman, A., and Staal, S. 2006. *Quantifying the Economic Impacts of a Policy Shift Towards Legalizing Informal Milk Trade in Kenya*. ILRI Markets Theme Discussion Paper No. 1. International Livestock Research Institute (ILRI): Nairobi, Kenya.
- SDP (Smallholder Dairy Project). 2005. *The Uncertainty of Cattle Numbers in Kenya*. SDP Policy Brief No. 10. Smallholder Dairy Project: Nairobi, Kenya.

3.6. Economic Assessment of Policy-orientated Research on the Private Health Costs of Pesticide Use in the Philippines

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Introduction

POR is research undertaken primarily to influence policy as a means of generating ultimate impact. However, despite the growing investment in POR, studies undertaken to assess the impact of these investments are extremely limited. The main reason being that measuring the impact of a policy change quantitatively, and attributing that impact to those factors that influenced policy-makers, is particularly complicated. Nevertheless, given the increased spending on POR, the methodological difficulties of quantification and attribution do not diminish the need for being able to demonstrate the value of investment in this endeavor.

The main aim of the paper is to estimate the economic value of the private health costs saved due to the 1992–1996 pesticide policy package (PPP) in the Philippines. Additionally, those factors that brought about or influenced the government's decision to change the policies on pesticides and pest control practices and, where possible and justified, to attribute the policy-induced benefits to the key players, with a focus on relevant research undertaken by IRRI are examined.

Background to the IRRI-led POR

In the Philippines, the widespread use of pesticides in rice production expanded rapidly during the 1970s and into the 1980s. This was largely due to concerns that crop losses from pest infestation would negate the benefits gained from planting modern rice varieties. Even the release of early pest-resistant varieties did little to alleviate those concerns. However, by the 1980s, it was clear that the indiscriminate use of pesticides could cause an ecological imbalance that can exacerbate, rather than alleviate, a pest

problem. Moreover, at the same time, a body of research was providing evidence of negative environmental and human health effects from the excessive use of pesticides – particularly insecticides.

During 1989 to 1992, IRRI contributed to the body of research on the harmful effects of pesticide use through a number of detailed analyses of private health costs and environmental effects of pesticide use in rice farming in the Philippines (Pingali et al., 1989; Márquez et al., 1990; Pingali and Márquez, 1990; Pingali and Palis, 1990; Antle and Pingali, 1991, 1994; Pingali et al., 1992; Rola and Pingali, 1993; Pingali and Roger, 1995). The uniqueness of the IRRI research was that it was the first study to place an economic value on the chronic effects of long-term use of pesticides in rice production. In particular, the analysis showed that the private health cost of using insecticides in rice production is large and overwhelms any potential economic gains. The primary policy recommendation resulting from the IRRI POR on pesticide use was to restrict the use of hazardous insecticides by imposing and implementing bans on those insecticides that pose acute or chronic health effects, and/or adversely affect the environment or, if banning is not feasible, to apply a selective pricing policy, taxing the more-hazardous (Category 1) pesticides at higher rates than the less-toxic pesticides.

While policies banning the use of some hazardous¹ pesticides were enacted by the Fertilizer and Pesticide Authority (FPA) of the Philippines in the early 1980s and in 1989, in response to the growing health concerns, the Ramos administration undertook a multi-pronged approach to the judicious use of pesticides from 1992 to 1996. As such, the FPA instigated a suite of pesticide regulatory policies and implemented guidelines aimed at banning or restricting the use of common-

ly used but highly toxic insecticides in rice production and encouraging safer pesticide management practices.

Impact Pathway

While establishing links between research to policy change to impact may appear to be theoretically fairly straightforward and logical, in practice it is a difficult task. This is because there are a large number of factors that can influence the policy-formulation process. As the task of the impact analyst is to assess the success (or otherwise) of research in terms of realized outputs, outcomes, and impacts, explicitly mapping out the components of the path from inputs, outputs, dissemination (or uptake), influence, and impact helps to clarify the essential elements of a robust PORIA. In addition, it is necessary to understand how policy-makers receive policy recommendations to clarify the source of information, types of influence, and advocacy behind policy formulation.

To illustrate, Figure 1 presents a stylized impact pathway for POR on the adverse effects of pesticide use in the Philippines. Central to this example is the pathway from the IRRI-led research on pesticide use and farmers' health to the chosen indicator of impact, which is the change in health costs (depicted by the solid gray shaded boxes). This does not mean to imply that IRRI's research was a necessary or sufficient precursor to the policy change. Rather, it is depicted this way because it is central to the research question addressed in the PORIA case study. The question was: "Did IRRI's research influence the policy change and, if so, how many of the potential benefits from the policy-induced changes in farmers' pesticide practices can be attributed to that research?"

As depicted in Figure 1, there are a number of factors that are likely to have influenced the implementation of the 1992–1996 PPP. For a start, rarely is any research study on any particular researchable issue unique, nor is that issue the only one likely to influence policy-makers on any given topic. The other research explicitly considered in the PORIA is non-IRRI research on the health implications of pesticide use. However, even though the

body of health-related research conclusively showed that insecticides are harmful to the health of farmers and contracted sprayers, policy-makers may still not have been willing to ban highly toxic insecticides if they had not been confident that farmers had alternative means of pest control. The research and development of pest-resistant rice cultivars and integrated pest management (IPM) had provided farmers with less-toxic alternatives to pest control since the mid- to late-1970s. As confirmed by discussion with the key informants, the results of IPM research, validating that more-judicious use of pesticides would not result in yield losses, was considered by the Pesticide Policy and Technical Advisory Committee (PPTAC) when providing pesticide policy advice to the FPA.

Changes in a country's political environment can also directly impact on a policy-maker's ability to enact policy. Therefore, an understanding of broader policy platforms can provide information on the likelihood of the policies being enacted, and on degree of enforcement. In the case of the PORIA study, a paradigm shift in the Philippine agricultural agenda, from one that strongly encouraged the widespread use of agricultural chemicals (Marcos regime, 1965–1986) to one that explicitly considered the harmful effects of pesticides on the environment and human health (Ramos era, 1992–1998) provided policy-makers with a strong political platform upon which policies that promote the safe and judicious use of pesticides could be pursued. This enabled the 1992–1996 PPP to be implemented. This resulted in the banning or restriction of numerous hazardous insecticides that were commonly used by farmers, and the promotion of safe and effective use of pesticides through educational activities and product stewardship by the industry and government. Indeed, it would not be an overstatement to say that without the strong political will at that time, the ratification of the 1992–1996 PPP may have been compromised.

Given the changing global environment, international codes of conduct, regulations, and alliances can also stimulate change in domestic policies. This global reach goes beyond trade policies. The Philippine's participation in international conferences organized by FAO and the World Health

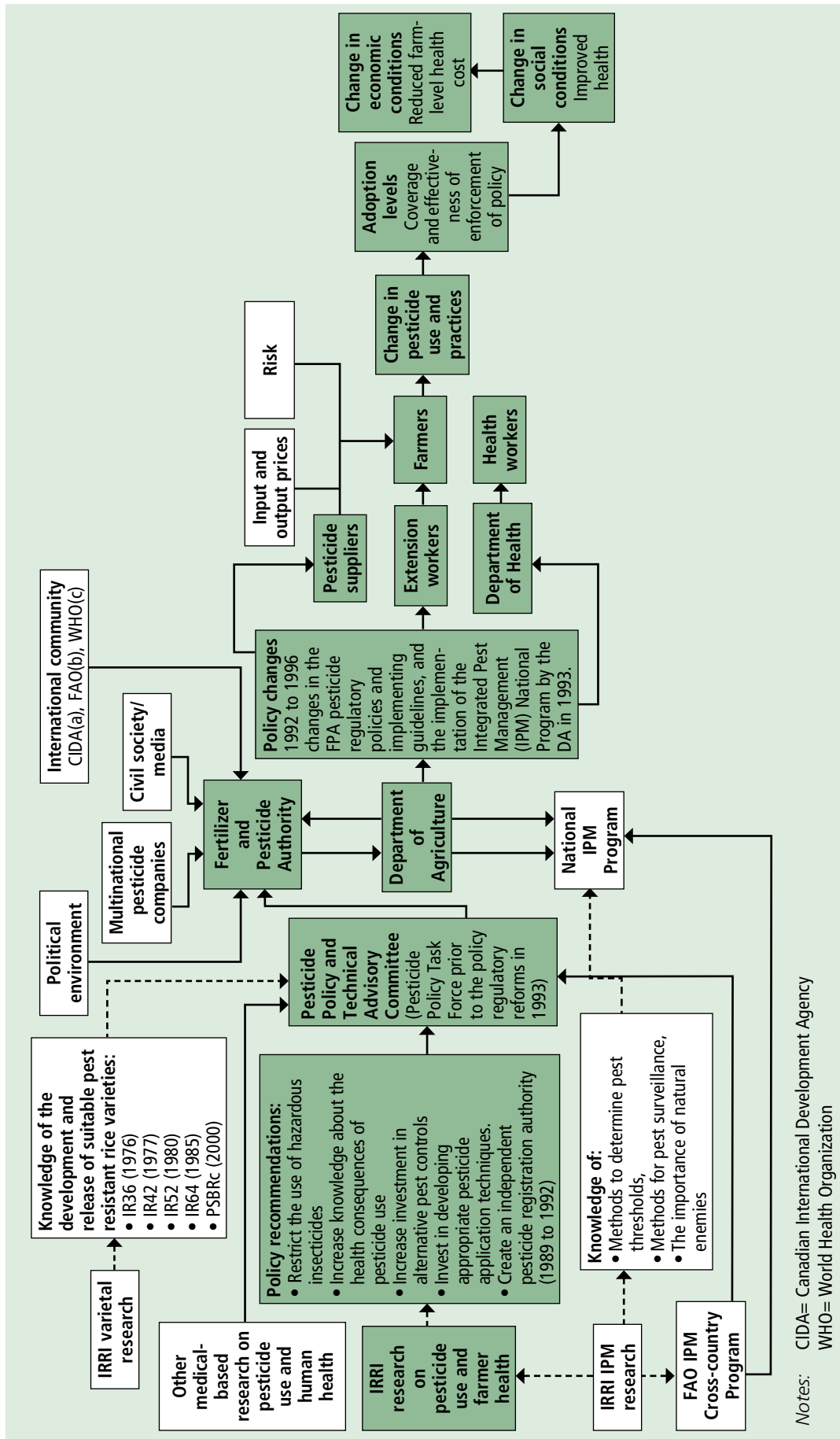


Figure 1. Impact pathway for PORIA of changes in the Philippine pesticide policy

Organization (WHO) on the harmful effects of toxic agricultural chemicals and the Philippine's adoption of international guidelines on the classification, production, distribution, and use of agro-chemicals would have influenced the policy-makers' resolve to reduce the number of harmful pesticides available to farmers.

Policy changes can also have a significant affect on the profit or operation of national or multinational companies. As such, these companies may lobby for or against the implementation of those policies. As pesticides have to be registered with the FPA before they can be imported, manufactured, distributed, sold, and used in the Philippines, there has traditionally been a strong working relationship between the pesticide companies and the FPA. However, this relationship was put to test when the Philippine government brought about changes in pesticide regulatory policies that had a direct impact on the operation of multinationals in the Philippines. As such, it is not surprising that there was some industry opposition to pesticide policies that imposed outright bans or significant restrictions on the sale of commonly used pesticides. Nevertheless, the pesticide industry also supported the 1992–1996 PPP through increased stewardship endeavors designed to educate farmers in safe and effective application, storage, and disposal practices, and by undertaking research into the development of new environment-friendly compounds that are toxic to pests at low doses.

The media and civil-society groups can also trigger policy discussions by bringing issues to public attention and keeping them there, or they can provide support to changes in government policy. While the media and civil-society groups may not have influenced the formulation and implementation of the 1992–1996 PPP, their backing at the time of industry opposition was valuable.

Changes in Policy and Regulations

The 1992–1996 PPP represents a multi-pronged approach to the safe and effective use of pesticides that directly targeted:

- The use of highly toxic insecticides in rice growing

- Regulatory policies and implementing guidelines on the importation, formulation, distribution, sale, and use of pesticides
- The illegal smuggling of pesticides
- Regulation on the labeling and advertising of pesticides
- Hazard awareness through the agro-medical training program, which trained rural health officers in the recognition and treatment of pesticide poisoning cases, as well as training the dealers, farmers, and Department of Agriculture field personnel on the safe handling of pesticides
- Improved product stewardship undertaken jointly by the pesticide industry and the government.

Indicators of the Effectiveness of a Policy Change

Once the policy had been clearly established, the next step was to determine whether the 1992–1996 PPP made a discernable difference at farm level. This was done by:

- Examining changes in the trends in the quantity of insecticides used over time
- Comparing survey data on the type of pesticides used and pesticide handling, and storage, and disposal practice
- Looking at changes in the incidence of pesticide poisoning.

While the aim of the package was to bring about changes in the type of insecticides used (from more- to less-hazardous) and in insecticide management (towards safer application and storage methods) rather than the quantity used, a change in the quantity was still of interest for two reasons. Firstly, it provided a benchmark by which to measure changes in exposure not necessarily due to the policy change. Secondly, because more-hazardous insecticides are cheaper than less-hazardous insecticides, the banning of cheaper insecticides indirectly raised the cost of chemical pest control to farmers, which a priori would lead to a reduction in the total quantity used. Data from IRRI farm-level surveys undertaken in Laguna, Nueva Ecija, and Quezon showed that insecticide use fell from 0.8 kg active ingredient (ai)/ha in 1991 to 0.16 kg ai/ha by 2004 – only 0.06 kg ai/ha above the pre-Green Revolution levels.

Further comparison with farm-level household survey data showed that by 2007 rice farmers were using safer pesticides and had adopted safer pesticide management practices than they were using in 1991. Moreover, these changes in insecticide use and management practices have resulted in a reduction in the incidence of insecticide-induced illness. In addition, hospital records on the type and incidence of pesticide poisoning show that not only has the incidence of acute pesticide poisoning fallen, but also that the primary cause is no longer Category I insecticides, confirming the findings of the survey data.

Estimating the Economic Benefits of the Policy Change

Having determined that the implemented policy has resulted in the targeted change, the next step is to quantify the magnitude and distribution of the policy-induced benefits. Following Pingali et al. (1994) and Pingali et al. (1995), the economic value of these changes was measured in terms of reduced health costs² per person per ha. However, all benefits and costs were not captured in this single measure. While the health cost value, which is based on the medical costs of the farmers and the opportunity cost of reduced productivity due to pesticide-induced health impairments, is relatively comprehensive, it could still be considered an underestimation because:

- The strength of the detailed medical assessment lies in its ability to detect chronic and sub-acute effects; a weakness is the inherent bias to survivors. Moreover, the medical examinations measured symptoms associated with long-term exposure to pesticides, while pesticide application data used in the estimation were for a single season. Therefore, the regression results may have underestimated the size of the relationship between pesticide exposure and health impairments. The value of foregone leisure and reduced life expectancy are also not included in the health cost function (Antle and Pingali, 1994).
- The opportunity cost is limited to rice growing and does not include the lost ability to earn off-farm income. However, as over 90 percent of the farm area is devoted to rice on irrigated and rainfed

rice farms, and off-farm income in the surveyed areas is less than 10 percent of the total income, this limitation is not considered to be significant.

- There could be other non-quantifiable health-related utility gains that are not included in the health cost estimation. These could stem from:
 - The general sense of feeling well
 - The knowledge that other household members no longer have to spend time caring for those affected by insecticide exposure
 - The peace of mind that comes from the knowledge that the risk of chronic and terminal effects of pesticide use has been reduced, as has the risk of intentional and accidental death caused by insecticides.
- The effect of pesticide exposure to other family members is omitted from the analysis. However, while women wash clothes that contain insecticides, they do not mix or spray the insecticides and so their exposure is relatively limited.
- The reduced economic burden on the public medical system due to a fall in insecticide-related illness is not included because of lack of data.

Notwithstanding the importance of the omitted private and public gains from the reduced use of pesticides and changes in pesticide practices, it was decided that the computations of the change in health costs provide reasonable 'base' estimates.

The estimated economic benefit is based on the observed fall in insecticide use and a 50 percent reduction in insecticide toxicity levels. The 50 percent reduction in toxicity levels is based on the observed change in the types of insecticides used in rice production (from extremely or highly hazardous to moderately or slightly hazardous) and the adoption of safer pesticide management and storage practices by rice farmers. This figure is considered to be realistic according to a prominent Philippine expert in pesticide toxicity and human health. It is also in line with the 50 percent fall in the incidence of pesticide poisoning reported by the farmers surveyed in Nueva Ecija (1989 and 2007) and Laguna (1988 and 2007).

Total benefits are estimated by multiplying the estimated fall in private health costs by

annual data on the number of hectares used for rice production and a 'compliance' rate to obtain an annual gross value. While it could be argued that any policy change would result in an immediate compliance of 100 percent, this is rarely the case. With this in mind, it is assumed that the decrease in insecticide use and change in pesticide management practices happened gradually, reaching a maximum adoption level of 80 percent. The underlying premise for this assumption is that it takes time for farmers to receive information on alternative pesticide and pest-control practices and then to respond to information. Even an outright ban on pesticides did not result in immediate compliance as evident from the FPA circulars and media reports. The relatively high maximum level of adoption of 80 percent is based on 2006–2007 survey data, which shows that over 99 percent of the chemicals being used by the respondents were registered for use in rice production in the Philippines and that over 80 percent have adopted safer pesticide managements.

The gross value of the annual benefits is then discounted, using a 5 percent discount rate, to obtain a present value of benefits over a 30-year simulation period³. The 30-year time span is then divided into two distinct time periods, 1989–2006 and 2007–2018, to provide estimates of realized and projected benefits, respectively. The present value of the economic benefit from the reduction in insecticide use and a change in insecticide types and pesticide management practices is estimated to be around US\$3.3 billion, comprised of just under US\$1.6 billion realized benefits and US\$1.8 billion projected benefits.

Attributing the Economic Benefits to the 1992–1996 Pesticide Policy Package

Clearly, within the rapidly changing global environment, the agricultural sector is very dynamic. Therefore, the observed changes may not be due solely to policy change. Other factors (outside the policy arena) that may have contributed to a continued reduction in pesticide use include the continued spread of pest-resistant varieties, and changes in the price of rice and the cost of insecticides. Recognizing that factors other than

the 1992–1996 PPP are likely to have contributed to the observed changes in insecticide use suggests that attribution should be based on relative importance. While quantification of the cause-and-effect scenarios for such a complex issue is very difficult, given the purpose and broad coverage of the 1992–1996 PPP including the effect it had on the cost of insecticides, it seems reasonable to assume that the policy package was the primary driver of the change in insecticide use and practices. Consequently, a conservative measure of the contribution of the 1992–1996 PPP to the welfare gains from the reduction in health costs is 75 percent of the total benefits. This, in essence, is equivalent to attributing most of the change in the insecticide types used and the management practices to the policy change, but only 50 percent to the change in the quantity of insecticide used. (For further details see Templeton and Jamora, 2008).

Subjective Assessment of the Factors that Influence Policy

Now that the economic benefits attributable to a policy change have been estimated, the next step is to examine the factors that influenced the policy package. Influence analysis attempts to determine the extent to which the impressions and/or responses of policy-makers involved in relevant policy processes have been changed (or confirmed) by specific information sources. The assessment of the factors that influenced the changes in the regulatory pesticide policies and implementing guidelines that took place 1992–1996 is based on information from a number of key informants. These included past and present FPA officials, members of PPTAC and the Pesticide Policy Review Committee, the National IPM Program Coordinator, members of the pesticide industry, and an agricultural economist. In addition, a thorough media review was undertaken to gain an understanding of how 'news-worthy' the issues surrounding pesticide use, its impact on human health, and the changes to the pesticides regulations were.

It should be noted that a major enabler of the 1992–1996 PPP was the policy environment at that time. It was characterized by a strong political will, a receptiveness to

change, and the existence of trust between and among those most responsible for agricultural policy in the Philippines at the time. The importance of this enabling environment cannot be over-stated. However, in this analysis, it is treated as an enabler to change rather than an influencer of change. The influencer that was subjectively ranked the highest by the key informants is local health-related research. International health studies were also considered to be highly important. The next most highly ranked are international alliances and regulations, and research on IPM. This was followed by the IRRI research on the health impacts of pesticide use in rice production. In general, NGOs, civil society groups, environmental studies, and the media were not seen to be significant drivers of the policy change. The media, however, was important in bringing to the public's attention the industry opposition of the pesticide bans and restriction, which rallied public support for the FPA decisions (see Templeton and Jamora, 2008).

Quantifying influence is a difficult task, resulting in a subjective assessment being the common course of action. For this reason, the question of how much of the estimated gains from the implementation of the 1992–1996 PPP are attributable to IRRI's research on pesticide use and farmers' health is a difficult one to address. However, the research question central to the PORIA case study is – “Did IRRI's research influence the policy change and, if so, how many of the potential benefits from the policy-induced changes in farmers' pesticide practices can be attributed to that research?” As such, it is necessary to apportion some of the total benefits to the IRRI research.

As a starting point, it is clear that despite the fact that there are differing views on the relative importance of each of the influencing factors mentioned, a reasonable conclusion is that IRRI research on the private cost of pesticide use to rice farmers in the Philippines did play a role in bringing about the 1992–1996 PPP. Using the relative importance approach to attribution, which apportions the share of benefits on the basis of a subjective assessment of contribution, a conservative estimate of the contribution made by IRRI is in the order of 10 percent.

Benefit–Cost Analysis

The final step is to compare the measured benefits attributed to the POR with the cost of undertaking this research to calculate the NPV, IRR and/or the BCR. Under the two key assumptions (75 percent attribution and 10 percent contribution), the analysis shows a strongly positive return to the investment in the IRRI project. The NPV of IRRI's influence on the policy-makers' decisions to implement the 1992–1996 PPP is estimated to be US\$248 million over the 30-year time horizon (1989–2018). The corresponding BCR is 202:1 and the IRR is 65 percent (Table 1). The returns to investment are high because for a relatively small investment of a million dollars, the outputs of the IRRI project contributed to a policy change that resulted in very large benefits in terms of the private health costs avoided.

Table 1. Benefit–cost analysis results

Item	
Total (realized + projected) benefits (1989–2018)	
Present value	250 (US\$million)
NPV	248 (US\$million)
BCR	202:1
IRR	65%
Realized benefits (1989–2007)	
Present value	118 (US\$million)
NPV	117 (US\$million)
BCR	96:1
IRR	65%

Conclusions

While establishing a link between research and policy change may theoretically appear to be fairly straightforward and logical, in practice it is a difficult task. This is because, in general, there are a large number of factors that can influence the policy-formulation process. The main factors likely to have influenced the implementation of the 1992–1996 PPP are research, the change in the Philippine government's broader agricultural and environmental policies, international pesticide codes of conduct and regulations, the demands of industry and the concerns of

civil society and the media. The aim of this chapter is to estimate the economic value of the private health costs saved as a result of the package and, where possible and justified, to attribute the policy-induced benefits to the key players, with a focus on relevant research undertaken by IRRI.

This chapter highlights a number of methodological-type issues. Firstly, given the difficulties in assessing the impact of POR, the policy component of the research being assessed, and the policy and regulatory changes that occurred need to be clearly defined. Secondly, explicitly mapping the components of the path from inputs to impact helps to clarify the essential elements of a robust PORIA. Thirdly, a detailed media/internet search and comprehensive interviews with key informants are essential in unraveling the complex nature of the policy process and compliance. Fourthly, as attribution and influence are difficult to quantify, the analyst may need to rely heavily on subjective assessment to determine the likelihood and extent of influence. Finally, given that the effects of a policy can be far-reaching, it may not be possible to quantify the full impact of the policy change.

In this chapter, quantitative and qualitative methods were used to determine the returns to the IRRI-led research on the adverse effects of pesticide use in rice growing in the Philippines. As such, the conclusion drawn from the analysis is that, even under the most conservative assumptions, the returns to the investment in the IRRI-led research were significant.

References

- Antle, J.M. and Pingali, P.L. 1991. *Pesticides, Farmer Health and Productivity: A Philippine Case Study*. Paper presented at the International Association of Agricultural Economists, 22–29 August 1991, Tokyo. IRRI Social Sciences Division Paper No. 91–10. International Rice Research Institute (IRRI): Los Baños, Laguna, the Philippines.
- Antle, J.M. and Pingali, P.L. 1994. Pesticides, farmer health and productivity: a Philippine case study. *American Journal of Agricultural Economics*, 76(3), 418–430.
- Davis, J., Gordon, J., Pearce, D., and Templeton, D. 2008. *Guidelines for Assessing the Impacts of ACIAR's Research Activities*. ACIAR Impact Assessment Series Report No. 58. Australian Centre for International Agricultural Research (ACIAR): Canberra, Australia.
- Márquez, C.B., Pingali, P.L., Palis, F.G., Rodriguez, V.C., and Ramos, M.G.P. 1990. Evaluation of the health effects of pesticide use among Laguna farmers. In: *Proceedings of the Workshop on Environmental and Health Impacts of Pesticide Use in Rice Culture, 28–30 March 1990, Los Baños, the Philippines*. International Rice Research Institute (IRRI): Los Baños, the Philippines.
- Pingali, P.L. and Márquez, C.B. 1990. *Health Costs of Long-Term Pesticide Exposure in the Philippines – a Medical and Economic Analysis*. IRRI Social Sciences Division Paper No. 90–04. International Rice Research Institute (IRRI): Los Baños, Laguna, the Philippines.
- Pingali, P.L. and Palis, F.G. 1990. Impact of pesticides on the environment and human health: a preliminary assessment in the Philippines. Paper Presented at the Annual Meeting of the American Association for the Advancement of Science, New Orleans, LA, USA, Feb 22–25, 1990. International Rice Research Institute (IRRI): Los Baños, Laguna, the Philippines.
- Pingali, P.L., Márquez, C.B., and Palis, F.G. 1992. Farmer health impact of long-term pesticide exposure—a medical and economic analysis for the Philippines. Paper presented at the Workshop on Measuring the Health and Environmental Effects of Pesticides, 30 March–3 April 1992, Bellagio, Italy.
- Pingali, P.L., Palis, F.G., and Rodriguez, V. 1989. Pesticide externalities in Asian rice production: Progress Report. In: *Proceedings of the Progress Reports Meeting on the Environmental Costs of Chemical Input Use in Southeast Asian Rice Production, 31 October 1989, Los Baños, Laguna, the Philippines*. International Rice Research Institute (IRRI): Los Baños, Laguna, the Philippines.
- Pingali, P.L., Márquez, C.B., and Palis, F.G. 1994. Pesticides and Philippine rice farmer health – a medical and

- economic analysis of impact. *American Journal of Agricultural Economics*, 76, 587–592.
- Pingali, P.L., Márquez, C.B., Palis, F.G., and Rola, A.C. 1995. The impact of pesticides on farmer health: A medical and economic analysis in the Philippines. pp. 344–360. In: *Impact of Pesticides on Farmers' Health and the Rice Environment* (Pingali, P.L. and Roger, P.A., Eds). Kluwer Academic Publishers: Norwell, Massachusetts, USA and International Rice Research Institute (IRRI): Los Baños, Laguna, the Philippines.
- Pingali, P.L. and Roger, P.A., Eds. 1995. *Impact of Pesticides on Farmers' Health and the Rice Environment*. Kluwer Academic Publishers: Norwell, Massachusetts, USA and International Rice Research Institute (IRRI): Los Baños, Laguna, the Philippines. 664 pp.
- Rola, A.C. and Pingali, P.L. 1993. *Pesticides, Rice Productivity, and Farmers' Health: An Economic Assessment*. International Rice Research Institute (IRRI): Los Baños, Laguna, the Philippines and World Resources Institute: Washington DC, USA.
- Templeton, D.J. and Jamora, N. 2008 (in press). *Economic Assessment of IRRI's Policy-orientated Research into the Private Health Costs of Pesticide Use in Rice Farming in the Philippines*. IRRI Impact Assessment Reports No. 1. International Rice Research Institute (IRRI): Los Baños, Laguna, the Philippines.
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- 1 The term hazardous refers to effects on human health rather than toxicity to pests.
 - 2 The reduction in the quantity of pesticides used could translate into a measurable benefit to farmers as a reduction in production costs. Further benefits could also arise from yield increases due to reduced losses from pest resurgence. However, measuring these production-based changes is outside the scope of this study.
 - 3 A 5 percent discount rate is typically used in impact assessment. There is, however, debate over the appropriate length of the simulation period. It has now been suggested that, as a general principle, benefits should be assumed to continue forever (Davis et al., 2008.) Nevertheless, to be conservative, 30-year simulation period was used here.

3.7. Community-Based Fisheries Management Project in Bangladesh

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Introduction

Fish from Bangladesh's vast inland waters are vital to millions of poor people, but catches and species diversity have been declining due to such problems as habitat degradation (through siltation and conversion to agriculture), increased fishing pressure, destructive fishing methods, and acute shortages of dry-season wetland habitat. The situation has been exacerbated by fisheries policies for 12,000 government-owned water bodies being based on short-term, revenue-orientated leasing to the highest bidder. This institutional set-up excludes poor fishers, while at the same time, encouraging leaseholders to over-exploit the fisheries.

In the light of these challenges, research on alternative management approaches for the inland fisheries resources of Bangladesh was initiated to improve the resource status and increase the incomes and livelihoods of small-holder fishers. One alternative approach is community-based management where the control of the fishery resource is handed over to community groups for an extended period. Pilot projects that implemented this approach in a small number of water bodies started in Bangladesh in the mid-1980s and were later scaled up. However, in order for such an approach to be successful, a dramatic change in the paradigms of institutions in charge of managing inland water fisheries resources at different levels is inevitable.

Research on Community-based Fisheries Management (CBFM)

The overall goal of the research projects on CBFM coordinated and led by the WorldFish Center (WorldFish) was to: "improve inland fisheries management policy and policy process adopted by the Government of

Bangladesh and NGOs resulting in more-sustainable, equitable and participatory management of resources". In order to achieve this aim, the projects focused on two elements. Firstly, working towards a participatory management approach involving all stakeholders and facilitating the development of linkages between community groups and local government (institutional component); and secondly, developing and implementing improved fisheries management practices comprising habitat restoration and conservation measures. Research was implemented in collaboration with partners, including the Department of Fisheries (DoF) and a number of NGOs through the course of several projects (Table 1). In each of these projects valuable lessons were learned, and by building on the generated knowledge in the next project step-by-step, a prototype for CBFM was developed. The work started in the mid-1980s when, under the New Fisheries Management Policy (NFMP), additional players such as the DoF, the National Fishermen's Association (NFA) and different NGOs became involved in the management of inland fisheries. The project *Experiments on New and Improved Management of Openwater Fisheries* (ENIMOF, 1987–1990) was implemented by WorldFish in collaboration with DoF and the Bangladesh Centre for Advanced Studies (BCAS). The major objective was to "test and develop alternative approaches to managing open-water fisheries, in order to establish, from an administrative point of view, how best to achieve the equity and sustainability goal set out in the government's open-water fisheries policy" (Agüero et al., 1998). It was noted that conservation of fisheries is, in part, a function of fishing pressure and that the current licensing system and lack of enforcement to prevent entry of unlicensed fishers presents a severe limitation to conservation (Agüero et al., 1998). Also, it became obvious during the project that DoF had

Table 1. Overview of the WorldFish-led CBFM projects covered in this study

Project name (Duration)	Donor (Total funds)	Project partners	Water bodies	Summary of major research/activities
ENIMOF (1987–1990)	Ford Foundation (US\$150,000)	<ul style="list-style-type: none"> ■ The WorldFish Center ■ DoF ■ BCAS ■ NGOs 	9	Tested government-led licensing strategy to improve inland fisheries management in different types of water bodies Implementation of different conservation measures (e.g., sanctuaries, re-stocking)
IMOF (1991–1994)	Ford Foundation (US\$150,000)	<ul style="list-style-type: none"> ■ The WorldFish Center ■ DoF ■ 4 NGOs: BRAC, Caritas, Friends in Village Development, Proshika 	20	Tested the government and NGO partnership model Research on: awareness and skills training materials for farmers; alternative income-generating schemes with financial support; studies to assess improvement of fish production in different water body types
CBFM-1 (1995–1999)	Ford Foundation (US\$1,800,000)	<ul style="list-style-type: none"> ■ The WorldFish Center ■ DoF ■ 5 NGOs: Banchte Shekha, BRAC, Caritas, CRED, Proshika 	19	Tested range of fisheries management models and diverse institutional approaches (alternative models of collaboration and partnership) to develop prototype approach for CBFM and institutional arrangements
CBFM-2 (2001–2007)	DFID (US\$8,376,868)	<ul style="list-style-type: none"> ■ The WorldFish Center ■ DoF ■ 11 NGOs: Banchte Shekha, BELA, BRAC, Caritas, CNRS, CRED, FemCom, Gharani, Proshika, SDC, Shisuk 	116	Tested developed management systems and demonstrate that they work – i.e. increase people’s livelihoods Tested mechanism for linking community institutions to better manage larger fisheries systems Informing and influencing fisheries policy stakeholders

Notes: Prior to 2002, the WorldFish Center’s name was the International Center for Living Aquatic Resources Management (ICLARM)
 CRED = Center for Rural and Environment Development; BELA = Bangladesh Environmental Lawyer Association
 CNRS = Center for Natural Resource Studies; SDC = Society Development Committee)

neither the budget nor enough skilled personnel to provide effective institutional and financial support.

Thus, in the subsequent project *Improved Management of Openwater Fisheries* (IMOF, 1991–1994) research focused on potential partnership models of government and NGOs. Awareness (e.g., on the benefits of stocking and seasonal closure of the fisheries) and skill-training materials for fishers were actively developed. Alternative income-earning activities with additional financial support from NGOs were designed and tested in a participatory manner with local stakeholders. The implementation of alternative income opportunities largely increased the adherence to seasonal fishing closure, and formal registration of fisher groups strengthened the participation in fisheries management programs. In parallel, studies were conducted to assess the degree of improvement in fish production in

seasonal and permanent water bodies. The major lesson from this project was that it is necessary to involve all stakeholders in the management of inland water resources, implying a community-based approach rather than just putting fishers in charge and excluding middlemen (Ahmed et al., 1997).

Based on these lessons learned, two successive phases of CBFM projects were implemented for which the ownership of project water bodies was formally handed over from the Ministry of Land (MoL) to the Ministry of Fisheries and Livestock (MoFL). The first phase (CBFM-1, 1995–1999) was carried out at 19 sites, with the major focus being the development of prototype CBFM approaches and institutional arrangements that could be replicated. A range of fisheries management models was tested and diverse institutional approaches, such as the management of watersheds by community-based organizations (CBOs) and providing support

to women to manage their own fisheries CBOs, were explored (Thompson et al., 2003). However, questions remained about the sustainability of CBOs, and coordination across extensive inland floodplains. In the second phase (CBFM-2, 2001–2007), these concepts and arrangements were tested and extended to a larger number of water bodies (116 sites in 22 districts). One hundred and thirty CBOs, mainly comprising poor fishers, were created to manage the water bodies assisted by partner NGOs. To strengthen their status, 116 CBOs were registered as cooperatives under the 2001 Cooperatives Societies Act or the 1961 Voluntary Social Welfare Ordinance. Project beneficiaries received training on fisheries management, alternative income-generating activities, and legal issues around fisheries. Fisheries management models such as

the establishment of fish sanctuaries, closed seasons, and bans for harmful fishing gear were implemented. During CBFM-2 particular focus and effort was placed on the conditions that are required to ensure that CBOs are sustainable and that inland aquatic resources management is efficient and equitable. Furthermore, a process for the integration of CBFM approaches into official policies was initiated and promoted.

Impact Pathway

The impact pathway (Figure 1) shows the hypothesized information channels for policy influence starting from the CBFM project activities in the upper part of the graph down to how a policy change resulting from the research may lead to ultimate benefits.

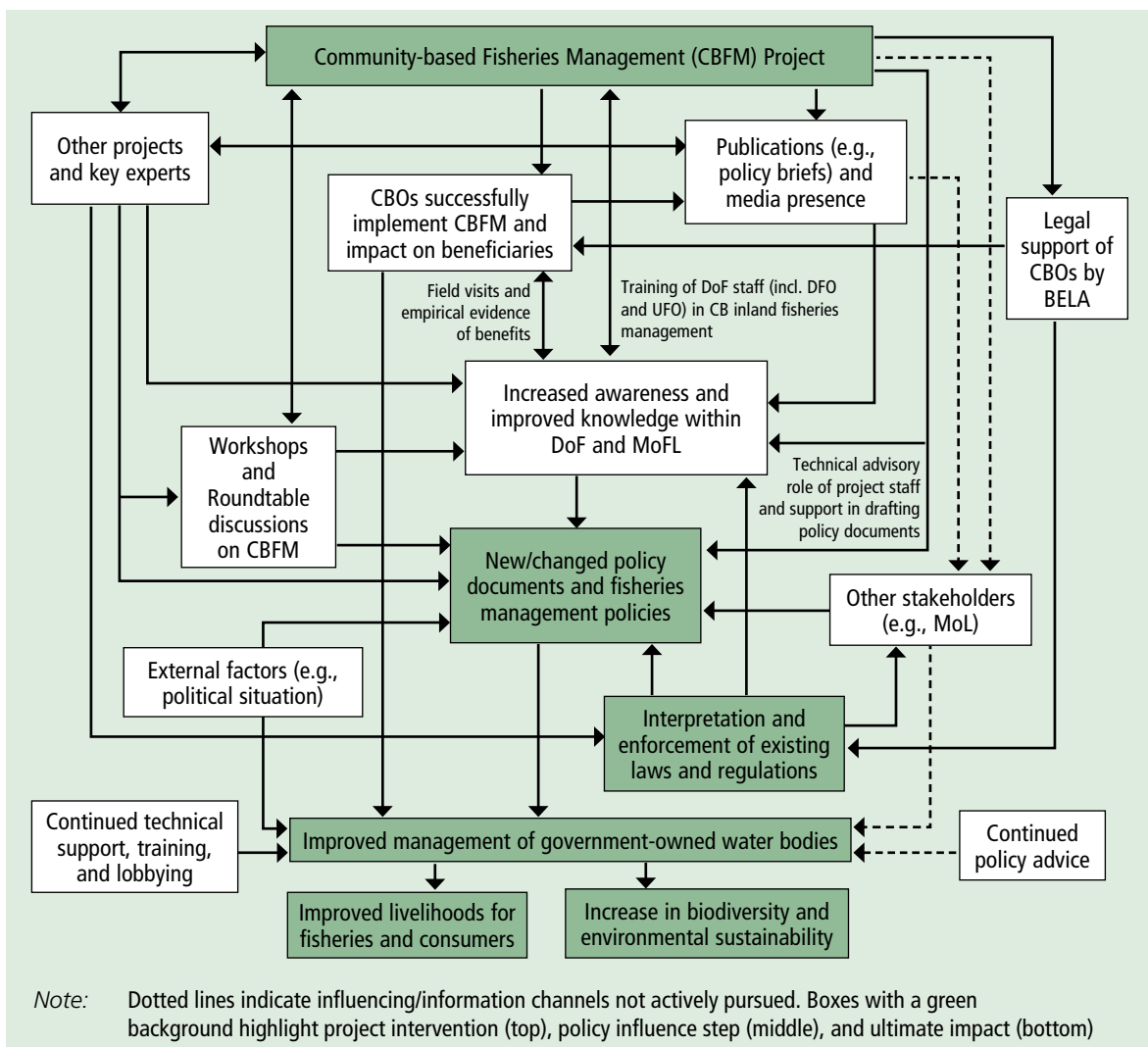


Figure 1. Hypothesized impact pathway for the policy influence and impact of CBFM project

We expect policy influence of the project on three different levels: national, intermediate, and local. A discussion of project activities and related impacts can be found in Pemsil et al. (forthcoming).

At national level, key stakeholders are the DoF, various ministries (including MoFL), and other government bodies (e.g., the Planning Commission). On this level, influence is exerted mainly via policy briefs and reports, workshops and conferences, field visits by officers to the project sites, and study tours to related projects abroad. Also, the legal support that was part of the project not only tackled individual cases of ownership disputes, but also aimed at a general change in the interpretation of laws, e.g., on taxation of water bodies. The informing role of the project also included the participation of leading project staff in official meetings as well as support in drafting relevant policy documents.

In Figure 1 key stakeholders at the intermediate level are government institutions up to district level and various NGOs. The major pathway of influence at this level is the (technical) training of staff, study tours to related projects abroad, day-to-day interaction with the project during its implementation, and training and advocacy material. Although scientific papers are not widely read within DoF, the publication of project results increases the credibility and reputation of the research. Given that the general structure of the Government of Bangladesh is centralized and hierarchical, a 'trickle-down' effect can be expected, once national-level awareness is achieved. At the same time, DoF district staff may be promoted and thus gain national-level influence. In a similar way, some of the larger NGOs are influential at national level and may become involved in the decision-making process and lobby for a particular outcome.

At local level, key stakeholders are communities and especially those households or individuals involved in fishing. The project influence is exercised via the project CBOs, through training of beneficiaries, folk theatres, TV, and radio screenings. The major purpose at this level is to increase the awareness about project activities and foster understanding of the management approaches implemented by the CBOs. The

acceptance and support of the larger community is essential in order to implement aspects of the new management approach such as the ban of harmful gear and the enforcement of sanctuaries and closed seasons for fishing.

There are, of course, other institutions and projects working in the field of inland fisheries management and thus other influences on policy-makers external to the CBFM project. Since we anticipate interactions between the different institutions working on these issues, we attempt to clarify the role the CBFM projects had on other major projects and players and vice versa.

Evidence of Project-level Impact

Unfortunately, an existing panel data set of some 2,800 households (HH) from 44 water bodies that was collected under CBFM-2 could not be used to assess project impact. The data set (baseline 2002, impact survey 2006) contains information on HH characteristics, income from different activities, fishing effort, and food security and the sample size is large, but with several subgroups, such as HH accessing different water body types (rivers, *beel*¹, floodplains) and three different treatment groups (i.e., direct beneficiaries, non-beneficiaries who access project water bodies, and the control group). Beneficiaries of the project received direct project support, including training and micro-credit while non-beneficiaries would gain indirectly from CBFM-2 activities. Control HH are those accessing non-project site water bodies. While some useful insights can be obtained from the analysis of the HH data set, it is not a suitable basis to elicit project-level benefits for two main reasons. Firstly, the size of the control group is small, and respondents are from very few water bodies; control sites are far away from most project sites, thus challenging the assumption that they are comparable and introducing biases if drastic changes due to external factors have occurred at any of the control sites. Secondly, because of changes in fisheries management, the unit of analysis for major impact, such as productivity increases of the water body, cannot be aggregated based on the HH-level results if information on total fishing effort (i.e., changes in number of fishers or intensity of resource

use between baseline and impact survey) is not available – thus the unit of analysis really is the water body. This issue is discussed in detail by Pemsal et al. (forthcoming).

A number of project-level impacts can be assessed based on a survey of all 129 CBOs which was conducted in August/September 2007, half a year after the CBFM-2 project had ended. The information collected comprises: 1. Community and CBO characteristics, 2. Previous and current management of water bodies, 3. Leadership and decision-making within the CBO, 4. Perception of project performance, and 5. Past, current, and future threats and opportunities for CBOs. Each interview was conducted face-to-face by one enumerator and a group of CBO members (including CBO executives) and took around 2 hours. Of the 129 interviewed CBOs, some 123 were still active and practicing CBFM beyond the duration of the project. This result is very encouraging with regard to the sustainability of the intervention. Furthermore, they were hopeful that they could continue doing so even beyond the current lease period of the water body. Furthermore, the majority of CBOs (74 percent) reported an increase in fish production, despite an increase of some 30 percent in the number of fishers accessing the water

body. This is in line with fish catch monitoring findings of the CBFM project that show increasing fish abundance and diversity (Halls and Mustafa, 2007). Rule breaking, both of CBO and other community members, was reportedly low and did not increase after the project ended.

Policy Influence and Contributions to Policy Changes

To analyze how far recent changes in the awareness and opinion of key agencies and policy-makers, as well as the content of new policy documents, can be attributed to the CBFM project, 26 expert interviews were conducted. Respondents were selected by the following criteria:

- Staff of relevant government institutions (preferably in a decision-making capacity)
- Individuals involved in project activities or working in the wider area of community-based management, or inland fisheries management.

See Table 2 for institutions and positions of interviewees.

Interviews were conducted face-to-face in English and took between 20 to 90 minutes.

Table 2. Institution and position of experts interviewed for influence analysis

Institution	Position of person(s) interviewed
Planning Commission (Agriculture, Water Resources and Rural Institutions)	Chief Former Deputy Chief
Ministry of Land	Deputy Secretary
Ministry of Fisheries and Livestock	Secretary Senior Assistant Chief
Department of Fisheries	Director General (former, acting and current) Director, Inland Capture Fisheries Wing Former Project Director CBFM District Fisheries Officer (Narail)
NGOs	Caritas, BRAC, CNRS, BELA, Banchte Shekha
Management of Aquatic Ecosystems through Community Husbandry (MACH)	Project Leader Chief of Party, Winrock International
Fourth Fisheries Project (FFP)	Former Project Leader, DoF/ Danish International Development Agency (DANIDA)
The WorldFish Center	Regional Director Former Project Scientist Project Leader CBFM-2
National Fishermen's Association (NFA)	President
National Fishermen Cooperative Association (NFCA)	President and Secretary General
Ford Foundation	Former Officer (in charge of CBFM)
CBO Central Committee	President

A list of guiding questions was used for the interviews, but not all interviews covered all questions. The majority of the interviews were tape-recorded and transcripts were produced based on the tapes and notes taken. The following text provides a synthesis of the interview narratives (see Pemsil et al., forthcoming) of the expert interviews. The overwhelming opinion of the experts was that the awareness of officials in major decision-making government bodies (DoF, MoFL, and PC) towards inland fisheries management has changed dramatically in the past years. One respondent said the DoF used to be a “Department of Aquaculture” rather than a “Department of Fisheries” because the sole focus was on the increase of fish production from aquaculture. All interviewed experts had a clear idea of the general CBFM concepts and a positive opinion of this approach. They further stressed that CBFM works, and that they had seen this through field visits and in the documentation of the project. While most acknowledged that a number of players are active in this area in Bangladesh, there was consent even among representatives of the other major projects (i.e., MACH and FFP on the pioneering role of the WorldFish Center-led

CBFM-1 project (including the earlier ENIMOF and IMOF projects) and the technical knowledge contributed by the WorldFish Center. This pioneering role is also supported by the sequence of other related projects (Figure 2).

The majority of experts flagged CBFM as the way forward in inland fisheries management in Bangladesh, some with the explanation that “nothing else had worked”, and the conviction that more participation and involvement of the resource users (i.e., the small-scale fishers) in resource management issues is important and desirable. This in itself is an important paradigm change – especially in government bodies.

It was stressed that some policy changes (see Figure 2) are on the way, for example there is explicit mention of CBFM as the preferred management approach in the *Fisheries Sub-Sector PRSP Road Map* of 2006 (Planning Commission, 2005) and the 2007 *Inland Capture Fisheries Strategy* (DoF, 2007). However, major constraints to the spread of CBFM, which is currently only practiced on a minor share of all inland water bodies (only project sites) in Bangladesh, have been the

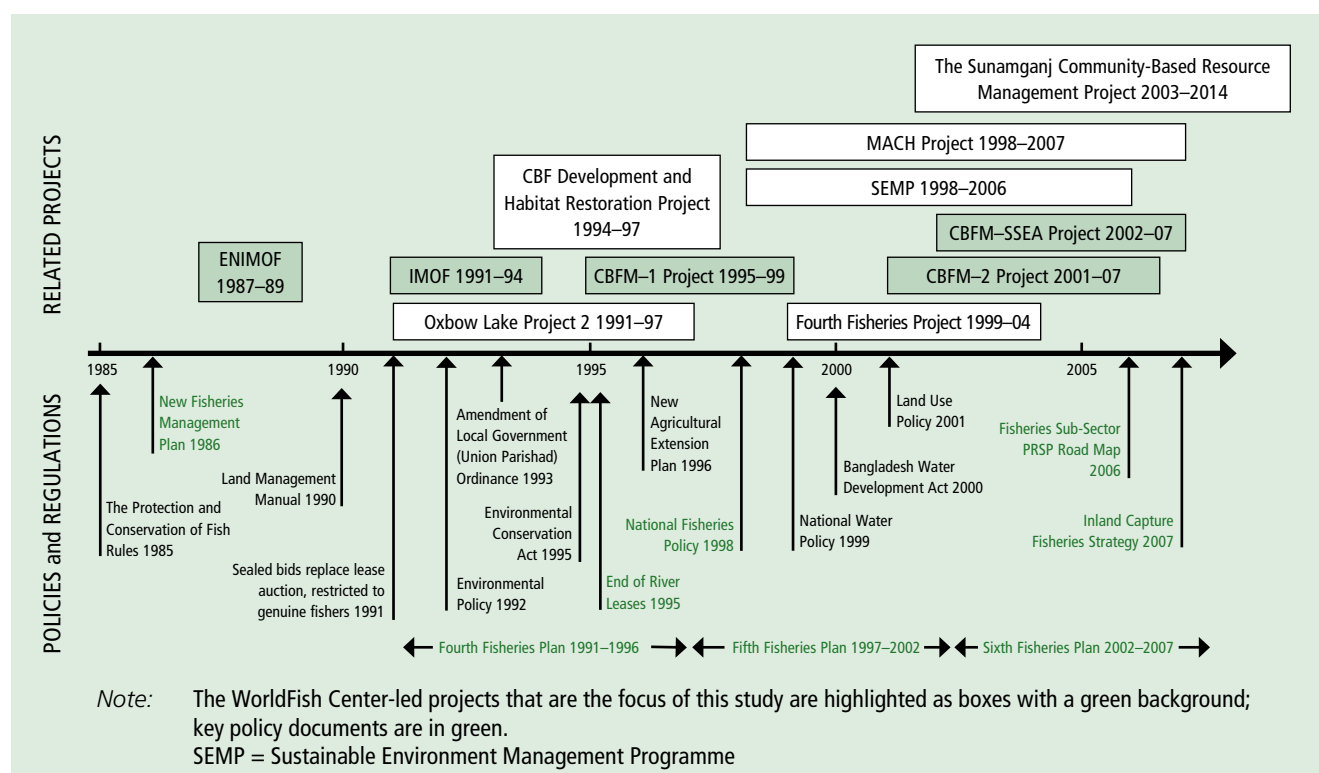


Figure 2. Timeline of recent projects and policies in Bangladesh inland fisheries

roles of different ministries (e.g., land ownership for water bodies is with MoL, which still pursues a highest-bid leasing strategy and was only marginally involved and not kept well-informed of CBFM activities), and the project-driven nature of the recent changes. A number of experts stated that the future of CBFM and its potential spread to more water bodies depend on the availability of external funds. This makes the future of the CBFM approach uncertain, despite the high level of awareness and conviction and recent initiatives of the DoF to get government funds allocated to CBFM work.

Capturing the information exchange among key stakeholders (ministries, NGOs, etc.) is important for understanding the diffusion of ideas and opinions inducing policy change. In many cases, important information follows informal pathways rather than formal, often hierarchical, structures of organizations, or governments. Thus, a written survey was sent out via e-mail to 32 experts from PC, MoFL, DoF, partner NGOs, and staff from other related projects, and 21 completed questionnaires were returned. Combined with the influence narratives and the formal institutional framework, the expert survey helps to assess the impact of network structures on information flows, and the relevance of individual actors in the dissemination of CBFM-related information.

Social Network Analysis is based on graph theory. Communication between two people is represented by a link between them. If the link is absent, they do not communicate with each other (see Wasserman and Faust, 1994, for a detailed introduction to Social Network Analysis). As a first step, we approached the network with two specific questions, applying a rather strict boundary specification to the network of all actors. The questions target the information flow of two subgroups in the project:

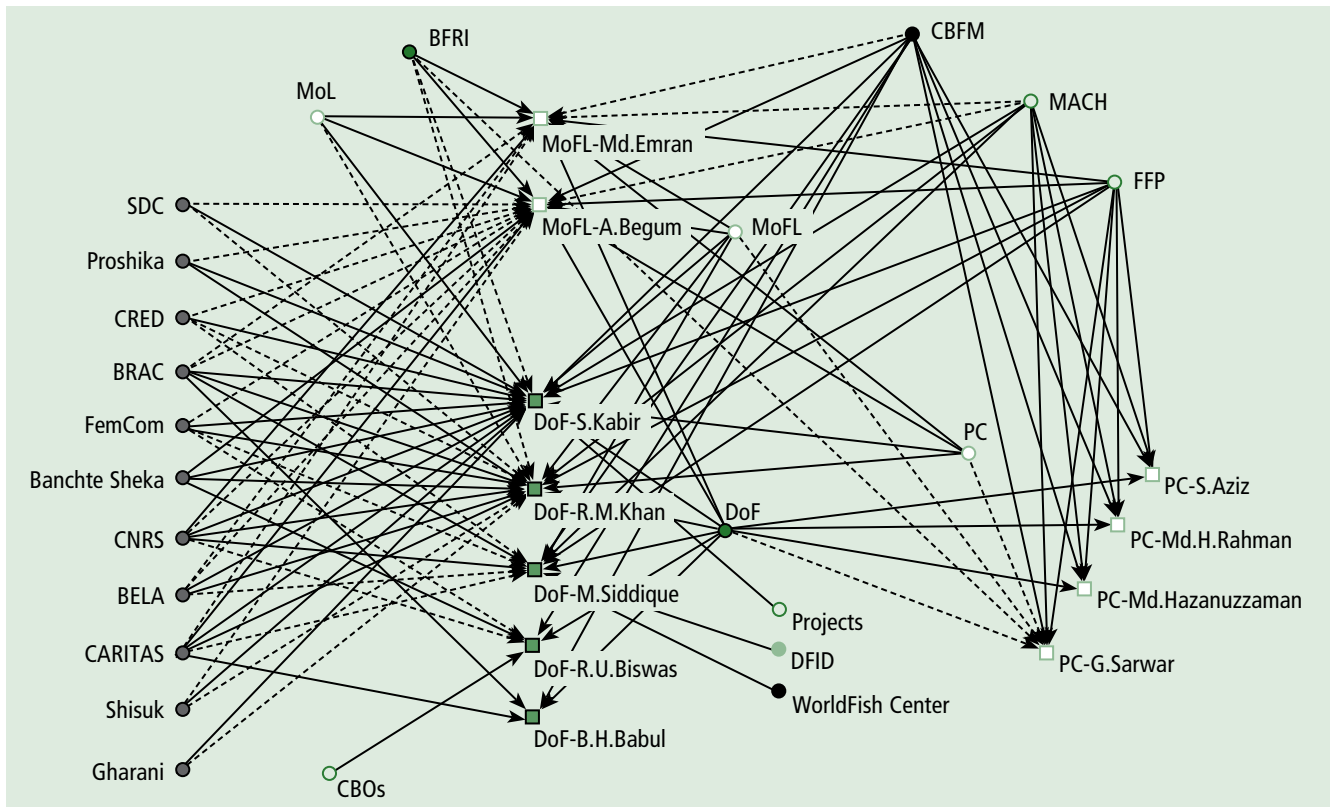
1. Who did the CBFM partners provide with information on the project?
2. Who were the perceived sources of information for actors of DoF, MoFL, and PC?

The analysis of the network graphs will reveal whether or not an informal network structure did evolve that interconnects participants of CBFM beyond the formal

structure of the project; if so, it will identify the most central, and thus important, actors in the (informal) network. It is important to note that distances are without meaning in these network pictures. Actors have been arranged in accordance with the formal structure of the project, where all interviewed experts are displayed as boxes and labelled with their institutional affiliation and their name. All actors who could be chosen as communication partners (listed in the questionnaire) are displayed as ellipses. Generally, the approach to extract networks of limited actors is a suitable way to narrow the number of actors according to specific research questions. We therefore addressed the question of outgoing information from CBFM partners and ingoing information to government bodies in separate networks without considering whether information exchange is reciprocated.

Figure 3 depicts sources for inland fisheries information of major government institutions (DoF, MoFL, and PC). The graph shows that DoF receives information from a wide range of actors, including MoFL, NGOs, major projects, and WorldFish. Surprisingly, the DoF respondents stated that no important information on inland fisheries management is provided by the Bangladesh Fisheries Research Institute (BFRI), the national institution in charge of research related to fisheries and aquaculture. Respondents from within MoFL, on the other hand, received information from BFRI. While MoFL staff stated they had received important information from the CBFM project, they rated the information provided by the MACH project as less important. The PC, as the major decision-makers in the allocation of government funds, did receive information directly from the major projects (including CBFM), rather than getting it via the MoFL, the 'official channel' for this information. Also, PC respondents rated the information obtained from the DoF as 'important' compared to 'less-important' information received from MoFL.

Figure 4 visualizes the information provided by CBFM-2 partners to external actors. The project partners are arranged in an outer circle while the information recipients are grouped in the center. It becomes very obvious which of the project partners are most active in providing information on inland



Note: Dotted lines show provision of less important information and full lines that of important information.

Figure 3. Sources of information on inland fisheries management to MoFL, DoF, and PC

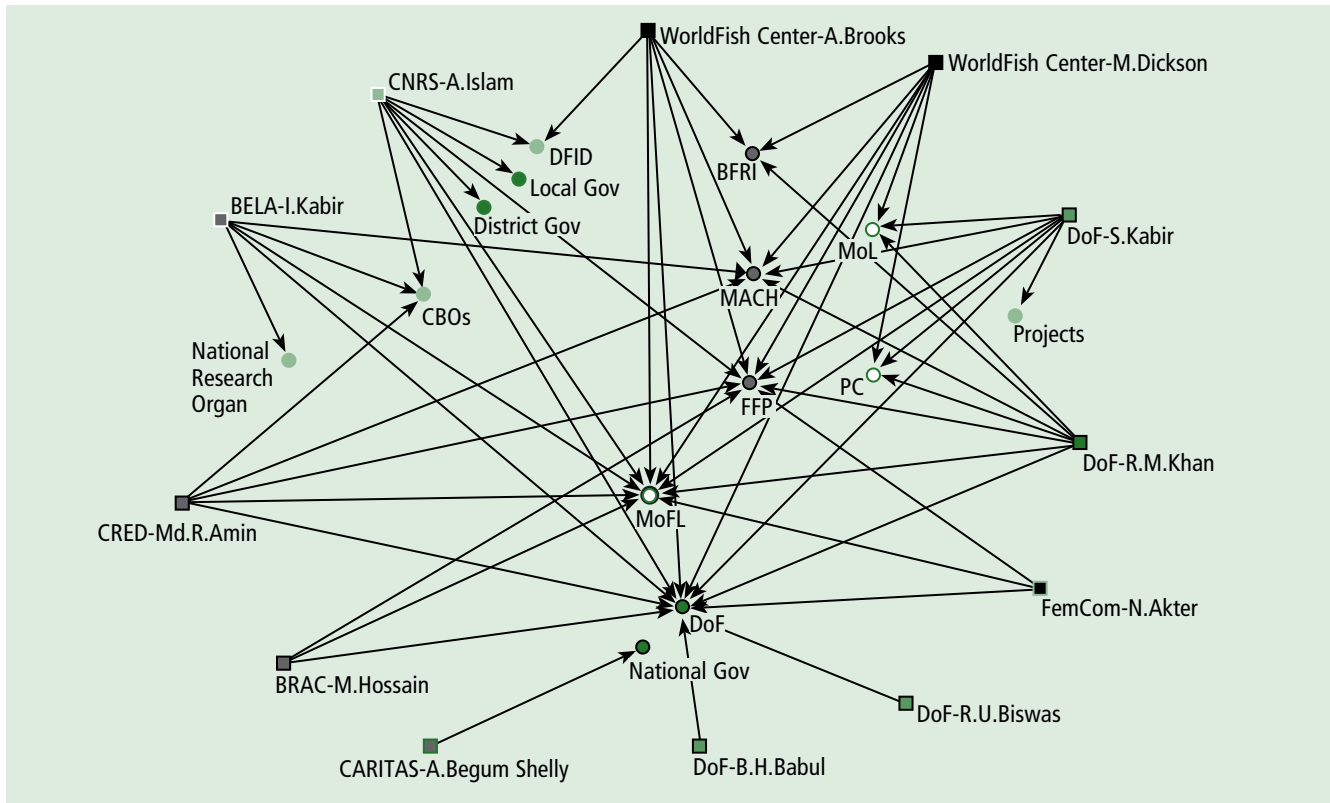


Figure 4. Information provided by CBFM-2 partners to non-project partners

fisheries management to non-project partners. The three NGOs: CNRS, CRED, and BELA communicate with the largest number of external actors, while the WorldFish Center and DoF partners are most crucial in providing information to the major policy players. Major findings of the expert survey and the social network analysis are the identification of central actors in the area of inland fisheries management in Bangladesh. The results show that central actors in formal or information networks can be different from the formal institutional role or position of individuals.

Moreover, the analysis of information sources of the major government institutions with responsibility in inland fisheries management, as well as with a decision-making role for future policy change (Figure 3), confirms the central role of the WorldFish-led CBFM project. The results also showed that there was information exchange between the major projects (CBFM, MACH, and FFP) as indicated in the expert interviews. Finally, when looking at the type and number of external sources partners to whom the CBFM project provided information, the WorldFish Center was crucial as an 'honest broker' between the involved NGOs and national government institutions. At the same time – as one of the project outcomes – there are now also direct communication channels between some of the NGOs with government bodies, so the profile of NGOs has been raised.

Conclusions and Lessons Learned

The PORIA study of CBFM in Bangladesh has had difficulties in providing empirical evidence of the project-level impact of the project. Though the general feedback of all involved staff and exposed government officials has been very positive, an existing large HH data set could not provide the answers to questions on the project impact on HH income and livelihood effects. There is, however, evidence of fish stock increases and an increase in (fish) biodiversity (Halls and Mustafa, 2007). Also, a large majority of the established CBOs were still active and practicing CBFM in their water bodies beyond the project duration.

The CBFM PORIA has been able to clearly show and document the changes in opinion and awareness of relevant policy-makers. Thus, the policy-informing and influential role of the project has been successful and major policy documents now make explicit mention of the CBFM concept as a viable management approach. It is, however, still too early to assess if this influence will really result in a larger-scale change in how inland water bodies are managed in Bangladesh. It seems that, although major paradigm changes have taken place in the concerned government bodies, especially in technical skills, institutional set-up and financial constraints could hamper future CBFM scaling up. It will be crucial to have a national CBFM 'champion' who will continue to push for the CBFM approach, irrespective of externally funded projects.

References

- Agüero, M., Huq, S., Rahman, A.K.A., and Ahmed, M. (Eds). 1998. *Inland Fisheries Management in Bangladesh*. Department of Fisheries and Bangladesh Centre for Advanced Studies: Dhaka, Bangladesh and International Center for Living Aquatic Resources Management (ICLARM): Manila, the Philippines. 149 pp.
- Ahmed, M., Capistrano, A.D., and Hossain, M. 1997. Experience of partnership models for the co-management of Bangladesh fisheries. *Fisheries Management and Ecology*, 4, 233–248.
- Halls, A.S. and Mustafa, M.G. 2007. *Empirical Yield-effort Models for Inland Fisheries of Bangladesh*. Working Paper (submitted to *Fisheries Research*. The WorldFish Center, SouthAsia Office: Penang, Malaysia.
- DoF (Department of Fisheries). 2007. *Inland Capture Fisheries Strategy*. pp. 61–75. In: *National Fisheries Strategy and Action Plan for the implementation of the National Fisheries Strategy*. Department of Fisheries (DoF), Ministry of Fisheries and Livestock, Government of People's Republic of Bangladesh: Dhaka, Bangladesh
- Thompson, P. M., Sultana, P., and Islam, N. 2003. Lessons from community based

- management of floodplain fisheries in Bangladesh. *Journal of Environmental Management*, 69, 307–321.
- Planning Commission. 2005. *Unlocking the Potential – National Strategy for Accelerated Poverty Reduction*. General Economics Division, Planning Commission, Government of People’s Republic of Bangladesh: Dhaka, Bangladesh.
- Pemsl, D.E., White, J.L., Ahmed, Md. M., Chen, O.L., Kanagaratnam, U., and Seidel-Lass, L. (forthcoming). *Policy-Oriented Research Impact Assessment: Community-Based Fisheries Management Project in Bangladesh*. Technical Report, The WorldFish Center: Penang, Malaysia.
- Wasserman, S. and Faust, K. 1994. *Social Network Analysis: Methods and Applications*. Cambridge University Press: Cambridge, UK.

1 *Beel* or *bheel* is a Bengali term that refers to a (seasonal) pond or wetland with static water.

4. Synthesis¹

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The seven case studies in this chapter aimed to assess the impact of PORIA. All the studies provided information on diffusion of research products and uptake of the research evidence by decision-makers in key policy positions. The seven also documented perceptions of influence on policy change. Five presented persuasive evidence on economic impact. To draw and tease out conclusions described in the next chapter, the case studies are examined from two recent perspectives: Firstly, an overview of the case studies against the background of key issues and considerations facing practitioners in the conduct of PORIAs (Raitzer and Ryan, 2008) in particular, and impact assessment of agricultural research (Walker et al., 2008a) in general. And secondly, some lessons learned using the key factors identified as important by IFPRI in conditioning influence and impact from a center's POR (Ryan and Garrett, 2003). The case studies as a group are informative in both areas. What they say, at times, supports conventional wisdom, but, at other times, is surprising. We conclude with an attempt to categorize these studies into the relevant research utilization models conceptualized by Weiss (1979).

Overview of PORIA Case Studies

Eight key issues in the conduct of PORIA were pointed out in the scoping study described in the Foreword and Introduction: 1. Scale, 2. Time lags and discontinuities, 3. Demand-side vs. Supply-side, 4. Surprise, 5. Attribution, 6. Choice of indicators, 7. Sampling, and 8. *Ex ante* and *ex post* assessments. The studies that arrived at a full-fledged impact analysis had to address all of these issues; those that are perceived to be the most relevant are discussed in this chapter.

The documentation of uptake and influence is the hallmark of these studies. Positive documentation of uptake and influence makes the case for attribution. All the

authors spent considerable time in evaluating the degree to which the policy change of interest could be attributed to the center's research or research-related output. The abridged versions of the studies do not do justice to the effort allocated to this one area of POR evaluation. For example, the unabridged version of the IFPRI impact assessment of the Mexican PROGRESA Program (Behrman, 2007) contains a 30-page appendix on the responses from key informants to four generalized questions about IFPRI's role in the development and evolution of this innovative program. In most studies, the results on influence were not confined to key informant interviews. Primary and secondary data sources and reports were canvassed to validate and support information gleaned from key informant interviews. More reliable information on influence also contributed to the structuring of a more reliable counterfactual. Key informants were also used to broaden the scope of later interviews and add other interviewees to the original list, which is desirable when a statistically random approach is obviously not feasible.

The studies as a group also suggest that methods for documenting influence are neither simple nor readily codifiable. The policy process is often a political, multi-actor, multi-interest process stretched over months or years. With such complex phenomena under enquiry, simple tabulations glossed over the subtleties and nuances of the story, but they were useful in highlighting contentious areas among key informants. Some key informants were closer to the action than others; some played more central parts in the development of policy; some had better memories of key conversations and critical events; and some left the arena before final decisions were made. For instance, in the ICARDA study, half of the key informants believed that the policy change to make fertilizer available for dryland barley would have happened without the POR, albeit considerably later than when it actually

occurred. For all the other questions, perceptions were more widely shared on the positive role of the research and advocacy effort.

In general, these abridged versions of the cases do not reflect the richness of the qualitative data. A journalistic, ethnographic, or anthropological style could have led to more persuasive storytelling. In the full reports, IFPRI, IRRRI, and ILRI enriched their presentations with passages from the key informant interviews. Their accounts provide persuasive evidence of research influence. The Bioversity study illustrates the power of providing narrative examples from key informants.

On the other end of the qualitative/quantitative continuum, none of the studies used Bayesian analysis to more rigorously probe the dimensions of uptake that precede influence, as described by Norton and Schimmelpfennig (2001). This would have been especially relevant in exploring the element of surprise in the outputs from the POR being assessed, which is discussed later. The absence of Bayesian analysis in applications that seem tailored for its use in valuing information, with hindsight, is not so surprising, and reinforces Lindner's evaluation that the Bayesian approach is difficult to implement (Lindner, 2004).

The studies that relied on single-interviewer taped conversations seemed to establish more credibility on the issue of influence than those that drew solely on written questionnaires, especially mailed-in responses. The latter may be suitable for perceptions of impact by key actors, but a written questionnaire approach may be too gross to capture the nuances and subtleties surrounding influence. The IFPRI study tried to strike a balance by combining a larger sample with questionnaires with a smaller number of key informants who were extensively interviewed in a more open-ended format. The IRRRI study featured a round of feedback from the key informants so that they could comment on the perceptions of their colleagues to arrive at more reliable subjective scoring.

Overall, the studies use a rather limited range of methods in the documentation of uptake and influence, but it is ample to build on and to establish priorities for future work. One technique effectively used was the development of 'impact pathways', or what

others have called: 'theories of influence'. The authors charted the assumptions about where information entered the system, the paths it took, and the decision-makers it influenced, and then sought to verify these assumptions of transmission and uptake. The WorldFish study employed social network analysis to identify the sources of information inputs in decision-making. That analysis showed that the role of WorldFish was critical as an honest broker between NGOs and the government, and that central actors in networks can be markedly different from their institutional positions.

Impact assessment lends itself to interdisciplinary research (Ravallion, 2001). Adding a team member with a keen interest and skills in interviewing may help to put uptake- and influence-related research on a firmer base. Incorporating in the team contextual knowledge of organizational analysis and policy-making processes may also strengthen the case for or against attribution and highlight elements of what may be a more complex storyline than tabular information provides.

The element of surprise loomed large in the case-study accounts to the lead author of this chapter, if not to the policy-makers. It would have been useful to have more explicitly explored this issue in the interviews as it is at the heart of a Bayesian approach. IRRRI's research showed that the negative health effects of pesticide use were perhaps higher than anticipated, and their calculations that the application of insecticides to rice did not pay was useful to policy-makers charged with pesticide regulatory responsibilities in the Philippines. ICARDA's crop management research on the higher-than-expected profitability of applying inorganic fertilizer to rain-fed barley in Syria also contradicted conventional wisdom that held that the application of inorganic fertilizer was not profitable for cereals in dryland farming in the arid tropics. In a variation on the surprise theme, a more precise rendering of the environmental damage of pulp wood production in Indonesia by CIFOR reinforced and spurred NGO demands for better regulatory policy, and more appropriate practices by the industry. In Bangladesh, investment by WorldFish showed that community-based fisheries could be successful – although success has yet to be effectively demonstrated in economic terms – and this surprising realization led to

an attitudinal change among stakeholders that may set the stage for future policy changes.

When agricultural research delivers unexpected results, such as the ICARDA finding that applying inorganic fertilizer to rainfed barley was profitable in the wetter arid zones of Syria, policy change can take place rapidly if the environment is enabling. *Ex post* impact assessments of technology-oriented research (TOR) point to the same finding: surprising outcomes at experimental stations and on farmers' fields, such as a 1.5 t/ha increase in upland maize production in the Philippines with the addition of lime (Walker et al. 2008b) or a 10 t/ha increase in rain-fed sweetpotato production in China with the substitution of virus-tested clean roots for propagation for the farmers' infected planting material (Fuglie et al., 1999) can provide a focus for the attention of government officials and the key to unlocking policy change. In these cases of 'spontaneous' policy change, a commitment to policy research and advocacy on a multi-year period, like that presented in the ICARDA study, may not be needed to achieve the desired policy response, but, if the environment is too proactive, change may not necessarily be for the better if inefficient technologies are heavily subsidized over longer periods of time.

Advocacy figured prominently in almost all the studies. Conflict was also palpable in several of them. For example, ILRI's case study makes mention of the so-called 'milk wars' during which opposing sides forcefully staked their positions in paid advertisements, policy forums, and high-level government meetings. The understanding of power relationships clearly matters in the documentation of the influence of research on policy change, and that understanding is implicit in several studies.

A tally or scorecard of the study characteristics on the issues of scale, time lags, and discontinuities, and on the relative importance of demand and supply in the choice of policies for assessment is itself surprising to some. When one envisages successful policy research, one thinks of a longer-term core research agenda that results in quality journal articles, reports, and extension-related information (i.e., supply) that is slowly

adopted in discontinuous fashion without an emphasis on highly specific demand.

The above conventional wisdom is rejected by the attributes of several of the studies. In general, the case studies were significantly demand driven². Therefore, perceived attributes of successful policy research in terms of publications in leading journals and subsequent citations do not appear to correlate well with either influence or impact. Moreover, like genetic improvement research, the trajectory from research to uptake to influence was mostly linear without marked discontinuities in time. Perhaps the only notable case of discontinuity occurred in the IFPRI case study in the way that research results from IFPRI – many years prior to the founding of the program – partially contributed to the development and design of PROGRESA. The IFPRI experience reflects a supply-driven orientation that was long term in nature.

The apparent linearity between research and policy change may also be a problem of memory bias. Research results may set the stage for policy change that occurs at a much later date when the results are forgotten. The link between the earlier research and the substantially later policy change is broken. An example may be the ILRI case, where substantial behavioral and institutional changes have occurred, but the Kenyan dairy policy legislation is still 'in process' in the legislature. A later analyst might not recognize the connection.

For a few of the case studies, the research base seemed thin for the amount of leverage on influence that was claimed. The quality of POR matters, and the IRRI case study is a good example of quality research translating into rapid and widespread impact. However, being spatially and temporally in the right place at the right time with substantial effort allocated to advocacy seemed more important than the breadth, depth, or quality of research in accounting for impact. The case studies as a whole displayed more variation in the latter than in the former.

Indeed, the Bioversity case study that was founded mainly on non-research outputs was all about being in the right institutional setting at a propitious time to respond to a serious threat that could have severely

compromised international agricultural research. Being in the right place at the right time was not an accident, as the Bioversity case study points out. Bioversity engaged in strategic behavior in compliance with its mission.

Timing also figured prominently in the ILRI case study. When the ILRI-led SDP started, a raging debate on potential policy change within the dairy sector was ongoing as to whether to formalize the activities of SSMVs. SDP results and efforts were later redirected to support the side favoring the policy change.

Several of the studies were project-based and funded by one or two donors. For example, the Rockefeller Foundation was heavily involved in supporting research on the adverse effects of pesticide use in rice cultivation in the Philippines. The Ford Foundation and DFID were instrumental in the funding of community-based fisheries management in Bangladesh for two decades. ILRI's SDP was also financed by DFID. WWF was a major sponsor for and player in CIFOR's research and extension activities on the negative environmental externalities generated by the pulpwood industry in Indonesia. ICARDA's farming systems research on crop management in Syria was funded by UNDP and the NEF. In general, it would not be too much of an overstatement to associate five of the seven case studies with specially funded research projects, although they do reflect ongoing lines of work at the international agricultural research centers (IARCs). The exceptions were Bioversity and IFPRI, which mainly used core funds for their research. Not surprisingly, these two 'non-project-related' case studies were also characterized by some of the more daunting challenges in impact assessment in a cost-benefit, project appraisal format.

The dominance of project-based funding in the case studies is a positive finding (in today's funding environment) and shows that unrestricted core or line funding is not a necessary condition for success. The high incidence of specific donor funding may also reflect the demand-side perspective of the POR conducted in the case studies that featured more adaptive research than was expected. More adaptive-type policy research may simply offer the best prospects for

assessing impacts. It is also highly correlated with the provision of special project funding opportunities, which tend to be country-specific from bilateral sources. Long-term strategic policy research of an IPG nature – by generating critical information on which policies and practices are based – could have greater impact, but is more likely to be of a long-term nature and poses greater challenges for attribution and measurement.

As discussed later, success was equated to a long-term presence, but not necessarily to long-term research in the specific area to which policy change was attributed. The time horizon for the research varied from less than two years for the Bioversity's punctual consultancies that contributed to the establishment of the ITAs to more than 20 years for WorldFish's significant investment in research and extension activities on community-based inland fisheries. Across the seven studies, the duration of research or the character of research on a strategic vs. applied vs. adaptive continuum did not seem to be associated with influence or impact. Indeed, the sustained research by WorldFish is one of only two cases that did not attempt to measure impact – mainly because the diffusion of community-based fisheries has yet to take off on many inland water bodies in Bangladesh, making it too early to assess national-level impact.

The inferred absence of a positive linkage between gestation period and success may be somewhat illusory because not all the upstream research inputs were dated and accounted for in the impact assessments. For example, IFPRI was hired as a reviewer for PROGRESA because of the institute's reputation that took many years to accrue. ICARDA's farming systems project was based on several years of fertilizer response work on barley prior to the initiation of the project. Indeed the 'honest broker' label that most centers claimed was instrumental in achieving influence was itself an accumulation of years of quality research and partner interactions that built their general reputation.

Six of the seven studies address policy impact at the national or sub-national level, and several highlight the potential for generating similar policy change in a multi-country setting. For instance, the ILRI case focused on

smallholder dairy production in Kenya because of its high level of milk consumption relative to the rest of the region. This study's geographic focus most likely offered the best chance of success for the implementation of ILRI's POR in this thematic area. Based on successes of the SDP, ILRI has embarked on a process of harmonizing dairy policy in East Africa. Likewise, the innovative PROGRESA program has been characterized by considerable demand for replication throughout the world, including New York City; the IFPRI study duly noted the potential for spill-over benefits. The ICARDA full report indicates spillover effects in Iraq, Jordan, and Lebanon.

Nevertheless, the case studies (with the obvious exception of Bioversity's contribution to global ITAs) give the impression that policy change is country-specific, which may seem surprising to economists who are accustomed to the idea of the location-specificity of agricultural technology, but who are unaccustomed to the notion that there is a need for more location-specific policies. The perception of location specificity mainly stems from the policy adoption process in the uptake and influence stages and is not driven by spatial variation in the consequences of policy change.

Some Lessons in the Conduct of PORIA

With regard to the welfare effects of policy change, cost-benefit analysis (CBA) is the staple methodology for economic ePIA that is characterized by several key considerations ranging from a precise definition of the intervention of interest, to a persuasive counterfactual, to an informative sensitivity analysis of the results. Several of these considerations are described in the methodology chapter of this report. The authors found some of these areas more challenging than others. The author of the IFPRI case study was able to draw on previous work in the evaluation of the PROGRESA program. In other instances, like the IRRRI case study, the authors could incorporate some of the results of policy research in their CBA of policy change.

Other authors had to carry out their assessments 'from scratch' in the sense that the earlier policy research did not contribute

empirical results for potential use in the CBA. Nor did the literature offer much assistance in valuing difficult-to-measure benefits with the exception of CIFOR's case study that drew heavily on the environmental literature for benefit estimation. For the Bioversity and WorldFish studies, these constraints proved too formidable for the time assigned for submission of abridged versions of manuscripts for this report. Coming up with a persuasive counterfactual is critical to the Bioversity case study that focuses on policy 'insurance' against a threat that was subsequently not realized. One has to specify the consequences of the sovereignty scenario that the ITAs militated against. Researchers in the WorldFish study did not have access to a reliable baseline from which to evaluate benefits from the management of common property resources, which is a difficult issue in valuation. Both of these studies, as yet, have not been able to satisfy the full intent of this initiative, but it is better to stop short than proceed with an ePIA that is not supported by reliable data and convincing analysis.

Those who completed ePIAs also faced challenging issues. Most of the studies used the mapping of impact pathways effectively; however, the resolution of how policy aspects generated specific benefits was blurred in one or two of the case studies, especially those that tried to focus on a diffuse mix of policy interventions. For example, the ILRI researchers faced the daunting task of translating legislation and training in promoting the inclusiveness and formal participation of smallholder farmers and traders in the dairy sector into reliable estimates of economic benefits.

The construction of an appropriate counterfactual was a challenging issue in several of the case studies. The IFPRI study set an interesting precedent in this area and demonstrated considerable creativity in constructing a truly persuasive counterfactual. CIFOR's case study established counterfactuals for both the overall effects of advocacy as well as the contribution of research.

Examples of good practice that provide more information to the reader are also readily visible in the ePIAs in this report. Realized versus projected benefits were explicitly identified in the IRRRI and CIFOR studies.

Three different benefit estimates by levels of conservatism were presented in the CIFOR study that was also characterized by a transparent CBA. The majority of the case studies took pains to adopt a conservative posture in the estimation and presentation of results.

Areas for some improvement are also evident. Like many ePIAs of technological change, some of the studies did not err on the side of simplicity in presenting the findings of their cost–benefit analysis, nor on the side of transparency in showing their spreadsheet calculations in the full reports.

The need for simplicity warrants more comment. Donors appreciate results in units that are easy to communicate (Raitzer and Winkel, 2005; Raitzer and Kelley, 2008a), and so do practitioners and analysts who use simple estimated relationships for comparability in order of magnitude calculations. For example, the non-market economic benefit estimated in the CIFOR study for avoided deforestation on tropical peat soils was US\$565/ha, primarily because of the enormous capacity for carbon storage in these soils. Expressing this value in per hectare terms is useful because it calls attention to the truly large size of benefits per unit (adopted, or in this case, saved). In ePIAs of TOR, benefit intensity rarely approaches the order of magnitude of these indicative estimates. In general, the authors could have cast some of their results in partial budgets, input–output price ratios, and output–input ratios to convey information that facilitates order of magnitude calculations.

Simplicity in the empirical analysis and in the presentation of the main results is also one of the conditions for effective policy research, which is discussed in the next chapter. It is epitomized in the IRR study by the finding that pesticide application in rice did not pay: the negative health effects outweighed the productivity gains from pest control.

One order of magnitude difference stands out: the model estimated IRRs in these studies as a group are significantly higher than comparable estimates for typical ePIAs of TOR. For the four studies that estimated them, IRRs ranged between 55 and 65 percent. In general, the case studies are consistent with the impression that successful policy research at a country level tends to

be more immediate than equally successful agricultural research such as genetic improvement. Gestation periods between initial research investment and output availability for adoption appear to be shorter. The diffusion process for policy adoption at a national level is markedly different from that for technology diffusion.

As discussed, most of the case studies were heavily associated with special project funding and did not rely primarily on unrestricted line/core funding. Shorter investment periods and usually lower costs relative to other types of agricultural research can result in very high IRRs that would be at the top end of the continuum in a meta-analysis of rates of return to agricultural research. Again, failure to include all the costs of upstream research may play a role in contributing to this comparative finding in some of the studies.

This observation could well have been different if the design of this initiative had fully included the costs of the relevant antecedent research. For example, the IFPRI study shows that findings of IFPRI's past research had contributed to the design of the PROGRESA program. If that research started at the time of IFPRI's founding in 1978, high rates of return would no longer stand out in an investment analysis with the lengthening of the gestation period between research initiation and the delivery of the program's first benefits. But such research could yield multiple benefit streams over time that are not fully described by impact on PROGRESA alone. Those benefits should also appear in the more comprehensive impact assessment. This raises the issue of the appropriate unit of analysis for ePIA: i.e., at the center, program, or project level. The degrees of difficulty rise with a broadening of the scale and scope of the assessment, especially for research with strong IPG attributes. Occasional meta-analyses are an attempt to aggregate from the project levels and SPIA has been conducting these at the system and regional levels (Raitzer, 2003; Maredia and Raitzer, 2006). Maybe it is time for the centers to begin to conduct meta-analyses of their own ePIAs, not only of POR, but of all of their research portfolios.

In both TOR and POR, the choice of a starting date is not so simple as it first appears in

a CBA of research-related interventions. As discussed in the methodology chapter of this report, the dating of the first research inputs could be a contentious issue that requires further analysis.

Aside from the high estimated rate of return on investment, another feature peculiar to these policy-related cost–benefit appraisals is their relatively small size in terms of NPV compared to success stories from genetic improvement. The size of their NPVs is more akin to natural resource management success stories than to technological change from genetic improvement that seems to have more of an international, multi-country public goods character. Based on estimated NPV in a true *ex post* setting, none of these ePIAs would rank in the top 15–20 success stories attributed to CGIAR-related research (Raitzer, 2003; Raitzer and Kelley, 2008b). Nevertheless, the IRRI study demonstrates that the potential for large benefits exists if the research focuses on issues of widespread economic importance. The CIFOR study makes the same point but in a more surprising ecological setting. More than anything, the size of economic benefits is constrained by the single-country setting.

The design of the initiative focused on the substantive content of the proposed studies and not on the institutional aspects of PORIA. With one exception, all the studies were conducted internally. The one external evaluator was, arguably, as much or more involved with the policy intervention that was the subject of his analysis than the internal evaluators were with theirs. For probably all of the studies, more ‘third-party’ evaluations could have been made, but generally at some costs of information and access. Long-term institutional involvement engendered the confidence and respect of the key informants that, in turn, made a significant difference in whether they were willing to respond seriously to questions.

Only one study (IFPRI) explicitly allowed for the real deadweight costs of raising public funds used for the investments in the POR. This is a practice that others should routinely employ. IFPRI also raised the subtle but important point about appropriately counting the opportunity costs of the funds it used in the cost–benefit calculus. Including the total IFPRI POR costs implicitly assumes the

costs of alternative suppliers are zero in the counterfactual analysis. Hence IFPRI correctly points out this implies a conservative bias to the resultant cost–benefits and IRRs.

On the other hand there was a case for including some of the research costs of IPM and development of pest-resistant cultivars in the IRRI case, as these options arguably provided alternatives for rice farmers when toxic pesticides were regulated. Without the availability of these options, it is doubtful if the time savings in effecting policy change assumed to result from the POR by IRRI on the health costs of pesticide use would have been as significant.

Key Conditions for Generating Influence and Impact

IFPRI is the flagship center for policy research in the CGIAR, and its work on the impact of policy research has identified the following conditions that are conducive to the generation of influence and impact:

- Production of high-quality, independent research
- Timely availability of relevant research information
- Long-term, in-country presence of researchers
- Need for a policy environment conducive to research results
- Presentation of empirical data and simple analysis
- Likely trade-off between immediate production of results and the long-term building of in-country capacity for policy analysis
- Strategic choice of partners and the identification of ‘policy champions’ who may effectively advocate for policy change
- Need to establish and fortify a consensus among stakeholders
- Learning from cross-country experiences to improve ways of conducting research and influencing policy change.

With the exception of capacity building for policy analysis, all of these conditions are met by one or more of the case studies. Only the most salient ones are discussed here.

The long-term, in-country presence of researchers is one characteristic shared by six of the seven studies. CIFOR, ILRI, IRRI, and ICARDA all report on research-related policy

change that took place in the countries where their headquarters are located. WorldFish has had a country program in Bangladesh for many years. Bioversity carried out its work on ITAs at its headquarters in Rome in close association with FAO. Although IFPRI has had a more centralized allocation of research resources than many of the other IARCs, and although it did not have a country program in Mexico, IFPRI has had a medium-term working relationship with the PROGRESA program.

The case studies underscored several of the desirable aspects for establishing a longer-term involvement in a well-defined policy setting (Timmer, 2004). But it is not just being in the same country for many years; the case studies suggested that good research is most influential when researchers are to some extent 'in bed' with others in the policy community who are not researchers such as NGOs and donors. The importance of developing these cross-over relationships with non-researchers is epitomized in the CIFOR and ILRI cases, where advocacy played a large role in contributing to policy change.

The long-term involvement and development of close working relationships between the research teams and government policy-makers and non-government stakeholders in the policies concerned, provide an excellent rationale for using the economic value of time saved in effecting welfare-enhancing policy change as a legitimate means of assessing the counterfactual impact of POR. This approach was used in a number of the case studies.

Both supply and demand considerations explain the centrality of headquarters' locations in the selection of case studies. On the supply side, policy research is more likely to be conducted or, at least, orchestrated from a headquarters base than from a regional or country location for most of the IARCs. Therefore, policy-related research output attains a profile in the host country that can be greater than the relative importance of the country in the center's mandate.

But demand-side influences may be even more important, because researchers are significantly more aware of the host country's policies – the consequences of which they have to live with daily – than with poli-

cies in other countries in their global mandate. As discussed above, most of the case studies were demand-side, in the sense of identifying well-defined research that could have contributed to policy change. The dynamics of policy change and prospects for attribution are more transparent in the headquarters' country than in others where the effects of earlier policy-related research may have escaped attention. For these reasons, the high incidence of headquarters countries in the case studies was expected and attests to the importance of a long-term involvement in policy research in a country over time.

The value of high-quality, independent research is another theme that weaves its way through several of the studies. It is most in evidence in the IFPRI case study as independence and high-quality applied research figured prominently in the selection of that center for program evaluation. Perhaps of greater importance, the conversations from key informants supported the case that IFPRI's earlier policy research was formative in contributing to the content and design of the PROGRESA program. Additionally, IFPRI's reputation and the quality of the PROGRESA program facilitated its longevity in spite of changes in government in Mexico, which traditionally meant the demise of such programs. In CIFOR's case, the perceived credibility of the center's research was reported as essential to its contribution to advocacy activities by others. The positive role of the IARC as an 'honest broker' was highlighted in most case studies as a determinant of successful POR. In some cases, this honest broker or advocacy role seemed to dominate the research role, e.g., Bioversity.

Success was also ascribed to a policy environment conducive to the assimilation of research results. An enabling policy environment was underscored in the IRRRI case study. The authors of this study note that if the research on the health costs of pesticide use had been conducted during the Marcos regime the odds are that the output would have fallen on sterile ground. The fall of the Suharto regime just before CIFOR's research began and the US\$14 billion default of the pulp industry's largest actor within months of the research's release created the openness and salience necessary for effective dissemination of research findings.

As a point of contrast, parallel research funded by the Rockefeller Foundation on the health costs of pesticide use was also carried by CIP and its partners over several years in a smallholder, intensive potato-growing area in northern Ecuador (Crissman et al., 1998). Similar to IRRI's work, large adverse effects to insecticide use were documented and disseminated. Some success was made in improving workers' safety via the adoption of protective clothing, but, in general, this work was not effective in spawning policy change because affordable and technically efficient substitutes to insecticides to manage Andean potato weevil were not available, and because pesticide importers vehemently opposed the regulatory controls proposed by the research. Government administrators and bureaucrats were aware of the research, but they were not influenced by it because of the strength of the pesticide lobby.

The WorldFish case study on community-based fisheries in Bangladesh also brings out an important institutional dimension of the enabling environment, i.e., effective policy action may involve more than one institutional player. In Bangladesh, the Ministry of Fisheries and Livestock was well versed on the research on inland fisheries, but the Ministry of Land that is responsible for leasing strategies for water bodies was not sufficiently involved in, or did not actively support, community-based fisheries management. The absence of a strong line agency or a reasonably effective ministry leads to a debilitated enabling environment. Likewise, casting too wide a net on the subject-matter content of POR may substantially increase the level of institutional difficulty in achieving uptake and influence. In developing countries, forestry, fisheries, and livestock seem to be more vulnerable to problems of institutional and organizational definition than crop agriculture.

The role of a policy 'champion' was a recurring theme in several case studies including ICARDA, ILRI, and WorldFish. The champion was primarily responsible for the continuation of policy-related activities after the project formally ended. In Syria, the key informants identified the Head of the Directorate of Soil Fertility as being instrumental in promoting the policy change. The key institutional role in the ILRI case study was played by the SDP Manager who was a

full-time employee of the Ministry of Livestock, the ministry that issued subsidiary legislation to legalize the participation of the SSMVs in the dairy supply chain.

Characterizing the PORIA Case Studies in Research Utilization Models

In *The Many Meanings of Research Utilization*, Weiss (1979) drew attention to the complexity of the impact pathway, and conceptualized research use in the context of the policy-making process. She identified alternative routes of influence, ranging from direct application of research results taken up by policy-makers ('knowledge-driven' and 'problem-solving' models) to more partial and indirect influence ('interactive', 'political' and 'tactical' models) to cases where research generates findings that may even run counter to prevailing opinion (the 'enlightenment' model). Drawing on the Weiss framework, Table 1 depicts the various pathways of influence (research utilization models) characterizing each of the seven PORIA case studies. While none of the case studies could be said to fall completely into one type of model, the studies could be characterized as having major elements of, in some cases, several models.

The Problem-solving Model is probably the prevailing imagery of research utilization. It involves the direct application of the research results to a pending decision. A problem exists, a decision has to be made, and information or understanding with which to generate a solution or choose a best one is lacking – research provides the missing knowledge. The expectation is that the research result clarifies the situation and reduces uncertainty and therefore influences the decision that policy-makers make. The problem-solving model is akin to the demand-led study, where a specific request for information is made. Weiss (1979) argues that most POR studies fail to leave a discernible mark on the direction or substance of policy, as "it takes an extraordinary concatenation of circumstances for research to influence policy decisions directly: a well-defined decision situation, a set of policy actors who have responsibility for making the decision, an issue whose resolution depends at least to some extent on information, identification

Table 1. Relevance of conceptual models for utilization of social science research in the policy-making process to the PORIA Phase II case studies

Center case study	Models of research utilization (following Weiss, 1979) ¹		
	Problem-solving model	Political model	Enlightenment model
Bioversity	Strong		Moderate
CIFOR		Strong	Very strong
ICARDA	Moderate		Strong
IFPRI	Moderate	Very strong	
ILRI		Strong	Moderate
IRRI		Strong	Strong
WorldFish		Moderate	Strong

¹ Weiss (1979) actually describes seven models of research utilization in the policy-making process, the others (not relevant in the PORIA cases) are the interactive model, the tactical model and research as part of the intellectual enterprise of the society.

of the requested informational need, research that provides the information in terms that match the circumstances within which choices will be made, research findings that are clear cut, unambiguous, firmly supported and powerful, that reach decision-makers at the time they are wrestling with the issues, that are comprehensible and understood and that do not run counter to strong political interests.” (p. 428). Because of the unlikely chances that these conditions will fall in line around any one issue, it is reasonable to assume that this model of research probably describes a relatively small number of cases. Nevertheless, several of the case studies in the PORIA study do appear to share elements of this model, in particular, Bioversity, IFPRI, and ICARDA.

The Bioversity case study was clearly operating in the problem-solving model – national sovereignty was threatening crop germplasm exchange and potentially restricting gene-flows and Bioversity was given a unique and key role to help resolve technical, legal, and political constraints to a solution. But it also appears that elements of the enlightenment model were in evidence, e.g., changing views and perspectives through indirect means (including research), discussions, and dialogue. While the IFPRI case study also had elements of the problem-solving model, it appears to have the stronger characteristics of the political model, where the government seemed to be pre-disposed to a positive result and contracted IFPRI – known to

be an objective, well-respected but independent evaluator – to confirm the value of PROGRESA. A similar case is observed for the ICARDA study, where there appeared to be demand for solid information about barley responding to fertilizer in dry areas, but as indicated earlier, ICARDA also played the role of policy champion in this respect, no doubt overshadowing its problem-solving role.

The Political Model is most characteristic of those situations when policy positions/opinions are already hardened, so the research results are used as ammunition to support a pre-determined position, often enhancing the confidence of decision-makers, reducing their uncertainties, and strengthening their position. As noted, the IFPRI case seems to share these characteristics. From the perspective of the major NGO players, whose positions had already been staked out, the CIFOR case probably follows the political model, whereas from the vantage of other stakeholders, including the Indonesian government, World Bank, etc., the enlightenment model may well apply. ILRI and IRRI, and perhaps WorldFish to a lesser extent, probably fall into the political model as well. As mentioned earlier in this report, Spilsbury and Kaimowitz (2002) and Rogers (1988) had also described the complexity in indirect influence, notably decision-makers’ search for published research they can cite in support of positions they have already reached, completely independently of that

research – essentially alluding to the ‘political model’.

The Enlightenment Model is, according to Weiss (1979), probably the most common pathway of utilization, where concepts and theoretical perspectives that research has engendered permeate the policy-making process. The research sensitizes decision-makers to new issues and raises awareness about policy problems, or generates findings that may run counter to prevailing opinion. Research contributes to a body of evidence that is diffusing through numerous channels and helping shape public opinion and decision-makers’ perspectives. In this model “rarely will policy-makers be able to cite the findings of a specific study that influenced their decisions, but they have a sense that research has given them a backdrop of ideas and orientation.” (p. 430). This model is more akin to a supply-led approach. As can be seen from Table 1, probably all the case studies, IFPRI excepted, reflect elements of the enlightenment model.

The problem with applying the enlightenment model to the PORIA cases is that enlightenment generally takes time. From the release of research findings to the ultimate influence on policy, there is likely to be a period when the concepts and ideas start circulating and work down to academics, journalists, policy advisors, and bureaucrats and eventually come to influence a substantial part of the policy environment. So in those cases where considerable time had elapsed between the research and the policy change, enlightenment is a real possibility. The best example of this from the PORIA case studies is the WorldFish case, where research activity has been in progress for more than 20 years and a formal policy change has still not occurred, but looks very likely to do so soon.

It is important to note that the POR does not necessarily have to be at the forefront or beginning of the policy change process. Often, as in the case of IRRI or CIFOR, the critical results brought forward from their research can often help precipitate an already ongoing process, i.e., the research contributes in a significant way to the changing perspective and provides critical impetus resulting in a policy change.

The element of surprise, highlighted earlier, is not an essential element of ‘enlightenment’. Policy-makers who receive the new research and gradually absorb its ideas and implications are not necessarily aware or surprised that it is different. The change in understanding can be subtle at first, so that it overtakes people without a sense of shock or surprise. But it introduces new concepts and new angles of vision. When surprise is in evidence, it is important to identify and track how the research has challenged and uprooted earlier (older) assumptions.

References

- Behrman, Jere R. 2007. *Policy-oriented Research Impact Assessment (PORIA) Case Study on the International Food Policy Research Institute (IFPRI) and the Mexican PROGRESA Anti-poverty and Human Resource Investment Conditional Cash Transfer Program*. IFPRI Impact Assessment Discussion Paper No. 27. International Food Policy Research Institute: Washington, DC, USA.
- CGIAR Science Council. 2006. *Impact Assessment of Policy-Oriented Research in the CGIAR: A Scoping Study Report*. Science Council Secretariat: Rome, Italy.
- Crissman, C., Antle, J.M., and Capalbo, S.M. 1998. *Economic, Environmental, and Health Tradeoffs in Agriculture: Pesticides and the Sustainability of Andean Potato Production*. Kluwer Academic Publishers: Norwell, Massachusetts, USA.
- Fuglie, K.O., Zhang, L., Salazar, L.F., and Walker, T.S. 1999. *Economic Impact of Virus-free Sweetpotato Planting Material in Shandong Province, China*. International Potato Center (CIP): Lima, Peru.
- Lindner, B. 2004. Second thoughts on a framework for evaluating agricultural economics research. pp. 153–173 In: *What’s Economics Worth?* (Pardey, P.G. and Smith, V.H., Eds). Johns Hopkins University Press: Baltimore, MD, USA.
- Maredia, M.K. and Raitzer, D.A. 2006. *CGIAR and NARS Partner Research in Sub-Saharan Africa: Evidence of Impact to Date*. 78 pp. CGIAR Science Council

- Secretariat: Rome, Italy. http://www.sciencecouncil.cgiar.org/fileadmin/user_upload/sciencecouncil/Impact_Assessment/CGIAR_WP_AI-proof3.pdf
- Norton, G.W. and Schimmelpfennig, D.E. 2001. *Using Bayesian Approaches to Value Policy Research*. Paper presented at the Ministry of Foreign Affairs, Netherlands–IFPRI Workshop on Assessing the Impacts of Policy-Oriented Social Science Research, 12–13 November, The Hague, The Netherlands.
- Ravallion, M. 2001. The mystery of the vanishing benefits: An introduction to impact evaluation. *The World Bank Economic Review*, 15(1), 115–140.
- Raitzer, D.A. 2003. *Benefit–Cost Meta-Analysis of Investment in the International Agricultural Research Centers of the CGIAR*. Report prepared on behalf of the CGIAR Standing Panel on Impact Assessment. CGIAR Science Council Secretariat: Rome, Italy.
- Raitzer, D.A. and Kelley, T.G. 2008a. Assessing the contribution of impact assessment to donor decisions for international agricultural research. *Research Evaluation*, 17(3), 187–199.
- Raitzer, D.A. and Kelley, T.G. 2008b. Benefit–cost meta-analysis of investment in the international agricultural research centres of the CGIAR. *Agricultural Systems*, 96, 108–123.
- Raitzer, D.A. and Ryan, J.G. 2008. State-of-the-art in impact assessment of policy-oriented international agricultural research. *Evidence and Policy*, 4(1), 5–30.
- Raitzer, D.A. and Winkel, K. 2005. *Donor Demands and Uses for Evidence of Research Impact – the Case of the Consultative Group on International Agricultural Research (CGIAR)*. Prepared on behalf of the CGIAR Standing Panel on Impact Assessment. CGIAR Science Council Secretariat: Rome, Italy.
- Rogers, James M. 1988. *The Impact of Policy Analysis*. University of Pittsburgh Press: Pittsburgh, PA, USA.
- Ryan, J.G. and Garrett, J.L. 2003. *The Impact of Economic Policy Research: Lessons on Attribution and Evaluation from IFPRI*. Impact Assessment Discussion Paper No. 20. International Food Policy Research Institute (IFPRI): Washington DC, USA.
- Spilsbury, M.J. and Kaimowitz, D. 2002. Forestry research, innovation, and impact in developing countries – from economic efficiency to the broader public good. *The Forestry Chronicle*, 78 (January/February), 103–107.
- Timmer, C.P. 2004. Adding value through policy-oriented research: reflections of a scholar-practitioner. pp. 129–152. In: *What’s Economics Worth?* (Pardey, P.G. and Smith, V.H., Eds). Johns Hopkins University Press: Baltimore, MD, USA.
- Walker, T., Maredia, M., Kelley, T., La Rovere, R., Templeton, D., Thiele, G., and Doutwaite, B. 2008a. *Strategic Guidance for Ex post Impact Assessment of Agricultural Research*. Prepared for the Standing Panel on Impact Assessment, CGIAR Science Council Secretariat: Rome, Italy.
- Walker, T., Friday, J., Casimero, M., Dollentas, R., Mataia, A., Acda, R., and R. Yost. 2008b. The economic impact of a nutrient management decision support system (NuMaSS) on small farm households cultivating maize on acidic, upland soils in the Philippines. University of Hawaii: Honolulu, Hawaii. (Unprocessed ms).
- Weiss, C. 1979. The many meanings of research utilization. *Public Administration Review*, 39, 426–431.

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2 Supply-led impact assessments start from the outputs of a center’s research and examine to what extent these had an effect or influence on a given policy. Demand-led impact assessments start with a policy change and work backwards from this to investigate the multiple forces and pathways by which this change has occurred – to observe whether the center’s work played any role (CGIAR Science Council, 2006).

5. Conclusions¹

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At a risk of generalizing from a handful of case studies, several conclusions can be drawn from this exercise on impact assessment of POR. The selection of case studies was comparable to the success story approach in the rate of return literature on TOR. Cases with a perceived high level of adoption are selected for analysis. In PORIA terms, technology adoption equates to policy change, which, for all intents and purposes, is known at the start of the study. What is unknown is the contribution that well-defined research and research-related activities made to the change in terms of uptake and influence, and the welfare effects of the policy change. The expectation was that specific research and advocacy subsequently contributed to well-defined policy change in a supply-driven context, but that expectation had to be documented.

Documentation of uptake and influence was center stage in this initiative. Such an emphasis was appropriate because few prior studies on POR carried out by the CGIAR were able to tell a persuasive story on the influence of research on policy change. The areas of uptake and influence are also the two dimensions of ePIA that most distinguish POR evaluation from the assessment of TOR.

In general, the extra effort that was made to document uptake and influence via key informant interviews was worth the time and expenditure. Although some were more persuasive than others, all the studies reported positive results in this area. The use of a very knowledgeable single interviewer engaging in structured, interpersonal conversations seemed to provide the firmest evidence on uptake and influence. Reading what the key informants had to say in the unabridged versions of these studies was more informative than viewing tabular presentation of results of 30 or more interviews. Similar to weighted regression, some

of the informants were more 'key' than others, and snippets of the most relevant parts of their conversations could have been incorporated into the study reports in a more journalistic narrative fashion to add texture to the discussion of uptake and influence.

The focus of these studies on uptake and influence advanced understanding, but more could have been learned if the enquiry had been more interdisciplinary. There is a need for greater knowledge and skill in key-informant interviews and document analysis. Crisp, informative interviewing combines science and art, and there is a well-established sociological literature on good practice in interviewing in several traditions. Other vital needs in this type of enquiry are knowledge of: the policy arena, the history of the focal issue in that arena, the central interests involved, and the cast of key actors. In these cases, perhaps the need for knowledge of the policy arena was obscured by the selection of cases in the headquarters' countries where authors already knew much about the politics of policy-making. Other studies may need to be more sensitive to this need.

In this particular application, successful enquiry on research influence requires good knowledge of the original research and the course of its development. Extensive experience in this highly specific research area is desirable so that good practice can be achieved as quickly as possible. Another topic worth exploration is the use of internal versus external case-study analysts. Whether internal knowledge trumps outsider objectivity/independence in this particular field is a hardy question in the methodological literature, which is unlikely to reach crisp resolution here. The attribution of research influence on policy change would also seem to be ripe for further applications of, and refinements in, social network analysis. Also,

putting this research area on a firmer quantitative footing calls for a systematic exploratory investment in Bayesian analysis that in this context draws heavily on the interdisciplinary research area of elicitation of probabilities and the notion of surprise from the results of POR.

With regard to the welfare effects of policy change, these PORIA case studies displayed some similarities between and contrasts to comparable ePIAs of TOR. Several problematic areas in the valuation of benefits in the ePIA of technologies also proved to be some of the more challenging areas for the ePIA of policies.

Also, like ePIAs of TOR, most of the studies focused on ‘young’ policies requiring the projection of benefits. In other words, the studies were a blend of *ex post* and *ex ante* assessments. The authors were informative about the separation of realized from projected benefits, but the threat of policy reversals did not warrant much discussion, as does the observation that most ePIAs of TOR do not address lack of adoption. Presumably, a concentration on ‘younger’ policies made the documentation of uptake and influence easier. An emphasis on more contemporary policy change also mitigates the common critique by donors and other stakeholders that ePIA does not have accountability implications for the present because it only addresses policy change from POR in the distant past (Raitzer and Winkel, 2005). Some of the case studies, such as that from CIFOR, explicitly addressed the *ex ante* character of their CBA through both their counterfactual and their emphasis on indicative benefits.

Differences from ePIAs of TOR were also noted. The results of the cost–benefit analysis perhaps offered the sharpest contrast. The mean estimated IRRs are likely to be markedly higher than comparable estimates found in agricultural research. Special project funding often supported the POR case studies. Shorter investment periods and lower costs relative to other types of agricultural research can result in very large estimates of IRR. Moreover, research-related success stories in policy change are often not characterized by the adoption lags of similar

success stories in agriculture, assuming that the policy improvement can be implemented and enforced.

However, high estimates for these cost–benefit parameters for some small project success stories do not imply that public-sector policy research is a substantially more profitable investment in the agricultural sector than public-sector biological research in the same sector. Policy change tends to be more discontinuous across countries and over time than technological change, particularly varietal change. Simply stated, these high estimates say that when policy change occurs it can be highly productive. Moreover, given the restricted geographic focus on countries in these studies, the overall size of benefits in terms of NPV may not favor these case studies relative to ePIAs of TOR. The authors of the case studies showed admirable restraint in not engaging in over-extrapolation beyond the boundaries of their case study, or beyond the type of intervention that was the subject of the cost–benefit analysis.

The case studies as a group affirmed several of the important elements in the scoping study described in the Foreword and Introduction in the conduct of PORIA. Of these, perhaps the one that resonated with the lead author of this chapter the most through the body of work as a whole was the element of surprise. Surprising research results led to revised thinking that subsequently contributed to policy change in several of the case studies. Surprises were registered in both direction and magnitude of research results. Surprising results should be nurtured and broadly validated over space and time because they contain the seeds for policy change if an appropriate extent of advocacy is associated with uptake.

Key conditions for enhancing the practical impact of POR weave their way throughout the case studies. Six of the seven studies were characterized by a long-term presence in-country. The value of an enabling policy environment in facilitating influence was underscored in several of the studies, particularly those that took place in periods following oppressive regimes in Southeast Asia. In Mexico, a highly responsive govern-

ment opened up policy space for a new initiative.

In some of the cases, the expectation was satisfied that high-quality, sustained policy research would play a major role in determining uptake, influence, and impact; but that was not the case in others where the center's independence and its capacity to perform as an 'honest broker' seemed more important than the quality of the particular POR involved, *per se*. In general, demand considerations, such as an opportune environment for policy change and effective partners for advocacy, were more instrumental in translating policy research into policy change than supply factors that are better reflected in publications and citations. Nevertheless, across these seven cases, the ones characterized by the deeper, quality research were the easiest to assess in terms of telling a persuasive narrative about uptake, influence, and subsequent impact, e.g., IRRRI and IFPRI.

The country-specificity of every case and the desirable attribute of a long-term country presence in most of the cases seem to argue for the decentralization of policy research. But, not counting IFPRI, only one of the cases was conducted in a country setting away from center headquarters. These simple observations seem to argue for decentralization with long-term critical mass, but more experience with demand-side PORIA needs to accumulate before such a conclusion is warranted. It also raises questions about the ability of POR to deliver IPGs, or at least our ability to document their uptake, influence, and impact.

The documentation of POR that had a practical impact opens up the comparative possibility to learn more about 'failure'. A few of the studies such as CIFOR's were characterized by a multi-country programmatic initiative at the level of a research institute or donor. Comparing differing outcomes on uptake and influence and likely explanations for differences could be relevant for POR now that variation in success has been established. Five of the seven studies were nested in multi-country efforts that spun off the core country research, or were conducted simultaneously with research in the study

country. Follow-on studies that document whether spill-overs have taken place could address the hypothesis about the national specificity of POR.

Summing up, this effort featuring an emphasis on the documentation of influence and impact has significantly expanded the number of case studies of PORIA. Five of the seven case studies were able to measure the economic impact of the policy changes that were associated with the respective POR, and the returns on the POR investments themselves, although none were able to translate these economic impacts into poverty reduction or enhanced food security. In this respect, they are not so different from most impact assessments done in the CGIAR. The CIFOR study did assess the environmental externality benefits from the policy changes in addition to the direct economic benefits, which represents a major advance in the scope of PORIA. Adding together the estimates of economic impacts of POR from the five case studies that measured impact – using the base or conservative scenario in each case – gives us a cumulative NPV of about US\$750 million: CIFOR US\$130 million; ICARDA US\$73 million; IFPRI US\$73 million; ILRI US\$230 million; IRRRI US\$248 million. If we add this amount to the US\$200 million in benefits estimated from the three PORIA studies cited in the scoping study report (CGIAR Science Council, 2006), one arrives at a current estimate of US\$950 million as the NPV of documented benefits from POR in the CGIAR. While this figure is above the US\$800 million in cumulative investment in POR in the CGIAR (until 2004), the cumulative investment is now well above the US\$950 million figure. Hence, there remains a need for further PORIA studies by centers if donors are to be satisfied about the appropriateness of the increased emphasis on POR in the past 20 years.

Still, this study should go a long way in addressing the concern about the paucity of cases of PORIA in international agricultural research: some good-practice examples have been nurtured and developed, and the number of similar studies forthcoming in the next five years should be a good indicator of the impact of this initiative. Five years from now we should be in a position to determine

whether these first-generation case studies were the tip of an iceberg or the bottom of the barrel.

References

- CGIAR Science Council. 2006. *Impact Assessment of Policy-Oriented Research in the CGIAR: A Scoping Study Report*. CGIAR Science Council Secretariat: Rome, Italy.
- Raitzer, D.A and Winkel, K. 2005. *Donor Demands and Uses for Evidence of*

Research Impact – the Case of the Consultative Group on International Agricultural Research (CGIAR). Prepared on behalf of the CGIAR Standing Panel on Impact Assessment. CGIAR Science Council Secretariat: Rome, Italy.

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Acronyms

BCR	benefit–cost ratio
Bioversity	Bioversity International (formerly International Plant Genetic Resources Institute, IPGRI)
CBA	cost–benefit analysis
CBFM	community-based fisheries management
CGIAR	Consultative Group on International Agricultural Research
CIAT	Centro Internacional de Agricultura Tropical (International Center for Tropical Agriculture)
CIFOR	Center for International Forestry Research
CIP	Centro Internacional de la Papa (International Potato Center)
CIMMYT	Centro Internacional de Mejoramiento de Maíz y Trigo (International Maize and Wheat Improvement Center)
epIA	<i>ex post</i> impact assessment
FAO	Food and Agriculture Organization of the United Nations
ICARDA	International Center for Agricultural Research in the Dry Areas
ICRAF	World Agroforestry Center (formerly International Centre for Research in Agroforestry)
ICRISAT	International Crops Research Institute for the Semi-Arid Tropics
IFPRI	International Food Policy Research Institute
IITA	International Institute of Tropical Agriculture
ILRI	International Livestock Research Institute
IMF	International Monetary Fund
INIBAP	Banana and Plantain Section of Bioversity International (formerly International Network for the Improvement of Banana and Plantain)
IPG	international public good
IRR	internal rate of return
IRRI	International Rice Research Institute
ITA	In-Trust Agreement
MDG	Millennium Development Goal
NARS	national agricultural research system
NGO	non-governmental organization
NPV	net present value
POR	policy-oriented research
PORIA	policy-oriented research impact assessment
R&D	research and development
SPIA	Standing Panel on Impact Assessment (Science Council)
TOR	technology-oriented research
UNDP	United Nations Development Programme
WorldFish	WorldFish Center (formerly International Center for Living Aquatic Resources Management, ICLARM)
WARDA	The Africa Rice Center (formerly West African Rice Development Association)
WWF	WorldWide Fund for Nature

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