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AGRICULTURAL RESEARCH AND COMPETITIVE GRANT SCHEMES

AN IEG PERFORMANCE ASSESSMENT OF FOUR PROJECTS IN LATIN AMERICA

**NICARAGUA
AGRICULTURAL TECHNOLOGY AND RURAL EDUCATION PROJECT (C3371)**

**PERU
AGRICULTURAL RESEARCH AND EXTENSION PROJECT (L4519)**

**COLOMBIA
AGRICULTURE TECHNOLOGY DEVELOPMENT PROJECT (L3871)**

**BRAZIL
AGRICULTURAL TECHNOLOGY DEVELOPMENT PROJECT (L4169)**

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Independent Evaluation Group*

Abbreviations and Acronyms

APL	Adaptable Program Loan
ARTDT	Agricultural Research Technology Development and Transfer
ATLMP	Agricultural Technology and Land Management Project
CAS	Country Assistance Strategy
CECOCAFEN	Central Coffee and Cocoa Marketing Firm
CENI	Commodity-Specific Research Institute
CETAS	Agricultural Technology Information Centers
CGIAR	Consultative Group on International Agricultural Research
CIDEL	Information Centers for Local Development
COLCIENCIAS	Colombian Institute for Science and Technology Development
CORPOICA	Colombian Corporation for Agricultural Research
DANIDA	Danish International Development Agency
DNP	Department of National Planning
DRI	Integrated Rural Development
EC	Executive Council
EMBRAPA	Brazilian Agricultural Research Corporation
FAITAN	Support Facility for Nicaraguan Agricultural Technology Research
FAT	Technical Assistance Fund
FDSE	Strategic Program Development Fund
FINCYT	Fund for Innovation, Science and Technology
FTA	Agricultural Technology Fund
FUNICA	Foundation for Development of Agricultural and Forestry Technology
GDP	Gross Domestic Product
IADB	Inter-American Development Bank
ICA	Colombian Agricultural Institute
ICR	Implementation Completion Report
IEG	Independent Evaluation Group
IFAD	International Fund for Agricultural Development
IICA	Inter-American Institute for Agricultural Cooperation
INATEC	National Institute for Technical Training
INCAGRO	Innovation and Competitiveness for Peruvian Agriculture
INIA	National Agricultural Research Institute
INTA	National Institute of Agricultural Technology
LABEX	'Virtual Laboratories'
MAGFOR	Ministry of Agriculture, Livestock and Forestry
MARENASS	Management of Natural Resources in the Southern Highlands Project
NAC	National Advisory Council
NGO	Non-Governmental Organization
PAD	Project Appraisal Document
POA	Annual Operating Plan
PPAR	Project Performance Assessment Report
PRODETAB	Agricultural Technology Development Project
PRONAMACHCS	National Program of Watershed Management
PRONATTA	Agriculture Technology Development Project
PRORURAL	Multi-donor rural development program
PROSAAMER	IADB-supported Rural Market Access Program
PSI	Private Sector Investment Program
PTA	Agricultural Transition Project
SINTAP	National System for Agricultural Technology Transfer
SNPA	National Agricultural Research System
UMATA	Municipal Unit for Agricultural Assistance

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About this Report

The Independent Evaluation Group assesses the programs and activities of the World Bank for two purposes: first, to ensure the integrity of the Bank's self-evaluation process and to verify that the Bank's work is producing the expected results, and second, to help develop improved directions, policies, and procedures through the dissemination of lessons drawn from experience. As part of this work, IEGWB annually assesses about 25 percent of the Bank's lending operations through field work. In selecting operations for assessment, preference is given to those that are innovative, large, or complex; those that are relevant to upcoming studies or country evaluations; those for which Executive Directors or Bank management have requested assessments; and those that are likely to generate important lessons.

To prepare a Project Performance Assessment Report (PPAR), IEGWB staff examine project files and other documents, interview operational staff, visit the borrowing country to discuss the operation with the government, and other in-country stakeholders, and interview Bank staff and other donor agency staff both at headquarters and in local offices as appropriate.

Each PPAR is subject to internal IEGWB peer review, Panel review, and management approval. Once cleared internally, the PPAR is commented on by the responsible Bank department. IEGWB incorporates the comments as relevant. The completed PPAR is then sent to the borrower for review; the borrowers' comments are attached to the document that is sent to the Bank's Board of Executive Directors. After an assessment report has been sent to the Board, it is disclosed to the public.

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Outcome: The extent to which the operation's major relevant objectives were achieved, or are expected to be achieved, efficiently. The rating has three dimensions: relevance, efficacy, and efficiency. *Relevance* includes relevance of objectives and relevance of design. Relevance of objectives is the extent to which the project's objectives are consistent with the country's current development priorities and with current Bank country and sectoral assistance strategies and corporate goals (expressed in Poverty Reduction Strategy Papers, Country Assistance Strategies, Sector Strategy Papers, Operational Policies). Relevance of design is the extent to which the project's design is consistent with the stated objectives. *Efficacy* is the extent to which the project's objectives were achieved, or are expected to be achieved, taking into account their relative importance. *Efficiency* is the extent to which the project achieved, or is expected to achieve, a return higher than the opportunity cost of capital and benefits at least cost compared to alternatives. The efficiency dimension generally is not applied to adjustment operations. *Possible ratings for Outcome:* Highly Satisfactory, Satisfactory, Moderately Satisfactory, Moderately Unsatisfactory, Unsatisfactory, Highly Unsatisfactory.

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Borrower Performance: The extent to which the borrower (including the government and implementing agency or agencies) ensured quality of preparation and implementation, and complied with covenants and agreements, toward the achievement of development outcomes. The rating has two dimensions: government performance and implementing agency(ies) performance. *Possible ratings for Borrower Performance:* Highly Satisfactory, Satisfactory, Moderately Satisfactory, Moderately Unsatisfactory, Unsatisfactory, Highly Unsatisfactory.

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Preface

This report contains a comparative assessment of the performance of four similar agriculture research projects in Brazil, Colombia, Nicaragua and Peru. The main report compares findings from the four projects.

The Project Performance Assessment Reports (PPAR) for each project are presented in Annexes 4-7. Annex 4 presents the Project Performance Assessment Report (PPAR) for the Nicaragua Agricultural Technology Project (Loan Number 3371), approved 6 June, 2000 1998 and closed 30 June, 2005. Annex 5 presents the Project Performance Assessment Report (PPAR) for the Peru Agricultural Research and Extension Project (Loan Number 4519), approved 23 November, 1999 and closed 31 January, 2005. Annex 6 presents the Project Performance Assessment Report (PPAR) for the Colombia Agriculture Technology Development Project (Loan Number 3871), approved 20 April, 1995 and closed 31 December, 2003. Annex 7 presents the Project Performance Assessment Report (PPAR) for the Brazil Agricultural Technology Development Project (Loan Number 4169), approved 22 May, 1997 and closed 31 December, 2005.

The report was prepared by the Independent Evaluation Group (IEG). It is based on the project completion and appraisal reports, the Development Credit and Loan Agreements, a review of Bank files, and discussions with beneficiaries, Bank staff, government officials, non-governmental organizations, institutions, banks, donors, and private sector managers. The cooperation and assistance of all stakeholders as well as the support of World Bank Country Offices in Nicaragua, Peru, Colombia and Brazil is gratefully acknowledged.

Following standard IEG procedures, a draft of the main report and the respective PPAR was sent to each Borrower for comments before being finalized. The Borrowers' comments are presented in Appendices to the individual country Project Performance Assessment Reports. The final report will be available to the public following submission to the World Bank's Board of Directors.

Summary

This report assesses the performance of four agriculture projects that used a similar approach to support agricultural research in Brazil, Colombia, Nicaragua and Peru and draws conclusions based on a comparative analysis of the four projects.

The unifying theme for this assessment is the performance of nationwide systems of agricultural research with particular reference to the use of Competitive Grant Schemes to fund a wide range of generally small-scale initiatives for developing and transferring agricultural technologies.

Competitive Grant Schemes (CGS) typically entail nationwide contests, inviting a wide range of potential service providers to submit proposals for technical review. Selection of proposals financed is made according to transparent procedures and is based on rigorous criteria. The aim is to bring greater contestability and increased efficiency to bear on agricultural knowledge creation. CGS complement traditional “block” funding allocated annually to specified public research organizations for their core research programs.

Since the early 1990s Latin America has pioneered the CGS approach, with significant support from the Bank, including the four projects assessed in this report.

The main evaluation findings are six-fold. First, although the design of the projects was client responsive, outreach to the poorest groups and regions was problematic. Second, an IEG poll of persons knowledgeable about the projects found a widespread conviction that the rigor and transparency of subproject selection was enhanced by the competitive model, but IEG found no evidence that this model led to higher quality and more cost-effective research than alternative approaches.

Third, the assessed projects sought, in varying degrees, to promote decentralization in order to be more client responsive and to balance regional priorities. But progress was uneven. Brazil made the greatest progress in developing research capacity in the individual states.

Fourth, although the projects were generally conducive to the diversification of service providers, they did not lead to a significant increase in participation by the commercial private sector. On the other hand, to the extent that the projects helped to improve skills, increase capacity, and elicit co-payment financing involving farmers and their organizations as well as other private nonprofit organizations, they contributed to a broader process of private sector development.

Fifth, with the exception of Peru, there is no evidence from rigorous impact evaluations to show whether the various small subprojects led to higher agricultural productivity and increased farm incomes, and the assessed projects made insufficient provision for assessing the short-term performance of individual subprojects (there was no systematic specification of baselines and targets).

Sixth, while there are doubts about how long support for the competitive fund model will continue in all four projects, it is equally important to recognize the support these projects gave to strengthening the broader public research and extension apparatus. Where there is a

strong public sector apparatus there is likely to be a sound enabling environment for competitive funding over the longer term, which may offset short-term downturns in government and donor support for competitive funds.

The outcome of the **Nicaragua** project is rated *unsatisfactory*. The objectives and design of the project were only modestly relevant, given Nicaragua's weak institutional capacity. Financing for the competitive fund component was halved, hampering the launch of this pilot initiative. There is conflicting information about the achievement of project outputs; and outcomes, in terms of crop yields and increased farm incomes, are also in doubt.

The outcome of the **Peru** project is rated *moderately satisfactory*. The objectives and the design of the project were substantially relevant, both in terms of the need to strengthen Peru's agricultural research and extension institutions and the consistency with good practice thinking in the Bank. But there was a shortfall in the number of adaptive research and extension subprojects, weaknesses in strategic research services, and limited progress toward the objective of improving management of public investment in agricultural technology. The project's actual achievements were significant in relation to the small size of the project; and a recent impact study suggests that INCAGRO subprojects have had a favorable impact on technology adoption rates and farm incomes.

The outcome of the **Colombia** project is rated *moderately satisfactory*. The objectives of the project were substantially relevant to Colombia's development priorities. Most of the project's output targets were met or exceeded—particularly so for training—and the project substantially achieved 3 of its 5 objectives. One of the biggest contributions was a strengthening of the public research agency, CORPOICA. But it was not as instrumental as expected in leading to greater participation by non-government research providers. Also, efficiency was compromised by the small size and diffuse nature of the subprojects.

The outcome of the **Brazil** project is rated *satisfactory*. The project addressed important issues on the agricultural research agenda (including development of family farms and poorer regions) and exceeded its targets in terms of the number of subprojects generated and the investments in institutional strengthening. Output targets were exceeded, even though actual total project costs were slightly less than expected at appraisal. The strengthening of EMBRAPA had a clear positive impact on the agency's institutional capacity and undoubtedly benefited the national research effort.

Comparative analysis of the four projects yields the following lessons:

There is a clear need for stronger monitoring and evaluation of research projects. The lack of hard evidence about the results of CGS investments in research and extension is a considerable shortcoming of all but one project. In each of these countries, agricultural productivity has risen since the mid 1990s, with growth increasingly based on intensification rather than area expansion. Potentially, the assessed projects contributed to this expansion. But, with the exception of Peru, there is no robust survey evidence linking productivity and income changes to the project interventions.

It is important to strengthen the capacity of research organizations, not just to finance research. CGS can be an important vehicle for research financing and have a strategic role to

play in piloting new ways of working or focusing research on new topics. But they are most likely to make a sound and lasting contribution when they complement a relatively strong public-sector framework for research.

To be able to compete, research institutions must have a minimum budget and a critical mass of staff. All institutions need a portion of the budget that is core funded to cover costs of maintenance and upgrading of physical and human resource infrastructure. CGS usually only fund operating costs, and the subprojects they finance have only 2-3 years' duration.

The CGS model is more likely to strengthen the strongest agencies providing research and extension services than it is to reduce the disparities between the strong and the weak. The principle of competition between alternative service providers breaks down where the range of providers is limited (a problem at the municipal level and for small countries) and many of the potential providers lack the skills needed to prepare viable sub-project proposals.

The CGS model has not itself led to a large growth in the role of the private (for profit) sector as a provider of agricultural research and extension; but it has contributed to the broader process of private sector development. In these countries, to the extent that commercial firms have played a role, they have largely done so outside the framework of competitive grant schemes. On the other hand, under the competitive schemes, through the medium of subproject co-payments, producers have provided private funds as a complement to public sector grants. They have also received training in the preparation of business plans, and have become more market-oriented owing to partnerships with producer associations that have been facilitated by competitive funding agreements.

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1. Introduction

Purpose of the Evaluation

1.1 This evaluation provides background for IEG’s FY10 Agriculture Study, which assesses the Bank Group’s support to agricultural growth and productivity. IEG evaluated a cluster of agricultural research projects to assess the evidence that a particular, widely-replicated model of technology development and transfer (developed in Latin America in the early 1990s) has been effective in spurring the development and dissemination of technologies conducive to agricultural productivity growth. The evaluation takes into account the results of earlier “self-assessments” of the four projects conducted by Bank operational staff.

Background

1.2 As the Green Revolution demonstrated, the development and dissemination of high-yielding crop cultivars—and of new agricultural technologies in general—has a major role to play in boosting agricultural productivity and thereby helping to strengthen long-run food security. The recent spike in food prices has drawn attention once again to the importance of technology development and dissemination.

1.3 The economic rate of return to investments in agricultural research and extension is high relative to other sector interventions.¹ In Latin America, according to one study, returns to applied research were 47 percent (compared to a worldwide average of 49 percent) and 46 percent for extension (41 percent worldwide).²

Table 1. Growth of Cereal Yields (1990-92 to 2004-06)

<i>Region</i>	<i>Mean annual growth (%)</i>
MNA	3.4
LCR	3.3
SAR	2.0
EAP	1.4
High Income Countries	1.6
AFR	1.1
ECA	-0.8

Source: World Bank, 2009b.

1.4 Since 1990, agricultural productivity has grown rapidly in Latin America (LCR) relative to other regions. One indicator of this is the progress of land-productivity in cereals (Table 1). However, diversification into other crops and improved links to markets for high-value products has been equally important. Rising incomes,

1. World Bank (2007) summarizes the literature.

2. Evenson (2001).

urbanization, greater female participation in the workforce, wider media penetration—these trends are all strong in Latin America and they are driving the demand for higher-value products, semi-processed and processed products, and convenience foods. There is a corresponding focus in the latest development thinking on the need to link farmers to “value chains”, integrating them more closely with wholesalers, processing firms and retailers (particularly supermarkets).¹

The Competitive Grant Model

1.5 After several decades of extensive use in industrialized countries (Alston, Pardey and Smith 1999 review the experiences of five such countries), in line with emerging thinking about New Public Sector Management (e.g., World Bank 1997d), many developing countries have also been introducing Competitive Grant Schemes (CGS) to bring greater contestability and hopefully increased efficiency into their agricultural knowledge-creation systems. The competitive research funds being introduced can, in principle, better mobilize available research capacity, stimulate scientific creativity and promote efficiencies in the national research system. High-quality review, administrative efficiency, and transparent processes are obviously essential to program credibility and performance.

1.6 In CGS research providers are selected on a competitive basis, using calls to elicit proposals and scientific peer review to allocate funding. CGS complement traditional “block” funding allocated annually to specified public research organizations for their core research programs, infrastructure, and human resources. They can be used to accomplish objectives that may be difficult to achieve through block funding, such as funding to specific research topics perhaps through adaptive on-farm research projects requiring collaboration between organizations and farmers, or research within a specific target region. They can, if appropriately designed:

- Mobilize the best available scientists, including those in universities and the private sector, for work on specific high-priority projects.
- Develop a pluralistic research system by providing operating costs to better utilize available human and physical infrastructure from a wide range of institutions.
- Make research more demand-driven by involving clients in setting priorities and financing, executing, and evaluating research.
- Increase total research funding by mobilizing funds from farmers, agribusiness, and other sources.
- Improve research quality and eventual innovation by selecting projects based on rigorous technical review of scientific merit, sound work-plan, and expected results.

1.7 Latin America has been a major site for CGS experimentation, an experience that has been closely followed and strongly supported by the World Bank. In the Bank, support for agricultural research competitive grant schemes in Latin America can be traced back to the early 1990s. Analytic work examined the alternatives to the “national institute model”, drawing on the more pluralistic approach taken in countries such as

1. This theme is explored at length in World Bank (2007); see, for example, p. 124.

Spain and Chile.¹ Operational work began in 1993 with the preparation of the Colombia project that is included in this assessment (PRONATTA), as well as a Venezuela extension project.

1.8 By the end of the decade a new, cross-agency consensus had emerged about “good practice” on agricultural research. In 1998, an agricultural research specialist at the Inter-American Development Bank wrote:

“After 40 years of useful application of a “one size fits all” model, the standard model for public agricultural research in the region—the INIA model—is becoming obsolete, due to changes in the process of innovation, and changes in the macroeconomic environment. As the agricultural sectors of the region continue to grow and become more competitive, private sector funding (from farmers and input companies) will continue to increase; as well as the share of public funds allocated to competitive funding mechanisms”.²

1.9 The questions that this evaluation sets out to answer are keyed to the core assumptions of the competitive fund model for agricultural research as it developed in Latin America in the 1990s. The model emerged in part as a response to new thinking about public and private sector roles in agriculture. There was a growing sense among the Bank’s intellectual leaders that if agriculture was to flourish it needed free markets.³ Although few were rash enough to deny that government had a role to play in creating the conditions for markets to operate, many were persuaded that government was too intrusive and that markets were distorted as a consequence. The stage was set for an attempt to circumscribe government intervention in agriculture (most radically in the withdrawal from subsidized lines of credit); and to contemplate privatizing certain services where public sector provision had become dominant.⁴

1.10 Willingness to move in this direction was underpinned, in many countries, by the urgency of fiscal retrenchment. This was one of the factors accounting for the dismantling of the federal extension system in Peru, Colombia and Brazil. (In Nicaragua, the coverage of the federal program had always been limited, leaving many regions without extension services.) At the same time, in the World Bank there was a growing suspicion that its flagship model for agricultural extension (the “Training and Visit system) was too costly to sustain.⁵ This particular model was most widely used in Asia and Africa and the Bank had never promoted it in Latin America; but rejection of T&V echoed a wider skepticism about the usefulness of extension, a concern that national programs were inflexible and poorly equipped to respond to dynamic supply and demand conditions.

1. McMahan (1992).

2. Echeverria (1998a).

3. See, for example, Knudsen et al (1990).

4. Pray & Umali-Deininger (1998).

5. Purcell & Anderson (1997); Anderson, Feder & Ganguly (2006).

1.11 A further development, which flowed from the structural adjustment agenda, was the rise in the conviction that Ministries of Agriculture were not the prime movers in terms of sector growth prospects—the distortions constraining agricultural growth had more to do with overvalued exchange rates, the greater protection applied to other sectors, and other forms of implicit taxation of agriculture, rather than sector-specific policies controlled by Ministries of Agriculture.¹ Much more important than any dialogue with the line ministry was the dialogue with the Finance Ministry. The staffs of the Ministry of Agriculture and its satellite agencies had a vested interest in maintaining the apparatus of state intervention in the sector. Increasingly, they were not regarded as the best interlocutors for a Bank set on redefining public and private sector roles. The idea of setting up new institutions outside the traditional public agencies came to seem attractive: the competitive fund model was one instance of this move to break free from the supposedly dead hand of agricultural bureaucracy. What happened in Peru is probably the purest expression of this thinking. After President Fujimori came to power in 1990, policy in Peru was marked by a skeptical view of state intervention in the economy, particularly so with respect to the agriculture sector. There was a market-oriented shift in thinking on agricultural technology transfer, characterized by what a Bank sector report described as “a strong push towards extensive privatization of agricultural research and extension”.²

1.12 But, as this report demonstrates, the technology transfer model that emerged in the four assessed projects was *not* about privatization; while it focused on broadening the range of service suppliers, commercial firms were not, in any sense the preferred suppliers. Equally important were the universities (mainly public) and a variety of “private nonprofit” agencies, ranging from producer associations (e.g. the *gremios* in Colombia) to NGOs. Only in Peru did the overall project development objective invoke the creation of a “private sector-led” technology innovation system, and even there this did not amount to a specific focus on commercial (for profit) service providers. The design of the Brazil project (PRODETAB) explicitly acknowledged that the innovation system would continue to be led by the strong public research agency, EMBRAPA.

1.13 The competitive model presupposed: establishment of a fund for financing subprojects; a set of rules regulating the terms of the competition, including co-financing; a nationwide publicity campaign to alert potential service providers; and special grants to help train would-be service providers to prepare subproject appraisals. To varying degrees, the models in the four assessed projects also sought to:

- Set up an implementing agency with substantial independence in relation to the line ministry—a prerequisite for smooth disbursement;
- Oblige government suppliers of agricultural research and extension services to compete with other potential suppliers, thereby boosting the quality of the service provided and lowering its cost;
- Allow representatives of the end-users of research to participate with government in drawing up the research agenda;

1. Schiff & Valdes (1992).

2. World Bank (1992d), p. 40.

- Encourage vertical integration of small farmers with “value chains”, entailing diversification out of staples into high-value crops;
- Aim to raise small-farmer incomes to the point where these producers could “graduate” from extension services that were state-led and user-free to fee-for-service programs provided by private firms;
- Limit government research agencies to providing goods that the private sector, by virtue of externalities and market failures, is ill-placed to provide;
- Decentralize to the extent possible, giving regional and local governments and non-government agencies a role in planning, implementing and co-financing agricultural services.

2. Approach

Evaluation Questions

2.1 This evaluation asks: How effectively has the competitive grant model spurred the development and adoption of new agricultural technologies?

2.2 The following questions are addressed:

- To what extent has the competitive fund *process* met expectations in terms of: (a) responsiveness to the needs of farmers and other stakeholders; (b) transparency and rigor in the selection between competing subprojects; and (c) decentralization, entailing greater involvement of sub-national authorities in priority setting and implementation?
- Has introduction of the competitive model led to a diversification of service providers and a sharper differentiation between the roles of public and private sectors?
- Have subprojects led to higher agricultural productivity and increased farm incomes?
- Is the competitive model sustainable—has the supporting institutional framework been strengthened and, in the absence of continued donor support, is there adequate provision for funding recurrent costs?

Project Selection

2.3 IEG purposively selected a group of Bank-supported projects in Latin America that are roughly contemporaneous (Table 2). Three of the four projects have been followed by other Bank research/extension operations, which are currently under implementation. To the extent that it is relevant to lesson learning, the evaluation examines the design features and achievements of the follow-on operations; but the emphasis is placed on evaluating the closed projects.

Table 2. The Four Projects**(a) Identifiers**

Country	Project ID	Project Name	Approval Year	Closing Date	Subsequent Bank research/extension projects
Colombia	P006880	Agricultural Technology Development Project	FY1995	31Dec03	FY05 Agricultural Transition (P082167)
Brazil	P043873	Agricultural Technology Development Project	FY1997	31Dec05	<i>None</i>
Nicaragua	P064915	Agricultural Technology and Rural Technical Education Project	FY2000	30Jun05	FY06 Second Agricultural Technology Project (P087046)
Peru	P047690	Agricultural Research and Extension Project	FY2000	31Jan05	FY05 Agricultural Research and Extension Project, Phase 2 (P082588)

(b) Timelines

FY	90	91	92	93	94	95	96	97	98	99	00	01	02	03	04	05	06
Colombia P006880						A									C		
Brazil P043873								A									C
Peru P047690											A					C	
Nicaragua P064915											A					C	

A=Approval; C=Closing. *In the case of Colombia, the project concept document dates back to July 1990.

2.4 The thematic domain of the assessed projects in this assessment covered a range of research and extension activities, which calls for some definition of terms (Box 1).

Box 1. Definitions

Basic Research. This is research that has no goal other than to increase knowledge.

Strategic research. This is research that uses the results of past basic research to help provide answers to a strategic goal even though those answers may not be immediately applicable.

Applied Research. Research whose findings have the potential for immediate application by farmers.

Adaptive Research. Applied research that has been adjusted and confirmed as appropriate for specific local conditions based on on-farm trials.

Technology Transfer. The sharing of research findings and new technologies with extension agents (and, possibly, farmers also), by means of meetings, field days, radio, television and publications.

Extension. Advisory services provided to farmers through direct contact with field extension agents and their support staff. The messages conveyed are based on the findings of both applied and adaptive research, in the form that they are diffused through the technology transfer process.

Public Goods. Goods and services which are non-rival and [non-excludable](#). “Non-rival” means that consumption of the good by one individual does not reduce availability of the good for consumption by others. “Non-excludable” means that no one can be effectively excluded from using the good.

Source: Adapted from Colombia: Agricultural Technology Development Project, Staff Appraisal Report, Annex 4, World Bank, 1995

2.5 In varying degrees between the four countries, research and extension activities extended *beyond* the competitive funds to cover strengthening of the agriculture public sector apparatus. (Only in Peru and Colombia did the competitive fund component account for more than one-half of total project costs.) The variation in the content of the four projects is captured in Table 3.

Table 3. Project Themes and Design Elements

Themes	Nicaragua	Peru	Colombia	Brazil
Agricultural research	✓	✓	✓	✓
Agricultural extension	✓	✓		
Agricultural technical training	✓		✓	✓
Agricultural information systems	✓		✓	
Demand-driven specification of research agenda	✓	✓	✓	✓
Decentralization (bigger role for regional and local governments and agencies)		✓	✓	✓
Diversification of service providers, including greater private sector participation	✓	✓	✓	✓
Differentiation of public and private sector roles: Public agencies focus on supplying public goods (including strategic research)	✓	✓	✓	✓
Small-farmer focus	✓	✓	✓	✓
Independent project implementation unit	✓*	✓	✓	
Integration of farmers with “value chains”		✓	✓	
“Graduation” of small farmers from free to fee-for-service extension	✓			

Source: Project Development Objectives and components, as described in appraisal reports.

*The Nicaragua PIU was replaced during implementation by a coordinating committee comprising Ministry of Agriculture and other stakeholders

3. Country Context

3.1 In agriculture, Brazil has a commanding lead with an annual growth rate of total factor productivity that averaged 1.9 percent between 1960 and 2000; Colombia and Peru are level pegging at 1.4 percent; and Nicaragua trails at 0.8 percent (Table 4). This ranking will show up again and again in the course of this report and is mirrored in the relative scale of the four countries: one that is vast, two that are of medium size and one that is small. Scale—whether in terms of land area or the economy—influences the resources that each country can apply to the overall growth of agriculture.

Table 4. Agricultural Productivity Indicators

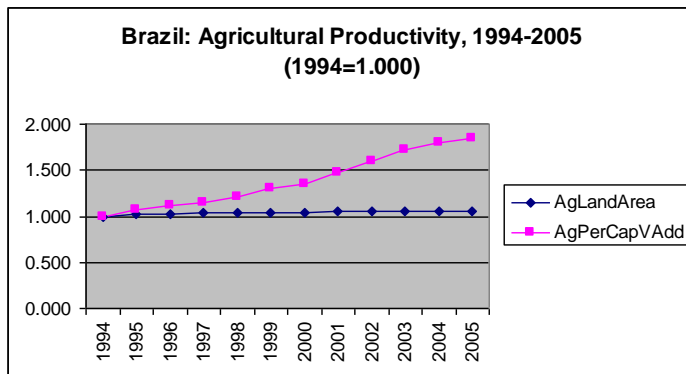
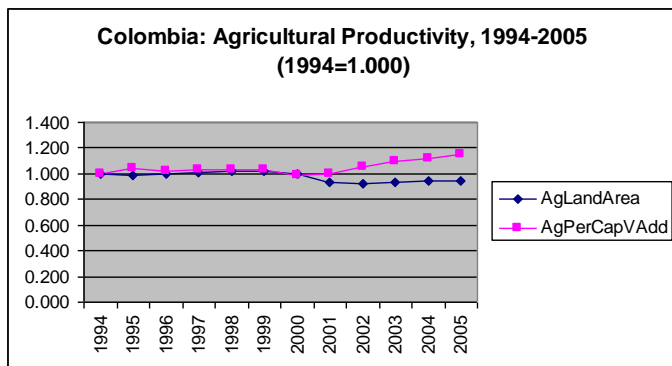
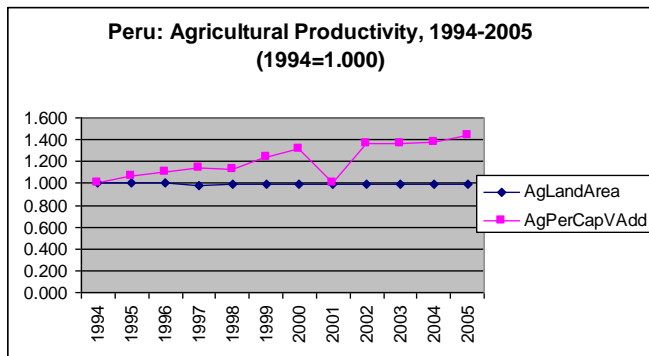
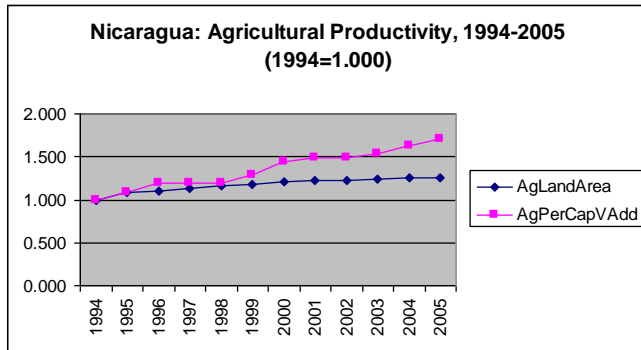
	Nicaragua	Peru	Colombia	Brazil
Growth in Agricultural Total Factor Productivity, 1960-2000 (Mean % per year)/a	0.79	1.36	1.43	1.93
Growth in Cereal Yields, 1990-92 to 2004-06 (Mean % per year)/b	1.2	2.6	3.8	4.0
Agricultural Value Added Per Worker, 2003-05 (Constant 2000 US\$)/b	2,071	1,498	2,847	3,126

Source: /a World Bank, 2005e (Table 5.8); /b World Bank, 2009b.

3.2 Between 1994 and 2005, agricultural value added per worker grew in real terms in all four countries (Figure 1). Growth was strongest in Brazil followed, in descending order, by Nicaragua, Peru and Colombia. Over the same period, the farmed land area rose in Nicaragua remained flat in Brazil and Peru and declined slightly in Colombia. This suggests that most of the agricultural growth in this period was at the intensive rather than the extensive margin, although extensive growth was still a factor in Nicaragua. (Between 1990 and 2005, agriculture's share of all land grew from 34 percent to 44 percent in Nicaragua.) Whether or not intensification in these four countries was partly driven by the projects assessed in this report (impossible to tell), the pattern of growth was at least in line with the overarching productivity goals of these projects. The rise in productivity is confirmed by the data on yields for two major crops common to the four countries—maize and coffee (Annex 2, Figures 1 and 2). A long-run series (1961-2007) shows a trend break for maize yields in the early 1990s and for coffee around the turn of the millennium, after which points the rate of land productivity growth accelerated. For both crops, however, yield growth in Nicaragua lags relative to the other countries, confirming that the expansion of value added in this country has been based to a larger extent on pushing back the frontier of cultivation.

3.3 Each country faces a different set of constraints on agricultural productivity growth. Colombia and Peru are both located in the Andean range but the mountain challenges faced by Peru are bigger. Much of its land is too steeply sloping or too high to favor crop cultivation; agricultural land occupies only 17 percent of the national territory, compared to 30-40 percent in the other countries. On the other hand, Peru has a higher share of cropland under irrigation (28 percent) compared to the other countries, adding to the strategic significance of the coastal strip where these works are concentrated (Annex 2).

Figure 1. Growth in Agricultural Productivity, 1994-2005

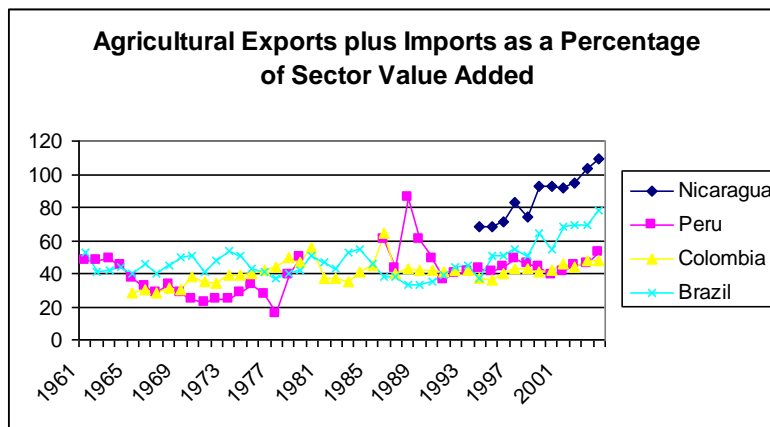


Source: World Bank, 2009b. (The indices refer to the total area farmed; and value added per agricultural worker, in constant US\$2000, including income from forestry and fishing.)

3.4 Owing to the mountainous terrain, much of Peru's rural population is remote from markets: 30 percent of those living in the countryside have to journey over four hours to reach a medium-sized town; in Brazil, Nicaragua and Colombia, the proportions are respectively 18 percent, 17 percent and 11 percent. Road density is also low in Peru, only 6 kilometers per 100 km² of territory; in the other three countries the density is 15 km per 100 km² or above, with Brazil the best served.

3.5 Communication difficulties also manifest themselves in other ways. In Peru 45 percent of the population is Amerindian with a mother tongue other than the national language. By contrast in the other countries the indigenous population represents 5 percent or less of the total. In Nicaragua the issue is rural illiteracy: one-third of persons aged 15 and above living in the countryside is unable to read or write (compared to one-quarter in Brazil and Peru and 16 percent in Colombia).

Figure 2. Towards Agricultural Trade Liberalization?



Source: World Bank, 2009b

3.6 A common theme applies to all four countries. Trade policy has tended toward greater openness since about 1990 (Figure 2). By broadening the arena of competition and the size of the market, the opening up of agriculture may help spur productivity growth (although, equally the line of causality may flow in the opposite direction, more productive countries finding it easier to compete). The opening is most marked for Nicaragua and Brazil (the countries which, coincidentally or not, had the strongest growth in per capita agricultural value added).

3.7 A stark indication of Brazil's preeminence relative to the other countries is the number of citations of agricultural research in international peer-reviewed journals, using a database filter that isolates work conducted by institutions native to that country (rather than research conducted in the country by foreign institutions). This crude measure of 'indigenous' research capacity also captures the substantial growth in research output that has occurred between nine-year periods in the 1990s and the 2000s—which may have facilitated agricultural intensification (Table 5). The same source also shows the high output of universities relative to the federal government research agency. The pecking order is the same for the federal agencies as it is for the universities: Brazil (way ahead)

is followed by Colombia, Peru and Nicaragua, echoing the ranking by agricultural total factor productivity growth (Table 4 above).

Table 5. Dissemination of “Indigenous” Agricultural Research: Citations for Agricultural and Biological Sciences*

	Nicaragua	Perú	Colombia	Brasil
Total number of citations for research conducted in the respective country				
1991-1999	8	69	133	1,448
2000-2008	23	262	387	5,377
N of “indigenous” citations (1): research conducted by the federal government research agency (“INI”)	(INTA)	(INIA)	(CORPOICA)	(EMBRAPA)
1991-1999	--	1	5	123
2000-2008	--	1	2	492
N of “indigenous” citations (2): research conducted by universities native to the respective country				
1991-1999	4	27	46	443
2000-2008	16	115	154	1,940

*“Indigenous” refers to the number of citations in international science journals of agricultural and biological research conducted by institutions native to the respective countries (excluding the international agricultural research centers, CIP in Peru and CIAT in Colombia, and other foreign institutions).

Source: Science Direct Database

4. Project Performance

4.1 Project performance was inevitably influenced by the country context—including the size of the economy, progress to date in raising agricultural productivity and, most importantly, institutional capacity. Nicaragua is a much smaller country than the other three in the IEG cluster (Annex 2, Table 1); agricultural productivity growth has lagged (Figure 1); the rate of rural illiteracy is high; and the capacity of agricultural research institutions—reflected, for example, in the level of research output (Table 5)—is limited. It is no surprise that the Nicaragua project performed less well than those in the other countries, particularly given the demanding nature of the competitive fund model and its high startup costs. Prospects in Nicaragua were hampered by the small volume of funds committed to the model and the uneven commitment by the Borrower and the Bank that was first manifest during implementation; and remains in evidence today under the follow-on project.

4.2 At the other extreme, project performance in Brazil was much stronger—because the implementing agency, EMBRAPA, was much stronger than the corresponding agencies in the other three countries. Peru and Colombia occupy a middle ground, performing above Nicaragua but, owing to concerns about the sustainability of project results, doing less well than Brazil. The public apparatus for agricultural research is stronger in Colombia than Peru—CORPOICA has more staff with better training, and superior infrastructure compared to INIA, its Peruvian equivalent. On the other hand, Peru arguably faced bigger challenges than Colombia and has made greater progress in terms of catching up. Apart from the relative weakness of INIA, Peru had considerable ground to make up in pushing toward decentralization (Colombia has, historically, had a

weak center while the government in Peru has always been highly centralized, partly because of the Inca legacy and because, unlike Colombia, it had the mineral wealth to support a central bureaucracy.) Also, in terms of the difficulty of the terrain in the sierra and the size of its (poorly integrated) indigenous population, Peru was in a more difficult position than Colombia.

4.3 In each of the four projects that are the focus of this assessment spending on the competitively-funded subprojects was less than forecast at appraisal. The actual cost of this component was 52 percent of the planned amount in Nicaragua, 72 percent in Peru, 75 percent in Brazil, and 86 percent in Colombia. This was partly the result of difficulties in mobilizing government counterpart funding; but also had much to do with the sheer complexity of organizing the various bidding rounds, evaluating proposals and providing technical assistance. The extent of this complexity—and the time needed to consolidate the new model—was underestimated when these projects were designed. The countries that already had ample experience with competitive funds (Colombia, Brazil) were better placed to make progress with the project. In terms of the decentralization challenge facing Peru—the need to build and staff a network of regional offices and panels—the Peru project was under dimensioned (actual total costs were a mere US\$13.6 million—for 153 subprojects—compared to US\$85.9 million in Colombia—for 636 subprojects).

4.4 The Nicaragua and Peru projects faced an additional hurdle. Both were envisaged as the first-phase in a sequence of operations, supported by one of the Bank's Adaptable Program Loans. Adopting a twelve to sixteen year horizon made sense in terms of the time it would likely take to embed the new model. But the transition from the first to the second phase was problematic in both countries. The implementing agencies were ill prepared for the amount of preparatory work needed to make the transition (the trigger conditions were more onerous than they had expected); and in the flurry to prepare for the next phase, the evaluation and supervision of subprojects approved toward the end of the first project tended to be neglected. Also, in both countries there was a rearguard action against the competitive model by the more established public research and extension agencies, which helped to undermine government commitment to a lengthy program. In Nicaragua (but not Peru), there was also a substantial loss of Bank commitment to the competitive fund model, based on a more realistic appreciation of the country's institutional capacity constraints—and the government's limited support for the model.

4.5 The performance of all four projects was potentially constrained by the absence of a sound, nationwide network of institutions capable of transferring technologies and providing technical assistance to producers. In Nicaragua and Peru, the government research agencies (respectively, INTA and INIA) had an extension arm—but INTA's coverage was geographically limited and INIA was a shadow of its former self, having been substantially cut back compared to its 1970s heyday. In Colombia and Brazil there was no national public extension service when the projects were launched and the quality of technical assistance (provided by state or local governments, NGOs, etc.) varied greatly from one region to the next. But in Colombia and in southern Brazil the population was relatively well educated and well connected to markets so that the scope for picking up technologies by means other than through extension was more developed.

4.6 Nevertheless, it is a concern that in all four countries the evidence concerning rates of technology adoption—*attributable to the projects assessed here*—is very patchy. This reflects an under investment in monitoring and evaluation. The best evidence comes from Peru. The independent impact evaluation, reported on below, was led by a Brazilian team (including EMBRAPA). Ironically, EMBRAPA’s monitoring of the impact of the Brazil project was substantially weaker, for reasons that will be discussed.

Box 2. How Positively do Informed Participants Rate the Competitive Fund Model? An IEG Poll

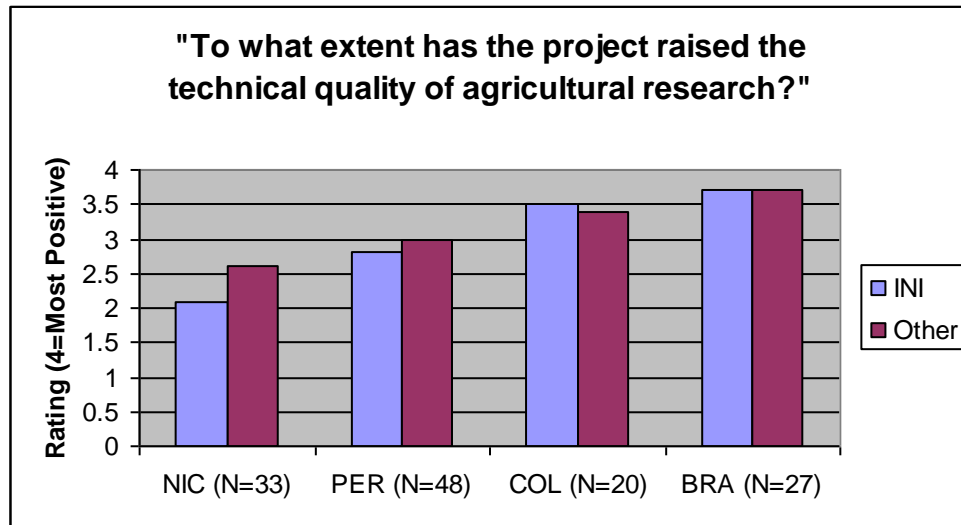
To help assess the value added by the competitive fund model IEG polled a total of 139 persons across the four countries (Annex 1). The poll was applied to persons working on, or familiar with, issues of agricultural technology development and transfer—agricultural researchers in public agencies (federal and state entities), plus representatives from the donor community, universities and NGOs and persons directly connected with the project that IEG was evaluating.

The aspects of the model which received the highest rating center on (a) the technical rigor and (b) transparency of the process for selecting research and extension subprojects. Next come (c) the adequacy of technical assistance for proposal preparation and (d) the technical quality of competitively-financed research—although the standard deviation for these items was somewhat larger, reflecting lower consensus. Aspects eliciting a less positive response with relatively high agreement among respondents concern (e) responsiveness to the needs of small and medium producers and (f) the extent to which farmers are integrated with value chains. The other items—including (g) outreach to the poorest, (h) contribution to natural resource management and (i) impact on yields—are characterized by low ratings and relatively low agreement. The question prompting the largest proportion of “don’t know” responses (31 percent) concerned the project’s impact on yields of basic grains. This may reflect a wider lack of hard data on the difference these projects made at the farm level; which in turn derives from the neglect of monitoring and evaluation.

Source: Annex 1

4.7 There is a marked difference between the four countries in how positively persons associated with the competitive fund approach viewed it. IEG polled participants at meetings convened for the mission (Box 2). The poll was applied to a subset of persons knowledgeable about the project and it is not clear how representative their views are of the groups to which they belong. The poll was not intended to measure objective differences in performance between the four countries; but rather to capture the aura attaching to the project—the perception of informed participants about how satisfactory the approach was. The poll results suggest a gradient between the countries with respondents in Brazil the most positive about competitive fund aspects of the project, followed in descending order by Colombia, Peru and Nicaragua.

4.8 In Nicaragua and Peru, the staffs of the national agricultural research institutes (INIs) have a less positive perception of the competitive fund aspects of the project than other people, whereas in Colombia and Brazil these staffs are relatively more positive (Figure 3). This bears out the impression received from interviews in the various countries: in Colombia and Brazil, CORPOICA and EMBRAPA staffs tend to emphasize how their research work has been enhanced by their capacity to draw on the competitive funds whereas the staffs of INTA in Nicaragua and INIA in Peru are more skeptical (and in some cases hostile toward the competitive approach).

Figure 3. Competitive Fund Projects and Research Quality

Source: IEG Poll (2008)
INI National Research Institute (federal agency)

4.9 Perhaps it is not surprising that INI staffs in Nicaragua and Peru are lukewarm in their support for the competitive model: they have derived very little funding from it—absorbing 5 percent or less of the subproject funding made available through the respective projects (Table 6). In Colombia and Brazil, the INIs (CORPOICA and EMBRAPA) snapped up, respectively, one-third and one-half of the project funds on offer.

Table 6. The Share of National Research Institutes in Competitive Fund Subprojects

	Nicaragua	Peru	Colombia	Brazil
N of subprojects	75	123	635	139
N of subprojects executed by 'INI'	INTA	INIA	CORPOICA	EMBRAPA
	5	6	248	93
%	7%	5%	39%	67%
Subproject investment * (US\$ million)	4.3	6.4	26.5	54.1
Investment in 'INI'-executed subprojects* (US\$ million)	INTA	INIA	CORPOICA	EMBRAPA
	0.2e	0.1	9.3	27.1
%	5%	2%	35%	50%

Source: ICRs; Project databases; Echeverri Perico (2002). 'INI' National Agricultural Research Institute." NA Not available
*Refers to the part of the total subproject cost financed through the World Bank project, excluding co-financing by subproject executing agencies; e IEG estimate, based on average size of investment per subproject.

5. Evaluation Findings

5.1 This section assesses the evidence from the four countries and seeks to answer the evaluation questions posed at the outset (paragraph 2.2 above).

Adequacy of the Competitive Fund Process

5.2 The design of the assessed projects shared, in varying degrees, the following *process* elements of the competitive fund model: (a) an attempt to be inclusive, demand-driven, and participatory; (b) a focus on promoting technical rigor and transparency in the selection of research and extension subprojects; and (c) a push to decentralize, involving sub-national authorities in priority setting and implementation.

5.3 Inclusion. For each project one of the challenges was to include groups—small farmers, women, indigenous communities—that might, in the absence of special initiatives, remain marginalized from the process of selecting and implementing research and extension subprojects. In general, projects of this nature do not lend themselves to targeting to the poorest—because this group often has no land or other assets to which they may apply new technology. Impact on the poorest is mainly indirect, through increased opportunities for wage employment and lower food prices. Therefore, it is not clear why the Bank listed the Colombia and Brazil projects as “targeted interventions” (Table 7).

5.4 However, all four projects did reach out to small farmers and these were the prime beneficiaries. Targets for covering this group were met or exceeded in Nicaragua, Colombia and Brazil, but there was a shortfall in Peru. In the Brazil project, the only performance benchmark pertaining to small farmers was an input not an outcome indicator—the level of spending on a small-farmer development program (the target was exceeded). Ex post, the funding of “family agriculture” research (a non-specific indicator, not exclusive to small, poor clients) was smaller than the other categories: it accounted for the largest share of proposals submitted (33 percent), but only 30 percent of proposals approved and 22 percent of funds committed to subprojects.¹ For all the projects, attempts to measure the coverage of women and indigenous groups were patchy (Table 7).

5.5 In the case of extension, there are straightforward ways attempts to measure client responsiveness: visits to farmers can be counted, as can the level of satisfaction that farmers report when asked about extension services. The Nicaragua and Peru projects made explicit provision for extension, each devoting a specific competitive fund to it. In Nicaragua, the level of satisfaction expressed exceeded appraisal expectations. The target was 60 percent of clients describing themselves as satisfied customers. But clients were even more satisfied with the service provided by the state (90 percent satisfied) than with service provided through the competitively-funded subprojects (69 percent). To put this in perspective, only 33 percent of the producers surveyed actually had contact with an extension worker—and other data show that, nationwide, the level of extension coverage

1. Annex 7, Table 4, p.11 (Brazil report).

is around 15-20 percent.¹ Clients may be satisfied with the service if they receive it; but most of them do not. In Peru also, there was a shortfall in the delivery of extension subprojects and lower than expected coverage of the indigenous population, despite a special initiative to reach out to these communities (Table 7).

5.6 Responses to the IEG poll show that most of those interviewed were relatively lukewarm in rating the projects' responsiveness to small and medium farmers' needs; and to those of the poor. In Brazil, responsiveness to small and medium farmers received a more positive rating than in the other countries (Box 2 above; Annex 1).

Table 7. Responsiveness to Key Clients

	Nicaragua	Peru	Colombia	Brazil
<i>Targeted intervention?</i>	No	No	Yes	Yes
<i>Small farmers</i>	Expected: 60,000 "small and medium farmers" (SMF) receive advisory services; Actual: 68,071 SMF receive advisory services	Expected: 20,000 farmers (no specific target for small farmers); Actual: 8,800 farmers (92% described as "small")	Expected: 350,000 small farmers; Actual: 350,000 farmers (of which 150,000 are described as "direct beneficiaries")	Expected: EMBRAPA's annual operating budget for research on small farm development to reach R\$4.8m (cf R\$1.2m in 1996); Actual: Target exceeded (R\$6.2m)
<i>Women</i>	Expected: "60% of surveyed farm households, with inclusion of at least 40% female respondents, express satisfaction with system performance" Actual: No data on female satisfaction level	Expected: 123 extension projects with 30% participation rate by women; Actual: No data	Expected: No target Actual: No data	Expected: No target Actual: no data
<i>Indigenous communities</i>	Expected: No target Actual: Two extension offices opened in Northern Autonomous Atlantic region to specifically address needs of isolated indigenous farmers	Expected: 123 extension projects with 30% participation rate by indigenous communities; Actual: 61 extension projects, of which 16 (26%) were for indigenous communities; special fund (<i>Huchuy Ayni</i>) created to assist project preparation in indigenous communities	Expected: No target Actual: No data	Expected: No target Actual: no data

Source: Appraisal and completion documents.

5.7 Another measure of inclusiveness concerns outreach to poorer regions. The projects in Peru, Colombia and Brazil made explicit attempts to secure participation of poorer regions in the various subproject funding rounds. There was a tension between this objective and the commitment to ensuring that only the most rigorous proposals were financed—the poorer regions had less capacity for developing proposals and needed special assistance. (In Peru, for example, the project included a special initiative to help indigenous

1. Annex 4, paragraph 20 (Nicaragua report).

communities in the Sierra—the poorest region—to prepare projects.) In general, project design made adequate provision for ensuring inclusion of the poorer regions.

5.8 *In conclusion, while the design of the projects was explicitly client responsive, outreach to the poorest groups and regions calls for special measures; and there was a limited extent to which these could be regarded as targeted interventions.*

5.9 *Technical rigor and transparency.* All four projects placed a high premium on rigor and transparency. Poll results (Annex 1) show that, of the twelve items assessed, informants rated rigor and transparency most highly. The poll also found that the technical assistance provided for preparing subproject proposals was highly rated.

5.10 The provision of technical assistance grants to facilitate preparation of subproject proposals was critical for enabling less educated people and weaker institutions to take part in the competitive process. In Brazil, “pre-proposal grants” of up to US\$10,000 were available for those who needed help in designing subprojects.¹ There was no equivalent facility in the other three countries; although special arrangements were made in Peru to assist indigenous communities. It is all the more striking therefore that respondents to the IEG poll rated the technical assistance for subproject preparation relatively highly (Annex 1). This suggests that, even in the absence of explicit grants for subproject design, the project staff were able to provide adequate orientation to those entering the subproject bidding rounds.

5.11 The various interviews that IEG conducted in each of the countries convey a strong impression that, in the view of the informants, the process of priority setting was more transparent than under the previous system of direct assignment of funds for research and extension. The apparatus of regional and national panels and the process for reviewing subprojects appears to have favored openness. But in none of the countries had an explicit attempt been made to assess the quality of research under the competitive and “pre-competitive” models, either in terms of outputs (for example, number of publications in peer-reviewed journals) or field-level outcomes (for example, evidence that research boosted incomes and productivity. Any such comparison of the competitive and pre-competitive models would need to consider their relative cost effectiveness. Even if the competitive model produces better research it probably comes at a higher cost given the expense involved in organizing bidding rounds and panel review. In Nicaragua, for example, economic rates of return to competitively-funded research and extension subprojects was 16 percent, compared to 32 percent for investments directly assigned by the government research and extension agency, reflecting differences in transaction costs.

5.12 *To sum up, while informed participants are convinced that both rigor and transparency were enhanced by the competitive model, the impact on research quality (allowing for cost effectiveness) needs closer investigation.*

1. World Bank (1997b), p. 21.

5.13 *Decentralization.* The push to decentralize was reflected both in the administrative apparatus of the projects and in the attempts to promote linkage to regional and local government.

5.14 Regional project offices were set up to help extend outreach, with officers trained to help target groups prepare subproject proposals; and regional panels were created to assess the proposals. (This was more the case for extension subprojects; research subprojects tended to rely on national panels and peer review processes.) Thus, in the case of Peru, extension subprojects were coordinated initially by offices in each of three macro-regions, with offices added in three more departments of the country in 2003. The offices were supported by regional agricultural technology fora, which included participants from farmer organizations and indigenous groups. The fora discussed regionally-specific technology issues, set priorities and provided guidance for the review and approval of locally-generated subproject proposals.

5.15 There is clearly an issue about the legacy of any decentralized administrative apparatus set up by a project. Once project funds are used up, the apparatus may be shut down and may well leave little mark on local institutional capacity. However, the project staff in regional offices are often locally recruited and may remain in the neighborhood after the project has shut down. In such cases, there may still be a long-term, local impact, as skills acquired under the project are applied to other initiatives. But the actual extent of this skill transfer has not yet been documented. Involving local authorities in the research and extension initiatives sponsored by the assessed projects was typically problematic. In Peru, IEG found that despite some attempts to second local government officials to the regional project offices (e.g. in Tarapoto), local government was not involved in priority setting for extension and research and had little awareness of the subprojects that were financed. In Colombia, the project involved training of the staff in extension offices (UMATAs) operated by local municipal government. But owing partly to the absence of earmarked transfers for extension from central to municipal government, the decentralized network of extension was unevenly funded and often of poor quality. This reduced the scope for transferring technologies generated through the project.

5.16 On the other hand, in Brazil, the project helped to build up the decentralized units of EMBRAPA (which will outlive the project) and to boost the capacity of public research agencies in some of the states: of the four projects assessed, this was the strongest instance of decentralization and is likely to continue to bear fruit. Also, in Colombia and Peru decentralization has been strengthened in the follow-on projects. For example, in Peru, the network of regional offices for INCAGRO has been consolidated and more tightly integrated with local public research facilities, helping to strengthen sustainability.

5.17 ***In conclusion, the assessed projects sought, in varying degrees to promote decentralization but progress was uneven with the strongest evidence of strengthening coming from Brazil.***

Diversification of Service Providers; Differentiation of Roles

5.18 Each of the four projects included diversification of service providers among its objectives. An implicit assumption was that government agencies would become more efficient if they were obliged to compete with other agencies. Alternative service providers included universities, producer associations and NGOs; but there was a particular interest in encouraging wider participation by private firms. This went hand in hand with an attempt to encourage the public sector to limit its intervention to public goods provision—clearly differentiating its role from that of the private sector.

5.19 A caveat is in order—the provision of agricultural research and extension services was *already* diversified before the projects that are the subject of this evaluation got underway. In Nicaragua, around project start up, NGOs accounted for one-third of the extension service contacts reported by farmers.¹ The proportional share of each class of service provider varied substantially among the four countries during implementation (Table 8). NGOs dominate in Nicaragua, producer associations in Peru, and the federal research agencies in Colombia and Brazil. The universities seem under-represented by comparison with their contribution to published research (the citation evidence presented in Table 5 above). It is also noticeable that, in Colombia, despite their independent research capacity, the commodity-based producer associations had next to no participation in the bidding process for competitive funds. Given that their research funding is secured through a government-mandated levy on crop revenues, possibly they felt no need to participate. Overall, in Colombia, the extent of diversification realized through the competitive funds was lower than that in the research system as a whole.²

Table 8. Share of Diverse Service Providers in Subproject Implementation

% of Subprojects Implemented	Nicaragua/1	Peru/2	Colombia/3	Brazil/4
Federal government research agency	10	5	39	67
Other public research agency	NA	13	4	13
University	13	11	9	15
NGO	50	14	11	1
Producer Association	21	48	32	1
Private Firm	6	8	--	--
Other	NA	1	5	3
Total	100	100	100	100

/1 Research subprojects (FAITAN), Source: Ammour (2005), p. 34; /2 All subprojects financed by INCAGRO (including follow-on project), 2001-2008, Source: Benites & Wiener (2008), pp. 28-29; /3 All subprojects, as of 2001, Source: Echeverri Perico (2002), p. 11; /4 All "projects", broken down by coordinating agency, Source: EMBRAPA (2006), p. 8; NA Not applicable.

5.20 It is also striking that, according to Table 8, other than for farmers through producer associations, private (for profit) firms played no role as providers in Colombia and Brazil; and only a small role in Nicaragua and Peru. In the case of Brazil, the private sector role calls for careful explication: private firms did have a role as subcontractors but

1. Annex 4, Table 3, p.10 (Nicaragua report).

2. Annex 6, Table 4, p.10 (Colombia report).

in no cases were they the prime movers in the design and implementation process.¹ Partnership did not necessarily entail active private sector participation. In the view of some researchers, partnerships were formed to meet a bureaucratic requirement rather than to enhance the technical soundness of a research project.²

5.21 Diversification refers not only to the share of subprojects implemented by each type of service provider; it also covers the contribution to the total subproject investment from sources outside the project (that is, in addition to the funds committed by donors and the government). By encouraging participant co-payment of this kind, the project implementing agencies sought to make their funds go farther, as well as to increase participants' stake in the success of the subproject. At first blush, impressive levels of co-payment were secured; often in excess of what was expected at appraisal. In Peru, at appraisal, the co-payment fraction was set at between 5 percent and 35 percent depending on the type of subproject; but, according to the INCAGRO database, the level actually achieved varied from 48 percent to 56 percent. In Nicaragua, producers contributed 21 percent to subproject investments in extension. In Colombia, contributions by the agencies implementing subprojects somewhat exceeded the 50 percent share specified at appraisal. In Brazil, the co-payment share subscribed by implementing partners and beneficiaries amounted to 42 percent.³

5.22 In each of these cases a note of caution is in order. IEG's review of project documentation suggests that accounting of co-payments by the implementing agencies was very approximate, mainly because little of it came in the form of cash. Typically, contributions were in kind, often involving a commitment of time by staff salaried outside the project; or the use of preexisting laboratory capacity. In Colombia, the cash proportion of co-payment from implementing agencies averaged 11 percent, falling to 3 percent in 2008.⁴ Contrary to expectations at the design phase, these projects have not sharpened the articulation of private and public roles in this sub-sector. This is not altogether surprising. The distinction between private and public goods is not as clear-cut in reality as it is in the textbooks. Strategic research comes closest to fitting the bill as a public good—because outcomes are uncertain, payoff is slow to materialize and the products are mostly non-excludable and non-rival in use (in Peru, the development of Sacha Inchi as a plant source of Omega 3 source is an example). There are also public good elements to developing new varieties of established crops: there will be little incentive for the private sector to engage if the returns are non-excludable and there is scope for free-riding.

5.23 Farmer capacity to pay for research and extension services is also a consideration. All the assessed projects included small-scale farmers as a priority client. There is a public good case for providing a subsidized service for those too poor to pay; but less of a case for subsidizing better-off small-scale farmers. Drawing the line between these two

1. Annex 7, paragraph 6 (Brazil report).

2. Argollo de Souza (2003), p. 41.

3. EMBRAPA (2006), p. 23.

4. Annex 6, paragraph 3 (Colombia report).

groups is problematic and the fiscal payoff to preventing subsidy leakage may not be large enough to justify the cost of tighter targeting. Nicaragua is a case in point. On a visit to the primary coffee-producing zone, IEG found that the government agency, INTA, was providing extension free of charge to farmers who were relatively able to pay and already had access to a coffee marketing firm that provided a similar type of service.¹ Although the design of the Bank-supported project entails a mixed role for INTA—charging certain farmers for services but not others—deciding who gets the subsidy is tricky; and, in Nicaragua, the Bank was probably too optimistic about the prospects for “graduating” poor, small-scale farmers into fee-paying clients.

5.24 The assessment confirmed the previous finding (Echeverria, 1998b) that the competitive fund model tends not to generate much research of a strategic nature. As long as there is a well-funded and well-established public research system capable of tackling strategic research it is of no great consequence if competitively-funded subprojects privilege applied and adaptive research. Given the sophistication of Brazilian research capacity compared to the other countries, and its evident strength in undertaking a broad program of strategic research across a wide range of commodities and themes, it is not surprising that only 6 percent of the competitively-funded subprojects research proposals were for strategic studies.² One of the project objectives was to focus public sector research on “quintessential public goods”.³ This project achieved that objective through the support given to the institutional strengthening of EMBRAPA, rather than through the competitive fund component. In Nicaragua, where the public sector capacity for strategic research is weak, it was perhaps of more consequence that of the five competitively-funded subprojects implemented by the federal research agency, INTA, none was strategic in nature.⁴ Here, unlike in Brazil, there was weak capacity for tackling strategic research *outside* the terms of the competitive model.

5.25 In conclusion, although the projects were generally conducive to the diversification of service providers they did not lead to a significant increase in participation by the commercial private sector. On the other hand, to the extent that the projects helped to improve skills, increase capacity and elicit co-payment financing involving farmers and their organizations, as well as other private nonprofit organizations, they contributed to a broader process of private sector development.

Impact on Incomes and Productivity Growth

5.26 There is worldwide evidence to show that agricultural research generates high economic returns.⁵ But—with the exception of the Peru project—IEG found no evidence of enabling income and productivity changes to be attributed to the project. On the one hand it can be argued that the 2-3 year span of the subprojects financed is too limited for

1. Annex 4, Box 2 (Nicaragua report).

2. EMBRAPA (2006), Annex 2.

3. Annex 7, paragraph 17 and Table 4 (Brazil report).

4. Ammour (2005), p. 35.

5. Evenson (2001); World Bank (2007).

capturing impact (allowing for potential spillovers). But, on the other hand, the projects generally made inadequate provision for following up the results of the subprojects (or, at least, a representative sample thereof). This is an intrinsic problem of the project cycle: the absence of funding provision for assessing impact once the loan is closed.

5.27 There is a broad spectrum of concerns about the likely impact of these projects. First, it is striking that none of the statements of project development objectives declared increased agricultural productivity or higher farm incomes as an expected outcome. This was perhaps a shrewd move given that gestation of such favorable outcomes might well take longer than the implementation period of the project. (The Nicaragua project was bold enough, however, to forecast a 25 percent increase in yields and 15 percent increase in real incomes by closing—neither of which appear to have been achieved.)

5.28 Second, the logical framework of the individual subprojects was generally characterized by the absence of any systematic attempt to establish baselines and set targets. Although the Peru and Colombia projects made explicit attempts to rate subproject performance the credibility of the ratings was hampered by weaknesses in the logical framework.

5.29 Third, the subprojects were short enough in duration (2-3 years) and modest enough in size (Table 9) to beg questions about whether they could make much of an impact. This issue was raised early on in the competitive fund literature: the concern that, in aggregate, the multiple subprojects would be too small, too dispersed, too diffuse and too short-lived to achieve critical mass.¹

5.30 Fourth, a bigger concern is what the subprojects add up to in terms of long-term income and productivity effects. With the exception of the Peru project, the ‘impact evaluations’ that have been commissioned have been carried out too soon after the completion of the research and extension subprojects for their full effect to be assessed.

5.31 Fifth, the studies that have been conducted around these four projects have fewer *operational* implications than might be expected. The most complete study—the one recently conducted in Peru—was something of a “black box” assessment of impact. The rate of return and the income effects were estimated, but it was not clear which of the preceding steps in the results chain were critical for attainment of this outcome. It was not clear which elements in the *process* of designing and implementing the subprojects would need to be altered for net benefits to be raised.

5.32 This reference to the results chain presages a sixth objection, one that is perhaps the most worrisome of all. Technology transfer has chain-like elements. Research is conducted; results are disseminated in various ways (ranging from research station open days to which farmers are invited to extension agent visits to farms); new technologies are adopted by an initial group of farmers; and then there is spillover to other farmers. One unresolved question is the extent to which technology transfer is contingent upon the existence of sound agricultural extension. Two of the projects—in Nicaragua and Peru—

1. Echeverria (1998b), p. 11.

had separate competitive funds for extension. In Colombia, there was no separate provision for extension; and, in Brazil, extension was entirely overlooked—technology transfer being limited to off-farm dissemination events. None of the countries has a national extension network—in Peru, Colombia and Brazil the former federal systems have either been wound down or dismantled; and in Nicaragua the federal system covered only part of the country. Nor do they have a decentralized network offering an acceptable level of service to all part of the country.

5.33 To what extent has this missing link in the technology transfer chain blunted the impact of agricultural research developed through the competitive funds? The available studies shed no light on this question. In regions such as southern Brazil where farmers have the education and the means to hunt for technologies on the Internet the absence of extension may not be critical; in a country such as Nicaragua where one-third of the rural population is illiterate its absence is likely to be more constraining.

5.34 The strongest evidence of impact comes from the Peru project. A recently completed independent evaluation (led by a Brazilian team that included EMBRAPA researchers) found that the economic rate of return from INCAGRO (2001-2006) varied between 25 percent and 37 percent.¹ This positive return stood up to sensitivity analysis: it would take a 25 percent increase in costs and a 25 percent drop in benefits to drive the rate of return down to the threshold of unacceptability (12 percent). The study was based on a random sample of 49 subprojects (almost one-quarter of the universe), stratified by region, by subproject type (research, extension or training), by period, and by the performance rating applied to subprojects by the INCAGRO team. The evaluation found that 53 percent of aggregate net benefits were captured by the Selva region, 27 percent by the Costa and 20 percent by the Sierra (the poorest region). Of the 739 farmers interviewed, 59 percent reported that they adopted new technologies during the period that INCAGRO was implemented; by the producers' own reckoning, adoption was one-quarter attributable to the project, three-quarters attributable to other factors.

5.35 The Peru study had two flaws. First, there was no control group, comprising farmers not exposed to INCAGRO. Second, the pre-project baseline was constructed using farmer recall. Both of these shortfalls raise the possibility that the impact of INCAGRO was overestimated. Relying on farmers to estimate to what extent INCAGRO was responsible for their adoption of new technologies was a poor substitute for a comparison between treatment and control groups.

5.36 The same two flaws applied to the rate of return evidence for the other three countries; but they were compounded by other drawbacks. In the case of Brazil, the available evidence was not specific to the Bank-financed project (PRODETAB): the completion report presented data on non-randomly selected EMBRAPA subprojects that were not PRODETAB financed; and, also, none of the subprojects featuring in the annual impact reports prepared by EMBRAPA was supported by PRODETAB. While it is perfectly plausible that the PRODETAB subprojects had similarly high rates of return, the evidence is not conclusive. Moreover, the available studies on rates of return have

1. Ministerio de Agricultura/INCAGRO, (2009).

nothing to say about subprojects financed by entities *other than* EMBRAPA. (It would be interesting, for example, to compare the returns to EMBRAPA research with that sponsored by its strongest competitors—the universities at Campinas and Vicosa.)

5.37 For Nicaragua, the evidence for sound rates of return to subproject investments was not compelling.¹ The Bank’s completion report estimated the ex-post rate of return at 25 percent but this was based on extrapolating from a series of farm models prepared at appraisal, rather than on survey data. The evidence failed to square with the information contained in a 2005 “interim impact evaluation”, involving interviews with 1,162 producers, which found that neither yields nor incomes grew significantly between the 1997-2000 baseline (constructed from farmer recall) and the project implementation period.

5.38 In the case of Colombia, a 2004 “impact evaluation” estimated the average rate of return at 88 percent, based on a random sample of subprojects that covered 17 percent of the universe.² But the information on the subprojects was obtained not from farm-level surveys but from ‘expert estimates’, based on the parameters of ‘typical’ subprojects. This was not an independent assessment: the experts comprised persons with “direct experience of PRONATTA, including subproject implementing agencies, beneficiaries, and selection panel members”.³

5.39 *Summing up, these projects made insufficient provision for assessing the short-term performance of individual subprojects (there was no systematic specification of baselines and targets); and insufficient consideration has been given to a robust assessment of the aggregate income and productivity impact of the various subprojects.*

Sustainability of the Institutional Framework

5.40 The four assessed projects combine, in varying degrees, support for competitive funds with support for the broader institutional apparatus of public research and, in some cases, extension. The sustainability of these two elements—the fund model versus the broader apparatus—needs to be separately addressed. Sustainability of the fund model is intrinsically less certain than that of the apparatus because it is more susceptible to the changing whims of government and donors. The public sector apparatus is more stable—many staff members have tenure and there is a substantial sunk investment in infrastructure which it may not be easy for governments to sell or write off.

5.41 The four projects fall neatly into two pairs. In the Brazil and Nicaragua projects more than half of total costs were devoted to strengthening the public sector agencies of research (plus, in Nicaragua, extension). In Peru and Colombia, by contrast, the bulk of project resources were absorbed by the competitive fund component.

1. Annex 4, paragraphs 1-5 (Nicaragua report).

2. Annex 6, paragraph 1 (Colombia report)

3. Sain (2004), p. 5.

5.42 Brazil and Nicaragua are polar opposites in terms of domestic funding capacity and the strength of public sector research institutions. In Brazil, the project had a strong foundation to build on—the federal research agency, EMBRAPA—and it filled a temporary funding gap in a period of government-wide fiscal restraint. The strengthening of EMBRAPA, both headquarters and decentralized units, plus the state research agencies and the building of stronger ties with research facilities in the USA and European Union—these were major project achievements the results of which are likely to endure. On the other hand, while the competitive fund component performed well, in the longer term, it may not leave a substantial mark on the research framework. In the follow-on project supported by the Inter-American Development Bank (not the World Bank) there was originally a competitive fund component but it was dropped. The project focuses on further strengthening of EMBRAPA. This may suggest that the government and EMBRAPA are not strongly committed to continuing the competitive fund model. But, on balance, IEG considered that sustainability prospects for project achievements were good, reflecting the relative weight of the institutional strengthening component.

5.43 In the case of Nicaragua, although strengthening of the federal agency INTA was, as in Brazil, a major component, project achievements were less significant: INTA's research capacity does not appear to have been substantially strengthened by the project, although there was significant training of extension agents. Also, there are doubts about the sustainability of the competitive fund component (which, anyway, received only 10 percent of project funds), mainly based on lack of guaranteed continuity in government and donor support. Specifically, the research arm of the competitive fund initiative was not directly supported in the follow on project. On balance, therefore, the sustainability of the project's development achievements seems doubtful.

5.44 In Nicaragua, for reasons that have not been well articulated, it was decided before the second project was launched to commit no fresh money to the two competitive funds (FAT for extension, FAITAN for research) that it had championed during the first project. (The Bank's withdrawal from FAT is less critical—IFAD has made a commitment to fund it through 2012—but the abandonment of FAITAN—whose subprojects now receive no direct donor support—calls into question the long-term viability of the competitive model in Nicaragua.)

5.45 In Brazil, the competitive fund was run by EMBRAPA and, in terms of funds absorbed, EMBRAPA was the prime beneficiary of PRODETAB. Although elements of the competitive model were incorporated in the programs of government research agencies in the states of Sao Paulo, Parana and Pernambuco, and although the competitive fund principle has an existence and a vitality independent of EMBRAPA, the effect of PRODETAB and the follow-on (Inter-American Development Bank-supported) Agrofuturo project has been more to consolidate EMBRAPA than to expose it to greater competition from other agencies. PRODETAB helped EMBRAPA to weather the downturn in federal spending of 1998-2003, allowing for upgraded staff training and closer collaboration with research institutions in Europe and the United States. Federal funding of EMBRAPA has risen sharply since 2006,¹ making the agency's competitive

11. Annex 7, Figure 1 (Brazil report).

position more or less unassailable. Agrofuturo funding is exclusively for EMBRAPA and IADB staff told IEG that there was no compelling reason for them to promote competition by other agencies. Commitment to diversifying research providers—a primary objective of PRODETAB—has been sidelined, for the moment at least. In Peru and Colombia, any judgment about sustainability hinges on prospects for the competitive funds which absorbed respectively 53 percent and 70 percent of project resources. Prospects for sustainability would seem to be higher in Colombia because the government has made a major funding commitment under the follow-on project, there is a closer relationship between the competitive fund unit and the national research agency and there is a stronger tradition of decentralization, creating a more supportive environment for the competitive funds model. The public apparatus of research is stronger in Colombia than Peru (CORPOICA is better staffed and better equipped than INIA) and this probably helps to make the competitive model more fruitful by pulling up the average quality of the research proposed.

5.46 Based on IEG’s assessments in the four countries, it seems that the competitive fund model is more likely to survive where it is “owned” by the Ministry of Agriculture, where government commitment to this approach is not held hostage to renewed pledges of donor financing, and where overhead costs compare favorably with those incurred through the alternative model of directly assigning public agricultural research and extension funds.

5.47 In Nicaragua and Peru, the projects deliberately aimed to set up the competitive funds outside the orbit of the Ministry of Agriculture, partly because the Ministry was perceived by the Bank to be inefficient and weak; and also because this was perceived as a “cleaner” approach that would both facilitate disbursement of project funds and signal a radical departure from the state-led model of development. (The approach taken by the Bank in Nicaragua was directly modeled on the project design used in Peru.) The net result was to alienate staff in the Ministry of Agriculture and to trigger a rearguard action that threatened to destroy the competitive fund institutions that were created. As one insider in Peru told IEG, there will always be a Ministry of Agriculture—however underfunded and demoralized it may be; survival of the project-driven entity that is INCAGRO carries no such guarantee. The government has recently bid to end the isolation of the competitive fund management unit, integrating INCAGRO with the federal research agency, INIA.

5.48 In Colombia and Brazil, the competitive funds established respectively by PRONATTA and PRODETAB were more integrated to begin with. In Colombia, the project coordination unit was set up within the Ministry of Agriculture, although all of the unit staff were brought in from the outside and hired on short contracts. During PRONATTA, the unit was perceived by outsiders to have little interaction with the Ministry—a situation possibly aggravated by the rapid turnover in project managers; but under the follow-on project there is closer liaison, although for reasons more related to personalities than to any change in structure or procedures.

Table 9. Subproject Size and Administrative Overhead

	Nicaragua	Peru	Colombia	Brazil
(1) Total project cost (US\$ millions)	41.8	13.6	85.9	118.6
(2) Aggregate cost of competitive fund subprojects (US\$ millions)	4.8	7.2	60.1	54.1
(3) Competitive fund share of project [(2)/ (1)] (%)	11.5	52.9	70.0	45.6
(5) Overall cost of administering subprojects (US\$ millions)	1.4	1.1	7.3	5.4
(6) Number of subprojects	75	123	635	470
(7) Mean cost per subproject [(2)/(6)] (US\$'000)	64	59	95	115
(8) Administrative cost per subproject [(5)/(6)] (US\$'000)	19	9	11	11
(9) Share of administration in subproject cost [(8)/(7)] (%)	29.7	15.0	12.1	9.6

Source: IEG estimates, based on project documentation and interviews.

5.49 The competitive model has high start up costs. When project funds for this component are small (the case for Nicaragua and Peru) the administrative overhead per subproject becomes very high (Table 9), which may undermine commitment to sustaining the model. In Nicaragua, extension services provided by the state outside the competitive model (at no charge to the farmer) cost US\$87 per producer per year; a similar service provided under the auspices of the model cost US\$126 per producer per year, reflecting the extra expense involved in organizing the competitive bidding process and supplying technical assistance to weaker would-be service providers. Respondents to IEG's poll reported that the extra cost of research and extension services provided through the competitive model did not result in better service compared to the alternative system of direct government provision (Annex 1).

5.50 The IEG poll results (Figure 3 above) picked up the differences between countries in the level of satisfaction with the project approach; which may have some bearing on the survival prospects of the competitive model. But it is impossible to determine whether the higher level of satisfaction expressed by meeting participants in Brazil and Colombia reflects enthusiasm for the competitive model principle in itself—rather, it may reflect gratitude that the project actually delivered substantial resources to the institutions that these people worked for.

5.51 There is an important final consideration. Because the competitively funded subprojects were only supported for 2-3 years it is possible that the various alliances between producers and providers that were generated under the subproject will not survive once external funding dries up. On the other hand the process of engaging with the subprojects undoubtedly helped to build up the skills of all concerned—in proposal writing, preparing business plans and application of new technologies—and this human capacity development will outlive the subproject. This is one respect in which sustainability prospects seem sounder.

5.52 *In short, while all of the four projects assessed raise concerns about the long-term sustainability of the competitive funds, it is equally important to consider the support these projects gave to strengthening the public research and extension*

apparatus and building up of skills, aspects that may be more sustainable. Moreover, where there is a strong public sector apparatus there is likely to be a sound enabling environment for competitive funds over the longer term, which may offset short-term downturns in government and donor support for competitive funds.

6. Conclusions and Lessons

6.1 *An important finding of this four-project assessment is the lack of hard evidence about the results of competitive fund investments in research and extension.* In each of these countries, agricultural productivity has risen since the mid 1990s, with growth increasingly based on intensification rather than area expansion. Potentially, the assessed projects contributed to this expansion. But, with the exception of Peru, there is no robust survey evidence linking productivity and income changes to the project interventions. Even in the case of Peru there are doubts about which of the steps in the results chain were most critical for achieving the increase in farm incomes. For example, extension services potentially have a role to play in the technology transfer chain but it is unclear just how a critical a role. In each of these four countries extension has withered on the vine; but from the evidence generated by these projects it is impossible to conclude if this attrition is truly significant—or whether, for example, tighter linkage of farmers to producer associations is an effective substitute.

6.2 With respect to the viability of the competitive fund model, more study is needed to compare the efficiency of the model with the alternative—a single (public) supplier with funds directly assigned by government. There is a perception—stronger in Brazil and Colombia than in Peru and Nicaragua—that the competitive process has been managed in a way that is both fair and transparent and has tended to raise the quality of the research proposals that are approved for funding. But there is no indication of how costs per unit of technology adopted vary between the competitive and the direct assignment approach.

6.3 *The four projects included in this assessment, and the follow-on projects that have succeeded them, have generated substantial learning, both by the Bank and by the countries concerned.* In Nicaragua, there is now greater realism about what can be achieved in a context of weak institutions and high donor dependence. In Peru, the importance of integrating the competitive fund approach with the broader public sector apparatus of research and extension has been acknowledged; and the government's commitment to maintaining the regional network of INCAGRO bodes well for increased decentralization. In Colombia, the progress under the follow-on project in linking subprojects to commodity chains and increasing engagement with producer associations is resulting in a more strategic allocation of competitive fund resources that will help to enhance the country's agricultural competitiveness under the terms of the new free trade agreement with the USA. In Brazil, the returns to increasing EMBRAPA's connectedness with diverse research institutions, both within the country and beyond, have become fully apparent.

6.4 The findings from this assessment suggest lessons of broad relevance that are likely to apply beyond the four countries studied. *A principal lesson concerns the importance of strengthening the capacity of research organizations, not just financing*

research. Competitive funds can be an important vehicle for research financing and have a strategic role to play in piloting new ways of working, or focusing research on new topics; but they are most likely to make a sound and lasting contribution when they complement a relatively strong public-sector framework for research (in this respect, prospects were brighter to begin with in Brazil and Colombia than they were in Nicaragua and Peru). Public funding is essential for agricultural innovation systems and private funding complements rather than substitutes for higher levels of public funding

6.5 ***Second, to be able to compete, research institutions must have a minimum budget and a critical mass of staff—all institutions need a portion of the budget that is core funded to cover costs of maintenance and upgrading of physical and human resource infrastructure.*** Competitive grants usually only fund operating costs; and the subprojects they finance have only 2-3 years' duration.¹ The sustainability of the public sector research apparatus in general and the competitive funding model in particular depends on a continuing commitment of government funds. The new model is unlikely to flourish in a climate of fiscal austerity because there is only limited scope for private funds to substitute for public money.

6.6 Third, the competitive fund model is more likely to strengthen the strongest agencies providing research and extension services than it is to reduce the disparities between the strong and the weak. Thus, in Brazil, the model strengthened an agency that was pre-eminent to begin with. At the other extreme, in Nicaragua, the model was underfunded from the outset, its transformative capacity was limited by the weakness of all the actors in the competitive arena, and the government provided little support to it. The principle of competition between alternative service providers breaks down where the range of providers is limited (a problem at the municipal level and for small countries) and many of the potential providers lack the skills needed to prepare viable sub-project proposals.

6.7 ***Fourth, the competitive model has not itself led to a large growth in the role of the private (for profit) sector as a provider of agricultural research and extension; but it has contributed to the broader process of private sector development.*** Compared to high-income countries, in Brazil, Colombia, Nicaragua and Peru, commercial firms have played a smaller role as providers relative to public and private nonprofit agencies. To the extent that commercial firms have played a role, they have largely done so *outside* the framework of competitive grant schemes; this is the case, for example, for the partnership between EMBRAPA and the private multinational Monsanto for producing herbicide-tolerant soybeans.² On the other hand, under the competitive schemes, through the medium of subproject co-payments, producers have provided private funds as a complement to public sector grants; they have received training in the preparation of business plans; and they have become more market-oriented owing to partnerships with producer associations that have been facilitated by competitive funding agreements. In this sense, the competitive fund model has contributed to the broader goal of private sector development without entailing a major role for commercial firms as service providers.

1. Echeverria (1998a), p. 1108.

2. EMBRAPA (2009).

Annex 1: IEG Poll on Perceptions of the Competitive Fund Model

(Range of Potential Responses: 1.0 to 4.0, with 4.0 the most positive)

<Least Positive			Most Positive>					
2.6	2.7	2.8	2.9	3.0	3.1	3.2	3.3	3.4
<p>Q07 To what extent has this project improved the capacity of the agricultural research system to respond to the needs of the poorest?**</p> <p>Q10 Has the project helped to increase the physical yields of basic grains?**</p>		<p>Q09 To what extent has this project increased the integration of producers with “value chains”?*</p> <p>Q12 Has the project helped improve natural resource management?**</p>	<p>Q06 To what extent has this project improved the capacity of the agricultural research system to respond to the needs of small and medium producers?*</p> <p>Q08 In the last ten years has there been a change in the level of integration of producers with “value chains”?*</p> <p>Q11 Has the project encouraged a diversification toward more profitable farming activities?*</p>	<p>Q01 Is the competitive model for agricultural research developed by this project more efficacious than the alternative (single public sector supplier) model?***</p>	<p>Q05 To what extent has this project raised the technical quality of agricultural research?***</p>		<p>Q04 In the case of the competitive fund developed by this project is there adequate technical assistance available to help with the preparation of agricultural research proposals?***</p>	<p>Q02 In the case of the competitive fund developed by this project, how important is technical rigor when choosing between agricultural research proposals?*</p> <p>Q03 In the case of the competitive model developed by this project, is the process for choosing between proposals transparent?*</p>

Source: IEG Questionnaire Survey, 2008. Standard deviation per question: *0.8; **0.9; ***1.0

Annex 1 (concluded)

QUESTIONS (Ranked in descending order of positive response)		N*	Mean Rating (1.0=Least Positive; 4.0=Most Positive)	F Test of Significant Difference
Q11 Has the project encouraged a diversification toward more profitable farming activities?	NIC	36		COL/NIC (.03) COL/BRA (.04)
	PER	44		
	COL	19		
	BRA	25		
Q08 In the last ten years has there been a change in the level of integration of producers with “ value chains ”?	NIC	36		None
	PER	45		
	COL	21		
	BRA	27		
Q07 To what extent has this project improved the capacity of the agricultural research system to respond to the needs of the poorest ?	NIC	34		None
	PER	47		
	COL	18		
	BRA	24		
Q09 To what extent has this project increased the integration of producers with “ value chains ”?	NIC	36		COL/BRA (.04)
	PER	46		
	COL	20		
	BRA	25		
Q12 Has the project helped improve natural resource management ?	NIC	33		None
	PER	46		
	COL	20		
	BRA	22		
Q10 Has the project helped to increase the physical yields of basic grains ?	NIC	33		NIC/COL (.05)
	PER	39		
	COL	14		
	BRA	10		

Source: IEG Questionnaire Survey, 2008

* Number of persons responding with a rating (excluding “don’t know” and non-responses).

Annex 2: Background Information

Table 1: Country Profile

	Brazil	Colombia	Nicaragua	Peru
Total Land Area ('000 sq. km) [1]	8,515	1,142	130	1,285
Population, 2006 (millions) [1]	189	46	6	28
Rural Share of Population, 1990 (%) [1]	25	31	47	31
Rural Share of Population, 2006 (%) [1]	15	27	41	27
Gross National Income, 2006 (US\$ billions) [1]	892.6	142.0	5.2	82.2
GDP Growth, 1990-2000 (mean annual %) [1]	2.7	2.8	3.7	4.7
GDP Growth, 2000-2006 (mean annual %) [1]	3.0	3.9	3.3	4.9
Agriculture GDP Growth, 1990-2000 (mean annual %) [1]	3.6	-2.6	4.7	5.5
Agriculture GDP Growth, 2000-2006 (mean annual %) [1]	4.2	1.6	3.0	3.5
Agriculture's Share of GDP, 1995 (%) [1]	6	15	23	9
Agriculture's Share of GDP, 2006 (%) [1]	5	12	20	7
Ag. Exports Per Rural Person, 1999-2001 (mean US\$) [2]	533	301	203	770

Sources: [1] World Bank, 2009b; [2] World Bank, 2005e (Table 2.7).

Table 2: Agricultural Productivity Drivers

	Brazil	Colombia	Nicaragua	Peru
Factors Bearing on Market Development				
Population Density, 2006 (people per sq. km.) [1]	22	41	46	22
% of Population in Low Density Areas, 2005 (with a journey time of over 4 hours to a city of 100,000) [2]	18	11	17	30
Road Density, 2005 (km. of road per 100 sq. km. of land area) [1]	21	15	15	6
Households with Television, 2006 (%) [1]	91	90	60	71
Mobile Phone Subscribers per 100 people, 2006 (%) [1]	53	65	33	31
Average Time to Clear Exports through Customs (days) [1]	8.2	7.1	5.0	5.6
Time Needed to Register Property, June 2007 (days) [1]	45	23	124	33
Time Required to Build a Warehouse, June 2007 (days) [1]	411	146	219	210
Ag Exports + Imports/Ag Value Added, 1989-91 (%)	35.4	41.6	(68.6)*	48.4
Ag Exports + Imports/Ag Value Added, 2002-2004 (%)	72.3	46.8	102.5	47.8
Land				
Total Land Area, thousand sq. km [1]	8,515	1,142	130	1,285
% of Total Area in Agricultural Land, 1990-92 [1]	28.9	40.5	33.5	17.1
% of Total Area in Agricultural Land, 2003-05 [1]	31.2	38.2	43.5	16.6
% of Cropland that is Irrigated, 2003-2005 [1]	4	23	3	28
Renewable Freshwater, 2005 (thousand cu. m. of flows per sq. km. of total land area) [1]	636	1,849	1,461	1,258
Labor				
% of Rural Population Aged 15 and Above that is Illiterate, 2005-2006 [4]	24	16	33	24
% of Rural Population with Access to an Improved Water Source, 2004 [1]	57	71	63	65
% of Rural Population Below the National Poverty Line, 1998 [1]	51	79	69	77
% of Population Classed as Amerindian Indigenous [4]	0.4	1.0	5.0	45.0
Capital				
Fertilizer Consumption (100 g/ha of arable land), 2003-05 [1]	1,539	2,940	317	854
Average Annual Growth in Fertilizer Consumption, 1990-92 to 2003-05 (%) [1]	10	4	1	18
Tractors, 2001-03 (Number per 100 sq. km. of arable land) [1]	137	91	15	36
Spending on R&D, All sectors, 2000-05 (% of GDP) [1]	0.91	0.17	0.05	0.15

Sources: [1] World Bank, 2009b; [2] World Bank, 2005e (Table 2.18); [3] SITEAL, "Informe sobre tendencias sociales e educativas en America Latina 2008" www.siteal.ipe-oei.org; [4] CIA, The World Factbook, 1999. *Data for 1994 only.

Table 3: Measures of Agricultural Productivity

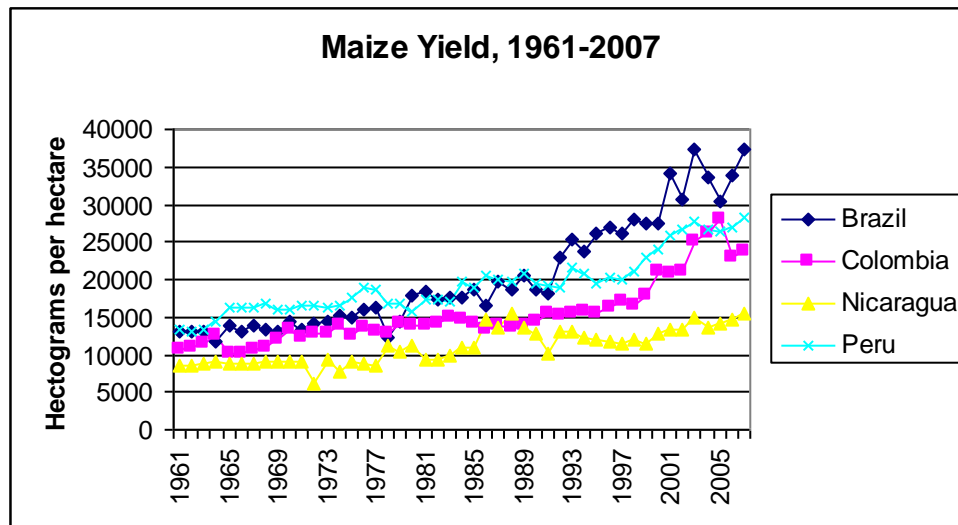
	Brazil	Colombia	Nicaragua	Peru
Agricultural Total Factor Productivity Growth, 1960-2000 (mean % per year) [2]	1.93	1.43	0.79	1.36
Agriculture Valued Added Per Worker, 1990-92 (Constant 2000 US\$) [1]	1,506	3,405	NA	930
Agriculture Valued Added Per Worker, 2003-05 (Constant 2000 US\$) [1]	3,126	2,847	2,071	1,498
Cereal Yield, 2004-06 (Kg per Ha) [1]	3,076	3,725	1,808	3,433
Growth in Cereal Yield, 1990-92 to 2004-06 (mean % per year) [1]	4.0	3.3	1.2	2.6
Crop Production Index, 2002-04 (1999-01=100) [1]	119.6	107.4	115.3	108.1
Food Production Index, 2002-04 (1999-01=100) [1]	124.3	109.7	123.1	110.2
Livestock Production Index, 2002-04 (1999-01=100) [1]	116.8	107.1	119.9	114.1

Sources: [1] World Bank, 2009b; [2] World Bank, 2005e (Table 5.8).
NA Not available.

Table 4: Productivity Rankings

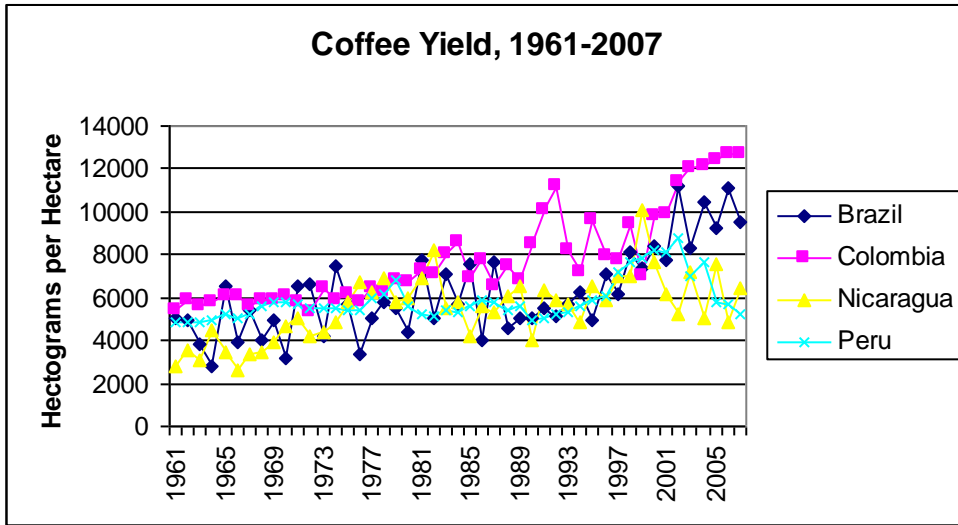
	Brazil	Colombia	Nicaragua	Peru
Agricultural Total Factor Productivity Growth, 1960-2000 (mean % per year) [2]	1	2	4	3
Agriculture Valued Added Per Worker, 2003-05 (Constant 2000 US\$) [1]	1	2	3	4
Cereal Yield, 2004-06 (Kg per Ha) [1]	2	1	4	2
Growth in Cereal Yield, 1990-92 to 2004-06 (mean % per year) [1]	1	2	4	3
Crop Production Index, 2002-04 (1999-01=100) [1]	1	4	2	3
Food Production Index, 2002-04 (1999-01=100) [1]	1	4	2	3
Livestock Production Index, 2002-04 (1999-01=100) [1]	2	4	1	4
Mean Ranking	1.3	3.3	2.9	3.1

Sources: [1] World Bank, 2009b; [2] World Bank, 2005e (Table 5.8).
[3] FAO.

Annex 2, Figure 1

Source: FAO

Annex 2, Figure 2



Source: FAO

Annex 3: Potential Advantages and Disadvantages of Competitive Grants Systems

ADVANTAGES	DISADVANTAGES
Increases research effectiveness by directing resources to the most productive scientists, by merit (improves quality and accountability of research)	Limited nature of funding (funds only operation costs, lack of support to core budget salaries and maintenance of research facilities)
Increases research efficiency by reducing: direct costs via competition and co-financing schemes, duplication of efforts, lack of accountability of research resources, underutilization of infrastructure by providing operating resources	Short term funding , lack of support for medium- to long-term research agenda
Promotes the identification of and consensus on national research priorities	Low institutionalization , lack of support to human capital development and to new research infrastructure
Increases flexibility to focus on newly emerging national/regional priority issues	Higher funding uncertainty could affect long-term projects and reduce confidence of research staff
Promotes a goal-oriented and demand-driven national research system	High transaction costs from grant seeking, proposal writing and implementation reports, less time for research
Strengthens links between research and extension organizations, agricultural production and agricultural policies	Reduces research flexibility to focus on additional (not open for competition) issues when researchers discover new research opportunities
Strengthens links among national, regional, and international public and private research organizations; promotes “spill-ins”	Higher risks involved when research consortia involves less-well-known organizations
More diversification of funding by involving scientists from outside traditional organizations, promotes “system”	Low sustainability of funding when national constituency is weak and external funding sources dry up (unless it's an endowment)
Induces institutional change in the national innovation system, separating research policy, funding and implementation	Needs a minimum market size , a research system with a minimum number of competitors (larger countries probable best suited)
May mobilize additional funding Merit review process provides expert feedback to researchers' proposals and objectivity of the competitive process, improving research quality	Legal, financial, administrative and technical costs of setting up and administrating
	May be biased to strong research organizations , increasing “equity issue” due to lack of competitive capacity of poorer/smaller organizations
	Possibility of “rent-seeking” in the process of allocating resources to research

Source: Echeverria (1998b).

Annex 4: Republic of Nicaragua

Agricultural Technology and Rural Education Project

Summary

This report assesses the performance of the Agricultural Technology and Rural Technical Education Project (PTA 1). The project was supported by an IDA credit (No. 3371-NC) of US\$23.6 million, which was approved on June 6, 2000. The loan disbursed fully and closed on June 30, 2005, nine months behind schedule.

The project was designed as the first phase of a 16-year Agricultural Technology Program that had the following purpose: to increase agricultural productivity and family income of 110,000 small- and medium-scale farm households through the generation/enhancement of an efficient, demand-driven agricultural technology, knowledge and innovation system. Specifically, by the end of this first phase, it was expected that: (a) the main public agricultural technology institutions would be providing effective, coordinated sector policy guidance and client-responsive services; (b) the private sector, non-governmental organizations, and the educational institutions would be participating significantly in providing agricultural services to client farmers; (c) the public sector would be proactively undertaking strategic and basic research and providing advisory services that generate positive externalities; (d) a national agricultural technical education training strategy would be defined and a pilot begun; and (e) a timely, high-quality agricultural and market information would be available to technicians and farmers.

The project comprised: (a) *Development of Institutional Capacity* (planned cost, US\$9.5 million; actual cost, US\$20.7 million), which involved strengthening public institutions of strategic importance to the sector, and involving public and private institutions in agricultural technology and agricultural technical education and training; (b) *Establishment of a Competitive Fund for Agricultural Services* (planned cost, US\$8.3 million; actual cost, US\$4.3 million), which piloted a scheme to provide grants for demand-driven agricultural service subprojects, supplied by private as well as public entities; (c) *Strengthening the Nicaraguan Institute for Agricultural Technology* (INTA) (planned cost, US\$16.7 million; actual cost, US\$13.9 million), which included support to this government entity in order that it might better provide agricultural research and extension services; (d) *Establishment and Piloting of an Agricultural Education and Training System* (planned cost, US\$2.6 million; actual cost, US\$1.8 million); and (e) *Establishment and Piloting of an Agricultural Information System* (planned cost, US\$1.1 million; actual cost, US\$1.1 million). During implementation funds were reallocated between components, resulting in a doubling of the cost of the first component; this partly reflected the addition, at the government's request, of a supply-driven program (*Libra por Libra*) that provided seed to farmers—a component that had not been envisaged when the project was designed.

IEG rates **Outcome** as unsatisfactory. The objectives and design of the project were only modestly relevant, based on Nicaragua's weak institutional capacity. Progress toward project development objectives was marred by the decision, during implementation to alter the

content of the first component, adding *Libra por Libra* and using some of the funds to pay the salaries of Ministry of Agriculture staff—neither of which were in tune with the original project design. Financing for the competitive fund component was halved, hampering the launch of this pilot initiative. Neither the agricultural training nor the agricultural information components left an enduring mark on the institutional framework of the sector. There is conflicting information about the achievement of project outputs; and the outcomes, in terms of crop yields and increased farm incomes, are also in doubt. The project was modestly efficient in its use of resources. The reported economic rate of return is not supported by evidence from elsewhere that shows limited increase in farm yields and incomes. Also, contrary to the spirit of the project design, the public research and extension service (INTA) did not focus on delivering public goods, such as strategic research—which also has negative implications for efficiency.

The **Risk to Development Outcome** is rated significant, mainly because the original plan to finance a 16-year program for strengthening research and extension fell apart; and, in the follow-on project, the competitive fund for research subprojects is no longer supported by the Bank or other donors. Prospects for a more sustainable research and extension effort led by INTA are also in doubt, unless donors continue to finance recurrent costs.

IEG rates **Bank Performance** as unsatisfactory. Quality at entry was hampered by over ambitious project objectives and the difficulty, in the Nicaraguan context, of supporting, in parallel, a government research and extension service and a competitive fund scheme run by a private foundation. During supervision the Bank did not provide the sufficient support to the foundation and did not amend the credit agreement when the government requested that funds be diverted to *Libra por Libra*.

IEG rates **Borrower Performance** as unsatisfactory, reflecting a loss of government commitment during implementation (particularly for the competitive fund) and weak oversight by the implementing agency.

The **Lessons** learned from this project are discussed in the overview report which draws on IEG's findings about the performance of competitive grant schemes for agricultural research and extension in four Latin American countries (Brazil, Colombia, Peru and Nicaragua). Taking the four countries as a whole, with the exception of Peru, there is a lack of hard evidence about the ultimate impact of the investments made—the extent to which farmers adopted new technologies developed through research and extension subprojects, and the related change in productivity and incomes.

The assessment also concludes that the principle of competition between alternative service providers breaks down where the range of providers is limited (a problem at the municipal level and for small countries) and many of the potential providers lack the skills needed to prepare viable sub-project proposals. The model is more likely to strengthen the strongest players in the field than it is to reduce the disparities between the strong and the weak. Summing up, the competitive fund approach is a useful adjunct to the broader public sector apparatus for agricultural research and technology transfer; it is not a substitute.

Principal Ratings

AGRICULTURAL TECHNOLOGY AND RURAL EDUCATION PROJECT

	<i>ICR*</i>	<i>ICR Review*</i>	<i>PPAR</i>
Outcome	Satisfactory	Satisfactory	Unsatisfactory
Institutional Development Impact**	Modest	Substantial	n.a.
Risk to Development Outcome	n.a.	n.a.	Significant
Sustainability***	Likely	Likely	n.a.
Bank Performance	Satisfactory	Satisfactory	Unsatisfactory
Borrower Performance	Satisfactory	Satisfactory	Unsatisfactory

* The Implementation Completion Report (ICR) is a self-evaluation by the responsible Bank department. The ICR Review is an intermediate IEGWB product that seeks to independently verify the findings of the ICR.

**As of July 1, 2006, Institutional Development Impact is assessed as part of the Outcome rating.

***As of July 1, 2006, Sustainability has been replaced by Risk to Development Outcome. As the scales are different, the ratings are not directly comparable. f5/7p

Key Staff Responsible

<i>Project</i>	<i>Task Manager/Leader</i>	<i>Division Chief/ Sector Director</i>	<i>Country Director</i>
Appraisal	Norman B. Piccioni	Thomas B. Wiens	D-M Dowsett-Coirolo
Completion	Samuel Taffesse	Mark E. Cackler	Jane Armitage

Background

1. Since the early 1990s the Bank has supported a broad program of adjustment and liberalization in Nicaragua that was intended to revive economic growth. A major part of this effort was directed at the agricultural sector, with a particular emphasis on increasing the contribution of research and extension to agricultural productivity. The Bank played a key role in the establishment of the National Institute of Agricultural Technology (INTA), which was founded in 1993. The creation of INTA was a precondition for the FY94 Agricultural Technology and Land Management Project (ATLMP), which ran through June 2000. A privatized extension pilot formed a part of ATLMP. The FY00 Agricultural Technology and Rural Technical Education Project (PTA 1), which is the focus of this PPAR, aimed to build on these foundations. It combined further strengthening of INTA with attempts to consolidate producer co-financing of extension (piloted under ATLMP) and to promote a demand-driven model of research and extension.
2. In addition to reviewing PTA 1, this evaluation also considers progress under the follow-on project (PTA 2).

Box 1. IEG Approach

During the October 2008 mission to Nicaragua, IEG interviewed the principal agencies involved in the project (Ministry of Agriculture, INTA, and FUNICA). Separate focus-group meetings were held with donors, NGOs and universities. Two field trips were staged, the first involving visits to the Departments of Leon and Chinandega, the primary locus for competitively-funded extension (FAT), and the second involving visits to the coffee-producing Department of Matagalpa, where INTA is active (Box 2 below). IEG's initial intention was to review completion reports (and any follow-up evaluations) of a sample of research and extension subprojects financed both through the competitive model (FUNICA) and through the direct assignment model (INTA). But there has been no adequate documentation of a representative sample of subprojects and there have been no follow up evaluations. Therefore, IEG revised its approach. First, it examined the consistency between the multiple background reports that were generated in the final year of the project and the published ICR. In addition, IEG polled groups familiar with the project (Ministry of Agriculture, INTA and FUNICA staff, and service providers, such as NGOs and universities) to determine how positively they rated the various aspects of the competitive fund model. The poll items were the same for each of the four Latin American countries included in this IEG assessment and the results are presented in the overview report, which compares findings across the four countries and derives lessons.

Objectives and Components

3. The project was designed as the first phase of a 16-year Agricultural Technology Program that had the following purpose: to increase agricultural productivity and family income of 110,000 small- and medium-scale farm households through the generation/enhancement of an efficient, demand-driven agricultural technology, knowledge and innovation system. The project's development objective was to establish this system. By the end of the project, it was expected that: (a) the main public agricultural technology institutions would be providing effective, coordinated sector policy guidance and client-responsive services; (b) the private sector, non-governmental organizations, and the educational institutions would be participating significantly in providing agricultural services to client farmers; (c) the public sector would be

proactively undertaking strategic and basic research and providing advisory services that generate positive externalities; (d) a national agricultural technical education training strategy would be defined and a pilot begun; and (e) a timely, high-quality agricultural and market information would be available to technicians and farmers.

Table 1 shows the project components.

Table 1. Expected and Actual Cost of Components

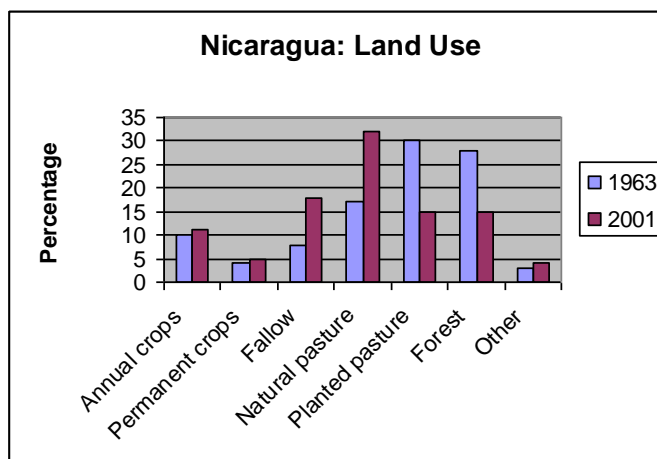
Component	(A) Expected cost (US\$ millions)	(B) Actual Cost (US\$ millions)	(B)/(A)
(a) Institutional Development	9.5	20.7	218%
(b) Competitive Fund	8.3	4.3	52%
(c) Strengthening of INTA	16.7	13.9	83%
(d) Agricultural Education and Training System	2.6	1.8	69%
(e) Agricultural Information System	1.1	1.1	100%
Total project cost	38.2	41.8	109%

PROJECT INSTITUTIONAL FRAMEWORK

4. The Ministry of Agriculture, Livestock and Forestry (MAGFOR) sets the strategic direction for research and extension. The Nicaraguan Institute for Agricultural Technology (INTA), a dependent institution of MAGFOR, provides research and extension services, based on funds directly assigned from the government budget (heavily underpinned by donor funding). INTA administers both a freely provided extension service and a service requiring farmer co-financing, each targeted to different income groups. Competitive funds for research and extension are administered by FUNICA. Established in 2000, this foundation was a direct product of PTA 1—its creation was a condition for project effectiveness. FUNICA manages separate competitions for research (FAITAN) and extension (FAT). While FAITAN has always been national in reach, FAT was initially limited to three Departments (Leon, Chinandega and Managua); it expanded to the Departments of Estelí, Nueva Segovia and Madriz in 2004, with the help of additional funding from DANIDA. INTA chairs the 27 member governing council of FUNICA and competes for the funds that it administers. Other institutions supported by the project are the National Institute for Technical Training (INATEC), which is responsible for educating extension agents and farmers, based on a network of regional centers (CETAS); and the Agricultural Information System (SIA), supported by Information Centers for Local Development (CIDEL). The project implementation unit was housed in MAGFOR.

Relevance

5. Relevance assesses the appropriateness of project development objectives in relation to country priorities and Bank country and sector strategies; and the suitability of project design for achieving project objectives.

Figure 1. Nicaragua Land Use

Source: Agricultural census data, cited by Montserrat (2008).

RELEVANCE OF OBJECTIVES

6. The productivity focus is relevant to country needs. The agricultural census data show that between 1963 and 2001 the share of land in natural pasture and under fallow increased while forestland contracted (Figure 1), reflecting the predominance of a pattern of agricultural growth based on expansion at the extensive margin rather than through increased yields.¹ However, there was a substantial increase in yields from the early 1990s onwards, with growth in Nicaragua exceeding that in most other Central American countries, leading to considerable exports, especially of dry beans and coffee. Nevertheless, in absolute terms, yields remain relatively low suggesting that further support to agricultural research and extension was eminently relevant.

7. On the other hand, some observers have argued that the real constraint to increasing productivity in Nicaragua is not farmer access to appropriate technology packages—packages were there to be exploited well before this project—but the low levels of literacy in the countryside (the lowest in Latin America) and the poor quality of roads.² Attending to these fundamental constraints was conceivably the first priority. However, the Bank did finance two basic education projects in the 1990s (including components to improve school infrastructure in rural areas) and it also supported a road rehabilitation project. Funding a research and extension project was arguably complementary to these initiatives.

8. On the other hand, given the weak institutional framework in Nicaragua the objective of implanting a competitive fund model (based on the Bank's experience in Peru, in particular) seems misplaced. Having been instrumental in the creation of INTA in the 1990s it was more than a little awkward that the Bank should suddenly appear to change direction, supporting the scaling back of staff in INTA and the development of an alternative model. Also, the Bank read too much into the limited evidence that small

1. ICR (2005), p. 21.

2. Arguello, et al (2002), p. 7.

farmers were ready to co-finance extension.¹ The development trajectory envisaged was as follows. Technical staff made redundant by the public institutions would swell the pool of potential research and extension providers. These potential providers would compete for the resources in a fund composed of both public and private money. Over time, as farmers prospered, they would graduate from the free extension program provided by INTA to the co-financed extension programs that emerged from the various competitive rounds supervised by FUNICA. Public-sector involvement in technology transfer would be limited to the provision of pure public goods, such as most of the products of strategic research. It would have been a challenge for most countries in Latin America to realize these objectives; with Nicaragua's limited resources such objectives were too ambitious.

9. IEG rates the relevance of objectives as **modest**.

RELEVANCE OF DESIGN

10. The project was designed as the first phase of a 16-year Adaptable Program Loan (APL). According to the ICR, the choice of an APL was justified by the need for long-term commitment and sustained intervention to bring about lasting and effective change. The design incorporated lessons learned from past projects, notably ATLMP which gave INTA the opportunity to pilot a private technical assistance scheme. The project's design was heavily influenced by prevailing thinking in the Bank's Agricultural Knowledge and Information System thematic group, which emphasized the need for a comprehensive approach to managing agricultural knowledge. As the ICR put it, "unlike traditional projects that mainly rely on improving productivity through the provision of technical assistance alone, the project design included other supportive activities such as rural education, improving access to information, and strengthening and diversifying the institutional framework"².

11. IEG finds that the attempt to secure a 16-year commitment from government was appropriate (although ambitious). The ICR acknowledges that it was optimistic to set a target of increasing farm productivity and incomes, respectively, by 25 percent and 15 percent—by the end of the first phase.³ Also, there was a further challenge. This was a race in which two horses would be backed against each other. Since the Bank had effectively created INTA in the 1990s, government had strong expectations that the Bank would continue to support it and the Bank evidently went along. But at the same time the project sought to move towards a competitive model that was contrary to the INTA culture. The dilemma is reflected in the relative size of the components: the expected investment in strengthening MAGFOR and INTA was three times as large as that for the competitive fund, raising questions about the extent of commitment to the competitive principle. At least one Bank task manager questioned the wisdom of setting up a competitively funded approach to research and extension in parallel with INTA, envisaging that limited human resources and budget would be spread too thinly and there would be a duplication of efforts.

1. Keynan, et al (1997).

2. ICR (2005), p. 5.

3. ICR (2005), p. 5.

12. IEG rates design relevance as **modest**.

Efficacy

13. Efficacy assesses to what extent the project's stated objectives were realized. This report systematically analyzes whether the expected inputs, outputs and outcomes actually materialized (the results chain). This provides a basis for the subsequent discussion of progress toward objectives. To the extent possible progress toward objectives is assessed against evidence bearing on intermediate and final outcomes (defined in Table 2). Where such evidence is lacking or insufficient, IEG considers data on outputs, considering whether there are plausible grounds for arguing that delivery of those outputs has led (or is likely to lead) to the expected outcomes.

14. The chain of expected inputs, outputs and outcomes (Table 2) is derived from the PAD. According to the ICR, during implementation the project's objectives and components were not changed and the project was not formally restructured. Therefore, the Table 2 results chain is a valid template for the ex-post evaluation. Each of the next sections begins with a presentation of ICR material bearing on the results chain, followed by a discussion of the relevant IEG findings.

INPUTS

15. Although there was no formal restructuring, the size of the project components changed during implementation and the content of some of the components was redefined. Total project cost increased from US\$38 million to US\$42 million. The institutional strengthening component more than doubled in size while the competitive funds component was roughly halved. By project end the competitive funds component accounted for only 10 percent of project cost, suggesting that there was limited scope for this component to catalyze the reform of the overall research and extension system.¹ Some of the funds previously earmarked for competitive funds and INTA were transferred to the institutional strengthening component to finance a US\$5.1m seed distribution initiative (Libra por Libra) that was out of tune with the demand-driven spirit of the original project design.² Taking out the Libra por Libra funding, the institutional strengthening component received an additional US\$6.14 million over the appraisal estimate. Most of this funding went to paying salaries of MAGFOR staff rather than direct financing of institutional strengthening,³ raising questions about sustainability.

OUTPUTS

16. *Institutional strengthening*. All the outputs listed in Table 2 were delivered. In addition, the (supplementary) seed-distribution program was fully implemented. IEG

1. The Borrower observes that owing to this cutback the competitive model was not properly tested (Appendix B).

2. This point was made to IEG by persons associated with the project in Nicaragua; Bank staff have pointed out that Libra por Libra was mainly financed by separate funds from Dutch bilateral aid rather than through transferred funds previously allocated to FUNICA.

3. ICR (2005), p. 6.

Table 2. Results Chain—Expected inputs, Outputs and Outcomes

Inputs (Components)>	Outputs>	Intermediate Outcomes>	>Final Outcomes
(1) Institutional framework (E) US\$9.5m; (A) US\$20.7m	(1) MAGFOR and line agencies invest in infrastructure and training (2) A foundation is established to manage competitive funds (3) INTA is reorganized	<i>Development of technologies</i> (1) INTA consolidates at least 180 technologies	
(2) Competitive Fund (E) US\$8.3m; (A) US\$4.3m	(4) 5 calls for research proposals carried out (5) At least 36 research/service contracts awarded to universities (domestic and foreign), regional research centers and private sector (6) At least 30 private firms provide co-financed services through FAT	(2) 70% of competitive fund research contracts provide solutions for SMF problems	
3) INTA (E) US\$16.7m; (A) US\$13.9m	(7) INTA able to train 500 technicians per year (8) INTA implements 30 service contracts per year with public and private clients (9) Production of seed on 218,000 <i>manzanas</i>	(3) 20% of SMF-appropriate technologies developed by universities and private agencies (profit and non-profit) <i>Transfer of technologies</i>	(1) 60,000 SMFs achieve: --25% increase in average yields --15% increase in real net household income (2) 60% of surveyed SMFs report satisfaction with system performance
4) Agricultural Education (E) US\$2.7m; (A) US\$1.8m	(10) Comprehensive strategy adopted (11) Curricula developed (12) 3 education centers renovated (13) Training plan administered	4) 60,000 SMFs receive advisory services (5) SMFs adopt 80% of technologies promoted	
5) Agricultural Information (E) US\$1.2m; (A) US\$1.1m	(14) 20 agricultural sector institutions interconnected (15) Training and capacity building plan implemented in 2 pilot regions	<i>Knowledge base</i> (6) Agricultural education and information institutions strengthened	

(E) Expected; (A) Actual; SMF Small and Medium-scale Farm households. Source: PAD

found that the seed initiative was not sustainable and, because there was no attempt to enforce payment for inputs, the broader aim of encouraging farmers to pay for services may have been undermined.

17. *Competitive funds.* Six funding rounds took place rather than the five that had been expected. The number of contracts awarded was 75 (up from the expected 36). IEG found that there was no consensus about the quality of the research and extension services that were competitively contracted. One report notes that FUNICA itself acknowledged the deficiency, stating that even some of the proposals approved for funding were deficient leading to subsequent problems with implementation.¹ Some observers said that quality remained poor, partly because Nicaraguan universities had weak research capacity and there was limited participation by (better-qualified) foreign institutions. One well-positioned observer has noted that the proposals funded in later rounds were significantly better than those financed early on.² Of the 70 subprojects that FUNICA approved for financing 4 were submitted by INTA—yet despite the declared project objective of focusing INTA on public goods provision, none of the 4 subprojects involved strategic research. The FUNICA contests attracted a wide range of service providers. With respect to the research proposals that were approved (by FAITAN), 50 percent were submitted by NGOs, 21 percent by producer associations, 13 percent by universities, 10 percent by government agencies and 6 percent by private firms.

18. *INTA strengthening.* With respect to extension, the annual target for training agents was exceeded (up from 400 to 436 persons per year). The area committed to artisanal and commercial seed production was 330,000 manzanas, 50 percent greater than expected.³ It is not clear from the ICR if the annual targets for the number of contracts to service providers (30) and the training of technicians (500) were met. IEG found that INTA paid relatively little attention to research during the period of PTA 1 implementation. Taking 2001-2004 as a whole, only 10 percent of its budget was devoted to research.⁴

19. *Agricultural education.* The training centers were equipped and the training plan was administered to 460 extension workers but the ICR says that a comprehensive strategy was not adopted and is silent about whether curricula were developed.

20. *Agricultural information system.* At one level targets were exceeded: 33 institutions were linked up (the aim was 20) and the system was implemented in 16 (rather than 2) municipalities, including creation of 10 information centers. But the ICR says that the quantity and quality of the information generated was limited and there was no commitment by institutions to continue implementing the system. The information system was designed independently resulting in low buy-in by government.⁵ The web portal created during implementation is no longer operating.

1. Ammour (2005), p. 29.

2. Pallaix (2007), p. 32. (The author was head of INTA for part of the project implementation period).

3. ICR (2005), p. 31.

4. Sain, (2005a), Section 6.

5. ICR (2005), p. 23.

INTERMEDIATE OUTCOMES

21. *Development of technologies.* The number of technologies “consolidated” by INTA was 181 (the target was 180). Most of the money INTA spent on research was devoted to maize, beans, rice, sorghum and tomato.¹ No corresponding target was set for the competitive funds but, according to the ICR, 75 percent of the contracts awarded provided solutions to the problems of small- and medium-scale farmers (exceeding the 70 percent goal). Competitively-funded research (FAITAN) resulted in the generation of 15 technologies. It is not clear from the ICR what proportion of the technologies were developed by agencies other than INTA (such as universities, NGOs and private firms). IEG found that, according to one of the background reports for the ICR, only 30 percent of the combined number of research and extension contracts was geared to small- and medium-scale farmers.²

22. *Transfer of technologies.* The ICR variously reports that the number of small- and medium-scale farmers receiving extension services was 61,797 (p. 6) and 68,071 (Annex 1)—both figures exceeding the target of serving 60,000 farmers. The ICR acknowledges that owing to budgetary cutbacks and a reallocation of project resources, INTA coverage fell from a peak of 53,730 farmers in 2001 to 34,055 farmers in 2004.³ Adoption rates were higher than expected for the technologies transferred by INTA (90 percent rather than 80 percent); but lower than expected (70 percent) for technologies transferred through the competitive funds. IEG found that extension outreach was possibly lower than reported in the ICR. The 2001 agricultural census reports that, in the country as a whole, only 23,677 farms (12 percent of the total) received technical assistance.⁴ With respect to the seed distribution initiative, *Libra por Libra*, a background report for the ICR shows that 68,000 farm households were served—about one-third of the national total.⁵ But these figures fail to square with another source. The 2005 national household survey found that only 5 percent of rural households received agricultural project assistance (defined to include *Libra por Libra*).⁶

23. Yet another data source adds to the confusion. An interim impact evaluation of the project’s extension activities compared results from a baseline survey conducted in 2001 with a follow-up survey in 2004. The evaluation covered 1,162 producers in each year, finding that the proportion of interviewees receiving extension rose from 28 percent in 2001 to 33 percent in 2004. In both years NGOs were the main service providers, accounting for about one-third of all the cases reported by interviewees (Table 3). INTA’s share fell while that of private firms and producer associations grew—consistent with the project’s aim of diversifying the range of service providers. It is not clear how many of the non-INTA providers were financed through competitive

1. Sain, (2005a), Section 6.

2. Centeno (2005), p. 9.

3. ICR (2005), p. 6.

4. Arguello, et al (2002), p. 8.

5. Centeno (2005), p. 22.

6. EHMNV, 2005, Cuadro 7.1A, p. 146.

funds. Data from the 2001 agricultural census are consistent with survey findings. (The census reports that two-thirds of the households not receiving technical assistance gave as the reason the lack of any service in the locality.)

Table 3. Agencies Providing Extension Services to Interviewees

Agency type	Impact Survey				Census	
	2001		2004		2001	
	N of cases	%	N of cases	%	N of cases	%
INTA	69	21.6%	47	12.1%	6,710	24.8%
Private-for-profit firm	38	11.9%	83	21.4%	2,492	9.2%
NGO	111	34.7%	141	36.4%	9,524	35.3%
Producer association	57	17.8%	88	22.7%	4,826	17.9%
Multiple sources	38	11.9%	22	5.7%	NA	NA
Other	7	2.2%	6	1.6%	3,470	12.8%
Total	320	100.0%	387	100.0%	27,022*	100.0

Source: Nitlapan, 2005; Censo Agropecuario, 2001.

NA Not available; 'Other' includes Instituto de Desarrollo Rural and information obtained on the farmer's own initiative;

*Exceeds the number of farm households (23,677) because some households received technical assistance from more than one source.

24. Estimates of the level of co-financing of technology transfer vary widely. INTA's co-financed extension service reportedly recovered 40 percent of its costs from producers in 2003, down from 60 percent in 1996-97.¹ The 1996 figure is consistent with the 63 percent level of co-financing estimated by the World Bank in 1995.² Yet in the case of extension financed through competitive funds (FAT), the producers contributed an average of 21 percent of the cost of each subproject.³ Overall, beneficiaries contributed US\$1.3m of the actual project cost of US\$41.8m (3 percent), less than half of what was projected at appraisal.⁴

25. *Knowledge base.* At loan closing the sustainability of the training centers (CETAS) and the information centers (CIDEL) was already in doubt. IEG found that these institutions failed to achieve their objectives. The original aim was to set up 14 CETAS but only three were established and the Ministry of Agriculture dropped the initiative in 2005. A 2005 report on the CETAS found that in municipalities where the training centers had been established, extension agents had little contact with them. From the perspective of farmers, the training courses provided general information but little practical advice about how to tackle the main problems being faced by producers, such as marketing bottlenecks. In the municipalities of El Sauce and Muy Muy, 72 graduates of the training centers were interviewed. These graduates had been trained to work as extension agents; but only 9 of the 72 had found employment. With respect to the CIDEL the same report found that, while they

1. Sain, (2005b).

2. Keynan et al (1997), Table 6, p. 240.

3. Centeno (2005), p. 9.

4. ICR (2005), p. 20.

played a useful role in providing students with internet access, their primary function of managing agricultural information was neglected—one of their main uses was to serve as call centers for local people wanting to phone family members who had moved to other countries in search of work.¹ The 10 CIDEL that were established have now been taken over by municipal governments or universities.

FINAL OUTCOMES

26. *Yield increase* The ICR notes that the yield data for Nicaragua in the World Bank's development data platform show substantial growth during the project period: cereal yields rose by 22 percent between 1999 and 2003, a faster rate of growth than in any other countries. However, it is not possible to ascertain how much of this nationwide growth was attributable to the project.

27. According to the ICR, crops that account for a large share of the value added produced by small and medium-scale farmers showed yield increases that exceeded appraisal targets: compared to the overall goal of a 25 percent increase, based on data from project sites, maize yields increased by 37 percent and bean yields increased by 63 percent. IEG found that, taking the country as a whole, maize and bean yields each increased by 18 percent between 1995-97 and 2005-07 (a period which brackets the project implementation period and is based on the—more reliable—comparison of three-year averages). Bearing in mind that the extension service reaches less than 20 percent of the nation's producers the shortfall in relation to the ICR figures is hardly surprising. However, in Leon and Chinandega—departments that did receive heavy project coverage—maize and bean yields also fail to agree with the ICR figures, increasing respectively by 30 percent and 21 percent between 1995-97 and 2005-07.

Table 4. Change in Crop and Dairy Yields

	N	2001-2004		1997-2000		Difference between means	Significance ¹
		Mean	SD	Mean	SD		
Maize	778	15.39	10.35	14.96	12.44	0.42	0.42
Beans	378	12.59	8.58	10.62	8.48	1.96	0.00
Coffee	24	14.39	9.72	10.19	9.75	4.20	0.18
Sesameí	25	10.67	5.43	10.21	5.73	0.45	0.73
Rice	64	29.89	18.50	30.76	21.32	-0.86	0.79
Sorghum	126	15.53	9.38	13.91	9.80	1.62	0.11
Milk (winter)	405	4.58	2.02	5.00	2.83	-0.41	0.01
Milk (summer)	349	3.20	1.47	2.89	1.20	0.31	0.00

Source: Nitlapan, 2005

Note: Yields for crops are expressed in quintales per manzana; milk yields refer to liters per animal per day.

¹ This is the probability that, according to the t-test, the difference is purely due to chance.

28. Contrary to the ICR, the interim impact evaluation found that the only crop to show a statistically significant yield increase was beans; there was also a significant increase in summer milk yields (Table 4). Another source (Table 5) found that in 2001 and 2002 INTA extension recipients did not, on average, obtain higher yields

1. Nitlapan (2005b).

than those who had not received extension—acknowledging, however, that the control may have been contaminated by technological spillover.¹

Table 5. Mean Yields of Producers Receiving INTA Extension Services Compared to Control Group, 2001 and 2002.

Productores	Año	Crops							
		Maize		Beans		Sorghum		Rice	
		Yield	B/C	Yield	B/C	Yield	B/C	Yield	B/C
ATPM	2002	15.75	0.41	10.12	0.81	11.27	0.01		
ATP1	2001	20.45	0.62	10.57	1.30			45.18	1.98
	2002	23.83	0.68	12.38	1.00			21.98	0.55
Control	2001	20.04	0.68	10.70	1.49				
	2002	21.13	0.58	11.20	0.96			26.37	0.87

Source: Sain, Extension... (2005). Yield refers to *quintals per manzana*
ATPM Free extension; ATP1 Producer co-financed extension; B/C Benefit-Cost Ratio

29. Even if the project had had a significant impact on crop yields in the zones that were covered there is an important caveat. Much of the impact—exactly how much is impossible to quantify—would be attributable to the supply-driven seed distribution initiative which was not part of the original project design and added nothing to the sustainable institutional reforms that the project sought to promote. This seed initiative ran for a limited period, giving only a temporary boost to productivity.²

30. In monetary terms, diversification into more profitable crops is as much a part of yield increase as the change in physical output per hectare. Comparing the periods before and during project implementation there was no observable increase in the introduction of new crops (Table 6). The report concludes that producers' averseness to market risk dissuaded them from diversifying. Of the four zones covered by the impact evaluation, the level of diversification was lowest for the zone covered by competitively-funded extension (FAT), probably reflecting the higher-than-average poverty and dryness of this zone.³ Livestock farming was slightly more dynamic than crop farming, with 10 percent of interviewees reporting adoption of new techniques.

Table 6. Crop Diversification Reported by Interviewees over Two Reference Periods

Type of Change	Number of Producers per Reference Period	
	1997-2000	2001-2004
New crops introduced	46 (4%)	69 (6%)
Existing crops abandoned	13 (1%)	40 (3%)
No change	1,103 (95%)	1,057 (91%)
Total	1,162 (100%)	1,166 (100%)

Source: Nitlapan, 2005.

1. Sain, (2005b), p. 30.

2. Centeno (2005), p. 22.

3. Nitlapan (2005), p. 16.

31. *Income increase.* The ICR reports that the income of farm households representative of project beneficiaries increased by between 25 and 84 percent, compared to an expected improvement of 15 percent. IEG found that the interim impact evaluation report presented a less positive picture of income growth: a 9 percent increase in total output value for farmers receiving extension—not a statistically significant increase (Table 7). Strikingly, there was a large increase in incomes from livestock, statistically significant both for farmers receiving and not receiving extension. Another author has confirmed that, as of 2004, there was no significant difference in the level of production between farmers receiving and not receiving technical assistance.¹

Table 7. Change in Gross Value of Output With and Without Extension (N=1,162 producers)

	Gross Value of Output (Constant Cordobas)			
	Mean 1997-2000	Mean 2001-2004	Variation	Significance/1
With Extension				
Total	23,617.70	25,840.90	2,223.20	0.40
Livestock	10,690.40	21,147.60	10,457.20	0.00
Crops	17,203.70	14,713.00	-2,490.70	0.24
Without Extension				
Total	23,946.70	22,879.00	-1,067.70	0.76
Livestock	14,874.40	24,676.90	9,802.50	0.00
Crops	15,626.40	12,042.60	-3,583.80	0.24

Source: Nitlapan, 2005. 1/This is the probability that, according to the t-test, the difference is purely due to chance.

32. *Client satisfaction.* Compared to the targeted satisfaction rate of 60 percent, 90 percent of clients expressed satisfaction with the services provided by INTA and 69 percent said they were satisfied with the services provided by agencies that won competitive fund contracts. Satisfaction was also high (90 percent) for the seed distribution initiative that was added to the original project design. IEG found that, based on the interim impact evaluation report, satisfaction was indeed high among producers that received extension services and adopted new techniques; but only 33 percent of the producers surveyed received extension—and, nationwide, the level of extension coverage varied from 15-20 percent. Clients may be satisfied with the service if they can get it; but most of them don't.

ACHIEVEMENT OF PROJECT OBJECTIVES

33. IEG evaluates the project against the overall objectives of the program (for which the project was intended to be the first phase) and the specific objectives defined for this phase. Overall, the project sought to increase agricultural productivity and family income of 110,000 small and medium-scale farm households. Since this was envisaged as the end product of a four-phase, 16 year program it is difficult to decide how high the bar should be set in evaluating the productivity/income changes

1. Sain, (2005a), Section 3.5.1.

realized by the end of phase 1. The project's specific objectives make no reference to productivity and income gains (although the logical framework did include income and productivity targets). The interim impact evaluation quoted above showed that, comparing the baseline (mean performance in 1997-2000) with mean performance during the project implementation period (2001-2004), there was no statistically significant increase in yields or income. But a judgment based on these findings would be precipitate—the project did not close until June 2005. Maybe things picked up in the final year of implementation. A discussion of this matter will be deferred to the section below on Risk to Development Effectiveness.

34. IEG rates the achievement of the specific objectives of the project as follows:

- (a) “The main public agricultural technology institutions would be providing effective, coordinated sector policy guidance and client-responsive services” (*Rating: Modest*). Overall coordination by MAGFOR was limited. MAGFOR was not fully committed to FUNICA. Shortfalls in counterpart funding undercut any strengthening of the institutional framework.
- (b) “The private sector, non-governmental organizations, and the educational institutions would be participating significantly in providing agricultural services to client farmers” (*Rating: Modest*). Table 3 shows that service provision did indeed involve a range of suppliers, but it is not clear how many of these suppliers were financed through the competitive fund; also, many were operating before the project. Moreover, various sources show that only a few producers actually received services.
- (c) “The public sector would be proactively undertaking strategic and basic research and providing advisory services that generate positive externalities” (*Rating: Modest*). There is no indication that INTA gave priority to strategic research and its extension service provided a mix of public and private goods.
- (d) “A national agricultural technical education training strategy would be defined and a pilot begun” (*Rating: Negligible*). No strategy was defined.
- (e) “A timely, high quality agricultural and market information would be available to technicians and farmers” (*Rating: Negligible*). The information system had negligible impact.

35. Weighing up these five ratings, the project's progress toward its objectives (efficacy) is rated as **modest**.¹

Efficiency

36. At appraisal, the economic rate of return was estimated at 30 percent. The ex-post analysis in the ICR gives a rate of 25 percent, attributing the difference in the two estimates to the lower than expected coverage of INTA's extension services and the higher than anticipated start-up cost for FUNICA. These negative factors were partly offset by the successful implementation of the Libra por Libra seed distribution

1. These achievements do not include the support given by the project to the establishment of the sector wide approach (PRORURAL) because this was not among the original project objectives—and was different from the 16-year programmatic loan originally envisaged.

initiative which (temporarily) increased the use of improved maize, bean, sorghum, rice, and sesame seeds.¹

37. IEG found that, based on a modeling of rates of return to FUNICA and INTA investments that was prepared for the follow-on project, the former was less efficient than the latter. The economic rate of return to PTA 1 investments in FAT and FAITAN was 16 percent, compared to 32 percent for INTA (extension services only). This discrepancy reflects the higher administrative cost of the competitive model compared to the INTA model of directly assigned funds.² Possibly this discrepancy would narrow over time as lessons are learned about how to streamline the administration of the contests. Indeed, the time for processing research grants (FAITAN) fell from 16 months in 2001 to 5 months in 2004.³ However, the attempt to level the playing field by providing project preparation assistance to some of the weaker competitors would probably continue to make the competitive model more costly. The discrepancy is reflected in the unit costs of service delivery. FAT extension cost US\$126 per producer compared to US\$87 per producer for ATPm (INTA's free extension service).

38. But the rate of return data are not convincing. They do not square with the evidence from the interim impact evaluation, which show that neither yields nor incomes grew significantly between the 1997-2000 baseline and the project implementation period. The impact evaluation data are perhaps more persuasive, based as they are on interviews with 1,162 producers—although baseline data were constructed from farmer recall, which may not be reliable. On balance, however, this survey data source is more 'real world' than the modeling which was based on extrapolating from a series of idealized farm models.⁴

39. There is one other reason for casting doubt on the project's efficiency. High rates of return may disguise an inappropriate allocation of resources if public money is used to finance the production of private goods. One of the project's objectives was for public agencies to concentrate on delivering public goods such as strategic research and services with significant externalities. But as the coffee case illustrates (Box 2), INTA has remained active in areas where the private sector had demonstrated a capacity to secure payment for the extension services it offered to producers. INTA's limited resources are spread too thinly, covering private as well as public goods.

1. ICR (2005), p. 16.

2. Bank staff have pointed out that evidence from supervision missions for the follow-on project suggests that although the FAT extension model is more expensive than the INTA model, it may also be more effective. The Borrower notes that the FAT model is still incipient and that higher costs are to be expected at the outset (Appendix B).

3. ICR (2005), p. 12.

4. A further study on the impact of FAT was conducted under the follow-on project (Nitlapan, 2009). IEG reviewed this study reaching the conclusion—subsequently borne out in correspondence with FUNICA—that the results are not comparable with the earlier study because they refer to different regions, a different sample of producers and only cover the period after the first project (2006-2008). IEG finds that the 2009 study does not offer a robust assessment of the impact of FAT because there was no baseline survey and there are doubts about the method used to match beneficiary and control groups.

40. Based on these considerations, efficiency is rated **modest**.

Box 2. Questionable Targeting of Extension Services in Nicaragua's Coffee-Producing Heartland

Background Coffee is Nicaragua's number one export, accounting for 17 percent of total export value in 2004. It accounts for roughly one-fifth of agricultural GDP and employs about 30 percent of the agricultural labor force. Nicaraguan coffee yields are below the Latin American average, averaging 576 kg/ha in 2005-07—about the same as in the 1970s. Yields are positively correlated with farm size. Small farms—those under 8 hectares (10 mz)—have yields of 300 kg/ha compared to 2,160 kg/ha for farms over 40 hectares. Small farms account for 90 percent of all coffee farms, cover 55 percent of the total area in coffee and produce 24 percent of output. The stagnation of yields has been attributed to problems applying particularly to small-scale producers: illiteracy, lack of secure property title, and limited access to credit. A 2006 survey found that in recent cycles coffee plantations had been less carefully managed and the share of the cultivated area under traditional (unimproved) technology had increased, partly owing to the increased difficulty in obtaining credit. In that year, 95 percent of the coffee producers surveyed (managing 57 percent of the planted area) used traditional farming practices (1).

Field Visit The Department of Matagalpa is a major coffee producer. Eleven producer cooperatives supply the marketing enterprise CECOCAFEN, which provides credit and technical assistance to farmers. CECOCAFEN deducts 40 percent of the cost of the technical assistance from the revenue paid to the cooperative. IEG found that for the past twelve months or so INTA has been supplying a mix of co-financed and free extension services in the same cooperatives where CECOCAFEN agents are active, aiming to increase extension outreach to farmers not already covered. The cooperative decides which of its members qualify for the free service and which are well off enough to co-finance. It is still early days for INTA in this area but the farmers who were interviewed could not identify an 'INTA premium' that would lead them to pay for the co-financed service provided by that agency. This begs two questions. First, given INTA's limited resources does it make sense to provide extension services in an area that is already reasonably well covered by a private extension service? Second, is there not a risk that running a free and a co-financed service side by side will simply encourage free riding by producers who have the means to pay for extension? It appears that INTA presence in this region is motivated by the strategic importance of coffee as the nation's primary export. But it runs counter to the logic of getting public agencies to focus on serving poorer producers while promoting privately-provide extension services for producers able to afford these (2)

(1) Montserrat (2008), p. 29. (The survey was conducted by MAGFOR and the central bank).

(2) The Bank Region's response pointed out that under the terms of the follow-on project referred to here INTA will engage in both public extension (free) and private extension (paid by the user), but will increasingly withdraw from the public scheme: what IEG observed in Matagalpa is not inconsistent with these terms. The Region notes however that, in the current government, INTA management provides more attention to public action than to supporting private initiative.

Project Development Outcome

41. Adding up the component criteria assessed above IEG rates outcome **unsatisfactory** (Table 8). The downgrade from the ICR rating is based primarily on the compromised nature of support for the competitive funds and the lack of agreement between various reference sources that were available when the ICR was written yet whose findings were not fully reflected in that document. These findings suggest that the project had less of an effect on institutional strengthening than was expected and the impact on productivity and the returns to investment were lower than expected.

Table 8. Derivation of the Project Development Outcome Rating

Relevance	Efficacy	Efficiency	Project Development Outcome
Objectives: Modest Design: Modest	Objective (a): Modest Objective (b): Modest Objective (c): Modest Objective (d): Negligible Objective (e): Negligible		
Rating: Modest	Rating: Modest	Rating: Modest	Rating: Unsatisfactory

Risk to Development Outcome

42. The primary risk derives from the collapse of the original plan to finance a 16-year year program for strengthening research and extension. The follow-on project (PTA 2) is not Phase II of the original four-phase APL but a stand-alone project that falls under the umbrella of a multi-donor sector-wide operation (PRORURAL). The Bank's engagement with the competitive fund model is more limited under PTA 2 than it was under PTA 1: it provides no resources for the research (FAITAN) or the extension (FAT) competitive funds.¹

43. Although the government signed off on the original design of PTA 1—which included competitive funds—strong animosity developed between FUNICA, the body responsible for managing the funds, and the Ministry of Agriculture. To make matters worse, competitive fund procedures were burdensome and FUNICA management was overstretched. The Bank's decision not to commit more resources to FAITAN in PTA 2 meant that some of the subprojects begun under PTA 1 were not completed.

44. Prospects for a more sustainable research and extension effort led by INTA are also in doubt, unless donors continue to finance recurrent costs. One of the purposes of PTA 2 is to support payment of MAGFOR and INTA salaries on a declining basis, with the government expected to assume responsibility for 100 percent of the MAGFOR and INTA payroll by December 2009. As of September 2008 (shortly before the IEG mission) the government was covering just 25 percent of this cost. But according to the Ministry of Agriculture, by year's end, the government contribution was 50 percent, consistent with the 2008 target.²

45. The recommendation of the PTA 2 mid-term review mission³ was that the Bank should remain committed to PRORURAL: while maintaining the project mode of operation the Bank will seek closer integration with PRORURAL and, to the extent possible, increase the technical support it provides. IFAD is committed to FAT through 2012; but there are still concerns about the sustainability of support to the

1. The Borrower states that, although the Bank has withdrawn, IFAD and DANIDA are supporting FAITAN and FAT (Appendix B).

2. Information relayed in the Bank Region's management response.

3. Misión de Medio Termino (2008).

public sector apparatus for research and extension, strongly borne out by discussions with government and donors during the mission. Based on these considerations IEG rates the risk to development outcome as **significant**.

Monitoring & Evaluation

DESIGN

46. According to a Development Letter addressed to the Bank by the Ministry of Agriculture, monitoring and evaluation was the responsibility of the Ministry's General Directorate of Agricultural Technology. M&E was intended to "generate, systematize and interpret information produced by the Project's relevant stakeholders using the Agricultural Information System".¹ The aim was to fund this under the Institutional Strengthening component, with M&E operations handled through the Project Implementation Unit. Verification of the output and outcome targets specified in Table 2 above hinged on the smooth operation of the envisaged M&E system.

IMPLEMENTATION AND USE

47. The Project Implementation Unit, which had been placed in charge of M&E, was replaced during implementation by a Coordinating Committee composed of representatives from the Ministry of Agriculture and other stakeholders. Consequently, the project-specific monitoring system that had been envisaged was not established and M&E was handled piecemeal. The project did support the separate monitoring systems of INTA and FUNICA (each agency reported on the performance indicators that were relevant to it). Also, there was a significant investment in a baseline survey and a follow-up survey, conducted by the Universidad Centroamericano (Nitlapan) in 2001 and 2004. These surveys formed the basis of an interim report on project impact prepared in 2005. Although parts of this report are referred to in the ICR, the available evidence was not examined as thoroughly as it might have been—this report has sought to make more systematic use of it. Under the follow-on project, implementation of the planned monitoring and evaluation system remains incomplete and, despite Bank insistence, data on performance indicators are not yet being systematically collected by INTA.²

48. IEG rates monitoring and evaluation as **modest**.

Bank Performance

QUALITY AT ENTRY (RATING: MODERATELY UNSATISFACTORY)

49. On the one hand, the attempt to secure long-term government commitment through use of an Adaptable Program Loan made sense. On the other hand, the objectives were too ambitious. Having built up INTA it was not feasible for the Bank to suddenly change tack and advocate a competitive fund model (FUNICA) that had

1. Letter of Development Program from the Government of Nicaragua, Annex 11, PAD (2000), pp. 83-85.

2. ISR, 15 September 2008.

proved to be a stretch to implement in better off countries in South America. The attempt to simultaneously build up separate systems of agricultural education and agricultural information was another sign of over reach.

SUPERVISION QUALITY (RATING: UNSATISFACTORY)

50. Having set up FUNICA the Bank did not provide it with the support it needed, with the result that the foundation had problems in implementing the competitive fund model and lacked a clear strategic vision. The Bank also stood by while the government diverted project funds to the subsidized input supply program (Libra por Libra), which was not in line with project objectives. The ICR concedes that the Bank should have amended the Credit Agreement once the government began to advocate for Libra por Libra.¹ The ICR also notes that the Bank did not exert enough pressure for the establishment of a project M&E system in the Ministry of Agriculture.

51. On a more positive note, the Bank project team was innovative in proposing new approaches when project implementation lagged. It introduced a Rapid Result Initiative that helped step up progress and improve cooperation among participating institutions. This pilot approach was written up as a case study and subsequently applied to other Bank projects in the Africa region.²

52. However, towards the end of the first-phase project the Bank lost the confidence of the other members of a multi-donor consortium compromising the prospects for effective follow up. A critical factor was the change in the Bank country management team that took place during project implementation, leading to a major scale back in support to agriculture. Arguably, the management team could have negotiated this transition better with government and with the other donors. The project team was left in an exposed position and the net effect was a loss of credibility.³

53. Overall, IEG rates Bank Performance **unsatisfactory**.

Borrower Performance

GOVERNMENT (RATING: UNSATISFACTORY)

54. Government supported the project concept originally but, partly owing to the rotation of top officials at the Ministry of Agriculture and INTA, there was a sharp fall off in commitment during implementation. One well-placed commentator observed that from the start FUNICA faced an uphill battle, with two Ministers of

1. ICR (2005), p. 24.

2. Harvard Business Review (2003).

3. The Borrower comments that the abandonment by the Bank of the APL approach was the main reason for the project's unsatisfactory outcome (Appendix B). In IEG's view, equally important reasons for the outcome shortfall were the overambitious project design and—as acknowledged in the Borrower's comment in Appendix B—the government's limited support for the development objectives of the project.

Agriculture attempting to abolish it between 2002 and 2007.¹ MAGFOR's decision to use project funds for *Libra por Libra* took resources away from institutional strengthening and the competitive funds and compromised long-term sustainability.

IMPLEMENTING AGENCY (RATING: UNSATISFACTORY)

55. There was a loss of continuity following replacement of the Project Implementing Unit (which had a capable staff) by a more cumbersome Coordinating Committee which unsuccessfully sought to bring together representatives of MAGFOR and other institutions involved in the project. This resulted in a substantial drop in the quality of project oversight.

56. Overall, IEG rates Borrower Performance **unsatisfactory**.

1. Pallaix (2007), p. 32.

Appendix A. Basic Data Sheet

AGRICULTURAL TECHNOLOGY AND RURAL EDUCATION PROJECT (CREDIT NO. 3371)

Key Project Data *(amounts in US\$ million)*

	<i>Appraisal estimate</i>	<i>Actual or current estimate</i>	<i>Actual as % of appraisal estimate</i>
IDA Loan	23.60	24.04	102
Cofinancing	9.04	10.29	114
Government	5.60	6.81	122
Total project cost	38.24	41.14	108

Cumulative Estimated and Actual Disbursements *(US\$ million)*

	FY01	FY02	FY03	FY04	FY05
Appraisal estimate	2.9	9.3	15.6	20.9	23.6
Actual	2.3	8.3	13.6	20.6	24.0
Actual as % of estimate	79	89	87	99	102

Project Dates

	<i>Original</i>	<i>Actual</i>
Departure of Appraisal Mission		07/07/1999
Appraisal		02/03/2000
Board approval		06/06/2000
Effectiveness		12/21/2000
Mid-Term Review		07/14/2000
Closing date	09/30/2004	06/30/2005

Staff Inputs *(staff weeks)*

	<i>Actual/Latest Estimate</i>	
	<i>N° Staff weeks</i>	<i>US\$US\$('000)</i>
Identification/Preparation	-	1.2
Appraisal/Negotiation	62.56	219.1
Supervision	127.09	662.4
Completion	15.00	46.7
Total	207.35	931.4

Mission Data

	Date (month/year)	No. of persons	Specializations represented	Performance rating	
				Implementation status	Development objectives
Identification Preparation	02/10/1999	5	Task Team Leader, Senior Agricultural Economist, Rural Financial Specialist, Rural Education Specialist, Operations Analyst		
	02/23/1999	1	Biodiversity Specialist		
	08/30/1999	13	Task Team Leader, Senior Agricultural Economist, Project Specialist, Operations Analyst, Education Specialist, Senior Natural Resource Specialist, Agricultural Economist, FAO/CP (3), Financial Management Specialist, FAO/SDRE, Consultant/COSUDE		
Appraisal/ Negotiation	02/14/2000	10	Senior Agricultural Economist, Senior Natural Resource Specialist, Education Specialist, Senior Institutional Development Specialist, Legal Counsel, Project Management Specialist, Operations Analyst, Consultants (3)		
Supervision 1	03/05/2001	7	Task Team Leader, Operations Analyst, Financial Management Specialist, Procurement Specialist, Project Management, Consultant, Team Assistant	S	S
Supervision 2	03/05/2001	3	Senior Agriculturalist, Operations Analyst, Project Management Specialist	S	S
Supervision 3	03/22/2002	6	Senior Agriculturalist, Technical Specialist, Operations Analyst, Consultant (3)	S	S
Supervision 4	09/30/2002	4	Task Team Leader, Communications Associate, Consultants (2)	S	S
Supervision 5	07/25/2003	11	Senior Agricultural Economist, Forestry Specialist, Extension SP- SCD (2), Communications Specialist – IFAD, Finland, Gender Environmental Specialist, Monitoring, RUTA (2)	S	S
Supervision 6	07/25/2003	11	Task Team Leader, Senior Agricultural Economist, Senior Social and Natural Resource Management Specialist, Environmental Specialist, Operations Officer, Consultant (2), Communications Consultant, Consultant/COSUDE, Procurement Specialist, Financial Management Specialist	S	S

ICR

Performance Rating: S: Satisfactory

Other Project Data

Borrower/Executing Agency:

FOLLOW-ON OPERATIONS

<i>Operation</i>	<i>Credit Number</i>	<i>Amount (US\$ million)</i>	<i>Board date</i>
Second Agricultural Technology	C4127	12.0	29 November 2005

Appendix B. Borrower Comments

From **JULIO C. CASTILLO VARGAS**, Director General de Políticas, **Ministerio Agropecuario y Forestal**

De acuerdo a la nota de la señora Monika Huppi, de fecha 8.06.09, enviado al compañero Ministro Bucardo, tengo a bien compartir con usted, algunos comentarios sobre el **“DRAFT PROJECT PERFORMANCE ASSESSMENT REPORT” (PTA I CREDIT NO. 3371)**, desde la perspectiva del MAGFOR y de FUNICA, respectivamente.

Comentarios Generales:

1. El cambio del Banco de un enfoque programático, a un proyecto que solo financia costos recurrentes a una entidad pública (INTA) es el principal elemento que marca cualquier evaluación que se pretenda realizar en estas experiencias. Esto, y no necesariamente unas metas muy ambiciosas, que pudieron ser ajustados oportunamente, fueron la principal razón que puede explicar cualquier fracaso en la ejecución. Se ignora el hecho de que este era un programa “ajustable”, precisamente para aprender de las experiencias e irlo adaptando a las prácticas y situaciones que se iban encontrando. La falta de continuidad de esta visión, es la principal explicación.
2. El PTA en su diseño, fue de alguna manera un precedente para pasar a un programa macro-sectorial como es PRORURAL y este cambio de paradigma, no ha sido menor en la actual política pública. Pero, en lugar de continuar en esta línea, se abandona sin mediar mayores explicaciones (incluyendo la inclusión del programa Libra por Libra), deja de lado los acuerdos, quedando al FIDA, uno de sus dos principales socios (el otro es COSUDE), en una situación compleja. Muchos de los temas incluidos y que estaban supuestos a ser brindados en el marco del PTA, dejan de operar sin haber completado su desarrollo y el FAT de repente, se ve totalmente aislado de su marco de nacimiento, el cual debe replantearse su esquema.
3. El FIDA se había comprometido a impulsar uno de los componentes: el FAT, quedando en esta situación, como un proyecto aislado que debe buscar como complementar los apoyos que se suponía daría el PTA en su versión programática. Es así, que el FIDA debe replantear la estrategia y redefinir los alcances del FAT para enfocarlo como un proyecto que CREA capacidades, para preparar condiciones para el desarrollo de los mercados de servicios y contribuir a desarrollar instrumentos que permita el desarrollo de un nuevo sector empresarial más inclusivo.
4. Estamos de acuerdo en lo general con las responsabilidades no asumidas por el Banco, y por la falta de compromiso de los sucesivos gobiernos, que inclusive intentaron el cierre de FUNICA. El Banco, ni en el inicio del PTA I y menos en el PTA II, tuvo un papel beligerante en el fortalecimiento de capacidades a FUNICA, al contrario, obvió su papel para que asumiera el rol para el cual había sido creada. El FIDA también tuvo que asumir esta responsabilidad de acompañar, financiar y proteger el desarrollo de FUNICA, acuerdos que le correspondían al Banco desde que el PTA fue creado y, que después abandonó.
5. Se indica (para justificar la evaluación de Riesgo en el objetivo de desarrollo como alto) que el fondo competitivo para proyectos de investigación no tuvieron más financiamiento. Esto no es cierto, dado que tanto el FIDA como DANIDA, continuaron financiándolos.

Comentarios particulares sobre los Fondos Competitivos y el FAT (FUNICA):

- 1- El cambio de instrumentos en los fondos competitivos ha permitido evolucionar de un modelo que solo brinda servicios de asistencia técnica a la producción, a uno más amplio, donde median las relaciones entre oferente y demandante, y con una visión integral de la cadena y de negocio, definido desde la demanda. Esto ha permitido promover una nueva “clase” empresarial, con pequeños productores anteriormente marginados, que hoy están integrados en cadenas o en mercados. Este cambio no es menor y no parece haber sido muy analizado en la evaluación.

2- De hecho, los resultados alcanzados en el FAT y el perfeccionamiento de sus instrumentos y metodologías, se convierten en la orientación para ampliar el área del FAT hacia Las Segovias (norte del país) con financiamiento de DANIDA y que otras iniciativas utilicen la misma metodología, introduciendo todo un nuevo concepto en la prestación de servicios. Igualmente, la experiencia del FAT ha orientado el diseño de PRODESEC y de PROCAVAL, y de otros proyectos financiados por el FIDA en la región, que están alcanzando resultados importantes en el uso de instrumentos competitivos, para un segmento de productores más pobres, que también buscan la excelencia en la prestación de servicios.

3- Si bien el “modelo” de fondos competitivos en América Latina no ha sido exitoso o viable, debido a las capacidades existentes, en oferentes como en demandantes, no solo en innovación tecnológica y sector agropecuario, sino en general; pero, en el caso del FAT, el modelo contrasta por los logros en el desarrollo de capacidades en la región. En el caso específico de Nicaragua y del PTA I, **es ligero valorar el modelo cuando el mismo no fue posible probarlo, dado los cambios introducidos en el segundo año de ejecución a los objetivos del programa** y con ello, la reorientación del presupuesto de los Fondos Competitivos, para el tema de Investigación.

4- Los aprendizajes obtenidos en el PTA I permitieron a FUNICA adaptar el modelo de Fondos Competitivos a la realidad del país, dando un paso atrás para desarrollar procesos de fortalecimiento de capacidades y asegurarlos y luego entrar a desarrollar un modelo de alianzas en el marco de la investigación con resultados sostenibles y apropiables en el sistema de extensión, que han sido financiados por otras agencias como DANIDA.

5- Se indica que el IEG Rates Bank Performance como insatisfactorio, tomando como referencia el hecho de que se apoyaron en paralelo dos iniciativas de prestación de servicios. Se ignora que la introducción de la asistencia privada en el marco del Programa, jamás fue visto como un modelo en competencia con el modelo público que se venía desarrollando, sino más bien como modelos amplios de prestación de servicios, a través de los cuales, se podían complementar competencias y determinar roles claros en el marco de la entrega de servicios públicos y servicios privados, en determinados rubros y en poblaciones identificadas para la provisión de bienes, por parte de ambos sectores.

6- En el caso del tipo y costos de servicios, los servicios públicos se orientan más a la producción primaria, mientras que los servicios privados se enfocan a atender todos los procesos de la cadena en su conjunto y, en ese sentido, los eslabones especializados requieren de servicios especializados, generalmente vinculados a garantizar la calidad y provisión de producto, colocación en mercados e inserción en cadenas de valor. Los costos para asegurar estos procesos son más altos que los costos del eslabón primario.

7- Igualmente, en el caso de los costos de los modelos, no se debe obviar la valoración de que en Nicaragua, el modelo de prestación de servicios privados es bastante incipiente y requiere de aprendizajes, que también elevan relativamente los costos en algunos casos.

A la espera que los presentes comentarios le sean de utilidad, le saludo,

Atentamente,

JULIO C. CASTILLO VARGAS

Director General de Políticas

Ministerio Agropecuario y Forestal

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Annex 5: Peru

Agricultural Research and Extension

Summary

This report assesses the performance of the Peru Agricultural Research and Extension Project (INCAGRO). The project was supported by an IBRD loan (No. 4519-PE) of US\$9.6 million, which was approved on November 23, 1999. The loan closed on January 31, 2005, nineteen months behind schedule.

The project was envisaged as the first of a three-phase Adaptable Program Loan, intended, first, to establish and then to consolidate a private sector-led and decentralized agricultural technology innovation system. The system would permit farmers and farmer organizations to collaborate with research institutions in carrying out adaptive research work and to access technical advisory services for a range of needs from production to management and marketing. This would lead to increased farmer adoption of environmentally sound technology. The specific objectives of the project were: (a) to improve management of public investment in agricultural technology; (b) to involve producers in planning and financing adaptive research and extension services; and (c) to develop plans for increasing capacity for strategic research and extension support services.

The project comprised: (a) *Program and Policy Coordination* (planned cost, US\$3.3 million; actual cost, US\$4.7 million), which financed a project implementation unit to manage the development of the technology system, coordinate public sector support for agricultural research and extension, and facilitate institutional reforms; (b) an *Agricultural Technology Fund* (planned cost, US\$7.2 million; actual cost, US\$5.2 million), which provided grant support to competitively selected subprojects focusing on adaptive research and extension, involving diverse service providers; and (c) *Institutional Strengthening* (planned cost, US\$3.2 million; actual cost, US\$3.6 million), which financed selected programs of applied and strategic research, extension training, information systems and competitively-funded strategic services subprojects.

IEG rates **Outcome** as moderately satisfactory. The objectives and the design of the project were substantially relevant, both in terms of the need to strengthen Peru's agricultural research and extension institutions, and the consistency with good practice thinking in the Bank. Progress towards the project's stated objectives was less than expected, based on the shortfall in the number of adaptive research and extension subprojects, weaknesses in strategic research services and the lack of productive dialogue and cooperation between the project, the public research and extension agency (INIA) and the Ministry of Agriculture—this last factor thwarting the objective of improving management of public investment in agricultural technology. However, the project's actual achievements were significant in relation to the small size of the project; and a recent impact study suggests that INCAGRO subprojects have had a favorable impact on technology adoption rates and farm incomes. Thus, the project made an efficient use of its limited resources.

The **Risk to Development Outcome** is rated moderate. Although there are some concerns about the dissemination of subproject results, the impact study suggests that in aggregate the funded subprojects produced a significant economic rate of return that is robust to sensitivity analysis. Moreover, since the IEG mission was concluded, the government has strengthened its commitment to the competitive fund model and the terms of the integration between INIA and INCAGRO have become clearer.

IEG rates **Bank Performance** as moderately satisfactory. Based on the design's alignment with good practice thinking at the time and the pragmatic adjustment to a difficult operating environment, quality at entry was generally sound. However, during project supervision the Bank had insufficient dialogue with INIA and the Ministry of Agriculture, contributing to a certain isolation of INCAGRO.

Overall, **Borrower Performance** is rated moderately satisfactory. On the one hand, there was an erosion of government commitment over the life of the project (which since appears to have been reversed) and a failure to grasp the nettle of institutional reform. But this was more than offset by the great dedication and solid performance of management and staff in the implementing agency; they did the best that could be expected, given the unpromising operating environment and the resource limitations.

The **Lessons** learned from this project are discussed in the main report which draws on IEG's findings about the performance of competitive grant schemes for agricultural research and extension in four Latin American countries (Brazil, Colombia, Peru and Nicaragua). Taking the four countries as a whole, with the exception of Peru, there is a lack of hard evidence about the ultimate impact of the investments made—the extent to which farmers adopted new technologies developed through research and extension subprojects, and the related change in productivity and incomes.

The assessment also concludes that the principle of competition between alternative service providers breaks down where the range of providers is limited (a problem at the municipal level and for small countries) and many of the potential providers lack the skills needed to prepare viable sub-project proposals. The model is more likely to strengthen the strongest players in the field than it is to reduce the disparities between the strong and the weak. Summing up, the competitive fund approach is a useful adjunct to the broader public sector apparatus for agricultural research and technology transfer; it is not a substitute.

Principal Ratings

AGRICULTURAL RESEARCH AND EXTENSION PROJECT

	<i>ICR*</i>	<i>ICR Review*</i>	<i>PPAR</i>
Outcome	Satisfactory	Moderately Satisfactory	Moderately Satisfactory
Institutional Development Impact**	Modest	Modest	n.a.
Risk to Development Outcome	n.a.	n.a.	Moderate
Sustainability***	Highly Likely	Likely	n.a.
Bank Performance	Satisfactory	Satisfactory	Moderately Satisfactory
Borrower Performance	Satisfactory	Satisfactory	Moderately Satisfactory

* The Implementation Completion Report (ICR) is a self-evaluation by the responsible Bank department. The ICR Review is an intermediate IEGWB product that seeks to independently verify the findings of the ICR.

**As of July 1, 2006, Institutional Development Impact is assessed as part of the Outcome rating.

***As of July 1, 2006, Sustainability has been replaced by Risk to Development Outcome. As the scales are different, the ratings are not directly comparable. f5/7p

Key Staff Responsible

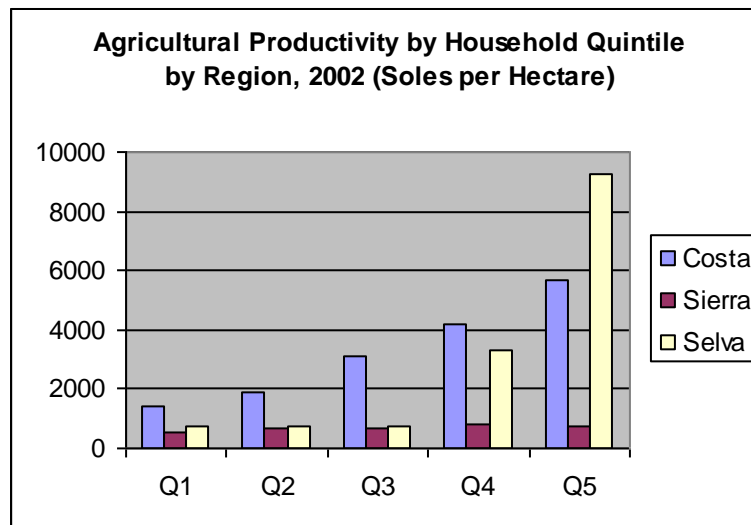
<i>Project</i>	<i>Task Manager/Leader</i>	<i>Division Chief/ Sector Director</i>	<i>Country Director</i>
Appraisal	Matthew A. McMahon	Mark E. Cackler	Isabel M. Guerrero
Completion	Matthew A. McMahon	Mark E. Cackler	Marcelo M. Giugale

Background

1. Following the accession of the Fujimori government in 1990, the opening up of the Peruvian economy to free market forces changed the environment for agriculture drastically, from a regime of indirect taxation, as a result of high industrial protection and exchange rate misalignment, to one that favored agriculture. As a result, during 1991-2000 agricultural GDP grew at 6.6 percent per annum, considerably faster than overall GDP¹. But rural poverty declined less than proportionately, partly because agricultural growth was largely confined to commercial farm enterprises on the coast (Costa); peasant farming in the interior—comprising the Andes (Sierra) and the Amazon hinterland (Selva)—languished by comparison, owing to the difficult terrain, lack of good roads and remoteness of markets.

2. In Peru, 36 percent of the population lives more than 4 hours away from a city of 100,000 people or more, compared to 18 percent in Colombia (another Andean country), 17 percent in Nicaragua and only 13 percent in Brazil.² Poverty rates in the Sierra and Selva are nearly double those of the Costa.³ Among households in the bottom 60 percent of the income distribution the disparity between the dynamic coastal strip and the other two regions shows up clearly in agricultural productivity (Figure 1).⁴ This “value of production per unit area” measure also illustrates the great diversity of farming systems in the Costa and Selva.

Figure 1. Agricultural Productivity by Household Stratum and by Region, 2002.



Source: National Household Survey, 2002

1. World Bank (2002), pp. 19-20.

2. World Bank (2005c), p. 53.

3. World Bank (2006a), p. 2.

4. World Bank (2005b), p. 109. (The data are based on the 2002 national household survey.)

3. Public spending on agricultural research and extension was equivalent to 0.5 percent of agricultural GDP in 2003. To put this in perspective, in Latin American countries, spending on agricultural research averaged 0.9 percent of sector GDP in 1995¹. In Brazil and Colombia in 1996 (the latest date for which comparable, cross-country data are available), spending on agricultural research was, respectively, 1.7 percent and 0.5 percent of agricultural GDP.²

4. This assessment focuses on the first-phase project (INCAGRO) of an innovative program of agricultural research and extension that was launched in 2000. To a lesser extent it considers progress under the follow-on project (INCAGRO 2) which was approved in 2005 and is still underway. IEG's approach to the evaluation is summarized in Box 1.

Box 1. IEG Approach

During the November 2008 mission to Peru, IEG interviewed the principal agencies involved in the project (INCAGRO, INIA, and Ministry of Agriculture). Field trips were staged to the three natural regions of Peru—Junín (*Sierra*), Tarapoto (*Selva*), and Piura and other coastal regions (*Costa*)—the 143 subprojects completed between 2001 and 2005 being evenly distributed between these regions. IEG interviewed farmers and service providers as well as staff of the regional implementing agencies in each location. A preliminary list of sites to visit was proposed by IEG and INCAGRO arranged visits to a subset of the projects on that list, selection based on time and logistical considerations. In addition to these site visits, IEG drew a stratified random sample of 54 completed subprojects (approved between 2001 and 2006) and requested INCAGRO to provide the completion reports. INCAGRO supplied 18 of the 54 reports requested and analysis of these is included in this assessment. IEG also drew heavily on the economic analysis in studies prepared by the Instituto de Estudios Peruanos (Barrantes et al, 2004) and by the Grupo de Analisis para el Desarrollo (Escobal, 2003 and 2005); as well as the 2009 independent impact evaluation. In addition, IEG polled groups familiar with the project (INCAGRO staff, INIA staff, and service providers, such as NGOs and universities) to determine how positively they rated the various aspects of the competitive fund model. The poll items were the same for each of the four Latin American countries included in this IEG assessment and the results are presented in the overview report, which compares findings across the four countries and derives lessons.

Objectives and Components

5. The project was envisaged as the first of a three-phase Adaptable Program Loan (APL). According to the Project Appraisal Document:

“The Project Development Objective is to establish a private sector-led and decentralized agricultural technology innovation system. The system would permit farmers and farmer organizations to collaborate with research institutions in carrying out adaptive research work and to access technical advisory services for a range of needs from production to management and marketing. This would lead to increased farmer adoption of environmentally sound technology. The Government would provide co-financing, and policy guidance for the system. Research institutions would develop strategic plans to increase their capacity to meet the

1. PAD (2005), p. 79.

2. IFPRI/Agricultural Science and Technology Indicators database.

long-term technology needs of the sector. Information and training institutions would develop plans for rural information services and extension training programs to complement decentralized, demand-driven extension services".¹

6. The specific objectives of the project were (a) improve management of public investment in agricultural technology; (b) involve producers in planning and financing adaptive research and extension services; and (c) develop plans for increasing capacity for strategic research and extension support services".² Priorities for strategic research included: genetic resources conservation and utilization, biotechnology, post-harvest handling and processing, water resources management, forest management, land and soil management, and integrated pest management.

7. Table 1 shows the project components.

Table 1. Expected and Actual Cost of Components

Component	(A) Expected cost (US\$ millions)	(B) Actual Cost (US\$ millions)	(B)/(A)
(a) Program and Policy Coordination	3.3	4.7	145%
(b) Agricultural Technology Fund	7.2	5.2	72%
(c) Institutional Strengthening	3.2	3.6	113%
Total project cost	13.8	13.6	99%

Source: ICR (2005)

PROJECT INSTITUTIONAL FRAMEWORK

8. The project (INCAGRO) established two competitive funds for agricultural research and extension. These would operate in parallel to the long-established and underfunded public research and extension agency (INIA, founded 1978). The project included a subcomponent to develop a strategy for INIA but it did not finance the agency's overhead or research and extension budget. However, along with other service providers, INIA was permitted to bid for the competitive funds. The Agricultural Technology Fund (FTA) was funded from component 2 and was earmarked for adaptive research and extension. The Strategic Program Development Fund (FDSE), funded from component 3, covered applied and strategic research, extension agent training, and information services. For both funds, grants were made in response to proposals submitted by applicants under competitive procedures. The applicants included NGOs, government research institutes, universities, agribusiness firms, consulting firms, and individuals. All projects required co-financing from grant recipients. Although formally the Ministry of Agriculture was the project implementing agency, an independent Project Implementation Unit was established, with a Board of Directors appointed by the Ministry. The Project Implementation Unit administered both competitive funds. In the case of FTA, subprojects were submitted and selected at the regional level. To support these contests, three regional offices were established and each region had an Agricultural Technology Forum, comprised of participants from farmer organizations,

1. PAD (1999), p. 4.

2. PAD (1999), p. 4.

indigenous groups, agribusiness, financial institutions, NGOs, and research and extension service providers. FDSE subprojects involved nationwide rather than regional contests.

Relevance

9. Relevance assesses the appropriateness of project development objectives in relation to country priorities and Bank strategy; and the suitability of project design for achieving project objectives. In line with IEG methodology, in this report relevance is assessed in terms of information and assumptions available at the time of loan closing rather than when the project was prepared (on the assumption that, during implementation, project objectives and design should be adjusted if they cease to be relevant). But to help understand the project concept as originally framed, this section begins with a short review of the context in the late 1990s, the period before preparation (which began formally with the issue of the project concept document in January 1999).

THE CONTEXT FOR PROJECT PREPARATION

10. After the Fujimori government came to power in 1990, policy in Peru was marked by a skeptical view of state intervention in the economy, a position that was broadly endorsed by the Bank. This was particularly so with respect to the agriculture sector. For most of the 1990s the Bank had no agriculture lending commitments. This changed with the 1997 Country Assistance Strategy, which included an FY2000 agricultural research and extension project in the lending program. Increasing agricultural productivity was included among the CAS development objectives; the strategy was “to strengthen research systems, both public and private...and to increase farmer participation in managing extension”; and the progress benchmark for the Bank program was to “reach consensus on private and public sector roles and appropriate policy/institutional framework for agricultural technology development and transfer”¹.

11. The announced shift in favor of private sector initiative was entirely plausible. Government agencies had a poor record in dealing with agriculture. The agriculture staff was persuaded that, based on past performance, the Ministry of Agriculture was a weak interlocutor with low credibility in the eyes of the lead agency, the Ministry of Economy and Finance. The previous research and extension project (approved in 1982; prematurely terminated in 1988) had foundered partly because the implementing agency, INIPA [a dependency of the Ministry of Agriculture from which today’s INIA is descended] was plagued by “repeated changes in leadership and management style...and irrational personnel and remuneration policies which affected morale and efficiency at every level of the institution”.² This project had sought to build up INIPA through an integrated program of research and extension. Although the aim was to be demand-driven, the completion report found that “researchers tended to pursue avenues of enquiry largely divorced from regional and farm realities” and “extensionists were unable to grasp the methodology for independently selecting good contact farmers, resulting in limited program coverage and effectiveness”.³ Against this background it is understandable that

1. World Bank (1997a), Annex A8, p. 3.

2. World Bank (1992a), p. iv.

3. World Bank (1992a), p. v.

the staff who prepared the FY2000 project tended to regard the Ministry of Agriculture as more part of the problem than part of the solution.

12. In Peru, the market-oriented shift in thinking on agricultural technology transfer was clearly apparent by 1992. A sector report issued that year observed that “the government has turned its attention toward alternative methods of providing research and extension services to the agricultural sector. A strong push towards extensive privatization of agricultural research and extension has emerged. One proposal envisages that INIAA [successor to INIPA; predecessor of today’s INIA] could be transformed into a much smaller and strictly administrative and managerial entity. Under this proposal, INIAA's role as a research center would be eliminated. The existing public experiment stations would be transferred to the regional governments, sold to the highest bidder, or transformed into non-profit foundations receiving some budgetary subsidies from the Government. Research would be contracted out to private sector firms or foundations. INIAA would be charged with deciding what research should be publicly supported in this way and would manage and monitor the process”¹.

Box 2. Public and Private Sector Roles in Research and Extension: From A Peru Sector Report

“Since most R&E activities are designed to increase yields which ought to increase a farmer's profitability, a good question to ask is why the government should be involved at all in the subsidization of R&E. Why shouldn't farmers be expected to carry out the optimal level of research and extension if left to the free market? There are several reasons why this may not happen. First, some kinds of basic research and certain kinds of extension cannot be successfully marketed by the innovators because, once they have been discovered, others cannot be prevented from being able to adopt or copy them at little or no cost. Second, whereas farmers as a whole may gain from the increase in yields, an individual farmer with limited production potential may not find it worthwhile to carry out research activities. This calls for organizing farmers in associations which should fund the research that is of use to them. While this may be possible in many instances, in some cases it may not be feasible for a large number of small farmers to organize themselves for this purpose. Third, the increase in yields may not result in increased farm profits; if the consumer demand for the product is not totally elastic, the increased output would lower prices, transferring the gains from higher yields to consumers. These factors above call for a *public subsidy* for most basic research and for applied R&E on crops such as potatoes, which face a fairly inelastic demand curve and whose farmers tend to be small and dispersed, but call for *private* funding for applied R&E activities for traded crops such as rice and wheat where the demand curve is extremely elastic and where farmers can organize themselves relatively easily. Although it is possible to come up with a number of other factors (information costs, credit market imperfections etc) which would lead to a sub-optimal allocation of R&E if left to the free market alone, it is necessary to mention one other important area of particular concern in the Peruvian situation. This deals with research aimed at reducing environmental degradation. Given the problems in Peru with soil erosion, salinity, toxic chemical runoffs into streams, R&E activities addressing these problems will need to be subsidized”.

Source: World Bank (1992b), p. 58

13. The same source contained a detailed explication of the rationale for assigning public and private responsibilities for research and extension. This is worth reproducing in full (Box 2) because reasoning along these lines formed the analytic underpinning of the FY2000 project that is the focus of this assessment. In August 1995, the new thinking—as it was now being applied to projects throughout Latin America—was showcased at a joint

1. World Bank (1992b), p. 40.

World Bank and Inter-American Development Bank workshop in Buenos Aires. The workshop proceedings concluded that “in efforts to promote greater institutional diversity and efficiency in the National Agricultural Research Systems, its several components will have to acquire a greater share of their funding through competitive bidding schemes. National competitive funds for the development and transfer of agricultural technology are increasing rapidly in the region and, to date, they have proven to be effective and efficient mechanisms for funding research by contributing to improved research quality and by providing greater accountability to the funding source”.¹

14. Outside the region, thinking in the Bank’s agricultural strategy anchor (the Rural Development Department) was moving along similar lines.² Interestingly, the recommendations from the contemporaneous Operations Evaluation Department study, based on its assessment of Bank support to research and extension worldwide, analyzed the problems with public service provision without explicitly invoking the need for a radical realignment of public and private sector roles; and made no specific reference to competitive funds.³ In this respect, the objectives of the FY2000 Peru project (and of similar projects elsewhere in Latin America) were ahead of the Bank mainstream and in line with the more radical thinking of the time.

15. An important clarification needs making. While the project’s objective was to help establish a “private-sector led technology innovation system”, it would be too narrow an interpretation to represent this as primarily about increasing the role of private (for profit) firms as suppliers of research and extension services. The aim was equally to help farmer organizations and farmers to build up the skills (e.g., preparation of business plans) needed for a more profitable, market-oriented agriculture, thus furthering private sector development in a broader sense.

THE POSITION AT PROJECT COMPLETION

16. Were the objectives and design of the FY2000 project in line with country and Bank strategy in 2005 when the project closed? This is the criterion on which IEG’s relevance rating is based. With respect to Peru’s development priorities, there was a sound case for supporting research and extension. For the nation as a whole the data show that programs of research and extension have a positive impact on agricultural productivity. “Plots cultivated by farmers with access to technical assistance are 15 percent more productive than other plots”.⁴ In particular, there was an urgent need to raise productivity in the Sierra and the Costa regions and the project design included sufficient elements—decentralized offices, cross-regional resource balancing—to ensure that these regions would not be neglected. The relevance of project development objectives to Bank-wide agricultural strategy is equally clear: the best expression of this is the inclusion of specific modules on public/private sector roles and competitive funds

1. World Bank (1996), p. xii.

2. World Bank (1992c); World Bank (1992d); World Bank (1998a); World Bank (1998b).

3. World Bank (1997b).

4. World Bank (2005b), p. 110.

in the research and extension chapters of the ‘good practice manual’ issued by the anchor in 2005.¹ IEG rates the relevance of project objectives as **substantial**.

17. Project design was also relevant; its features adhered closely to those in the good practice manual. There are three other positive points to consider. First, there is the issue of the three-phase adaptable program loan envisaged at the outset. The ICR argues plausibly that “the choice of an APL as lending instrument was appropriate as the ambitious development target of establishing a new agricultural innovation system clearly required longer than the period normally encompassed by a single investment project”.²

18. Second, careful consideration was given to the need to balance strengthening of the government research and extension institute, INIA, and the development of the competitive fund model. During project preparation it was first proposed to have a component dedicated to building up INIA. However, the Bank’s analysis—backed up the Ministries of Agriculture and Finance—concluded that INIA was not in a position to absorb resources efficiently. Consequently, the project was reduced in funding level and support to INIA was limited to strengthening some of its programs (through FDSE). Also, the idea of developing a strategic plan was introduced, partly in order to make the case for strengthening INIA in the second-phase project.³

19. Third, the design was flexible enough to allow for midcourse adjustments. Initially the quality of subproject proposals was poor leading to the introduction of a two-phase selection process in 2002. In the first instance, proponents submitted outline proposals that were assessed for technical merit. Successful outlines passed to a second round, which entailed preparation of detailed subproject proposals with technical assistance for those who needed it. In 2003, additional major changes were introduced to the selection process with competitions on a national thematic basis – one for extension and the other for adaptive research – rather than at a regional level. At the same time, more attention was given to identifying local priorities and requirements, with training and information workshops at local rather than regional levels.⁴

20. Weighing up these four factors, IEG rates design relevance as **substantial**.

Efficacy

21. Efficacy assesses to what extent the project’s stated objectives were realized. This report systematically analyzes whether the expected inputs, outputs and outcomes actually materialized (the results chain). This provides a basis for the subsequent discussion of progress toward objectives. To the extent possible progress toward objectives is assessed against evidence bearing on intermediate and final outcomes (defined in Table 2). Where such evidence is lacking or insufficient, IEG considers data on outputs, considering

1. World Bank (2005a).

2. ICR (2005), p. 10.

3. Ultimately, this did not take place. Bank staff pointed out that the decision not to include a component for strengthening INIA in the second phase was based on technical grounds.

4. ICR (2005), p. 5.

Table 2. Results Chain—Expected Inputs, Outputs and Outcomes

Inputs (Components)>	Outputs>	Intermediate Outcomes>	>Final Outcomes
<p>(1) Policy and program coordination</p> <p>(2) Agricultural Technology Fund</p> <p>(3) Institutional Strengthening</p>	<p>Project Implementing Unit established, with an independent monitoring and evaluation system</p> <p>3 regional offices established</p> <p>Approval of a strategic plan for INIA, detailing priorities, activities and financing.</p> <p><i>Adaptive research grants (FTA)* [US\$2.8]</i> --51 adaptive research subprojects implemented --228 innovations diffused to farmers</p> <p><i>Extension grants (FTA)* [US\$4.5]</i> --123 extension subprojects implemented --170 extension agents (of which 30% female) contracted by farmers</p> <p><i>Strategic research grants (FSDE)* [US\$2.5m]</i> --16 strategic research subprojects implemented</p> <p><i>Extension Services Support (comprising training of extension agents and information services) [US\$0.7m]</i> --6 extension support subprojects implemented</p>	<ul style="list-style-type: none"> • Effective public sector management of a demand-driven, pluralistic system of research and extension • Farmers participate in generation of efficient and environmentally sound technology for crop and livestock production • Increased capacity to conduct strategic research in support of long-term increase in agricultural productivity • Increased capacity to provide training and information services in support of extension • Private sector finances 15% of ATF subproject costs • 20,000 farmers participate in research and extension subprojects and adopt new technologies 	<ul style="list-style-type: none"> • Increased rural household incomes (<i>Real farm incomes of ATF direct beneficiaries up by 30%</i>) • Increased value of total agricultural production (<i>Adaptive research trials achieve average productivity increase of 30%</i>) • Lower costs of production • Reduced rate of land and forest degradation (<i>30,000 ha under improved natural resource management</i>) • More efficient use of irrigation water

*Competitive funds: Agricultural Technology Fund (FTA and Strategic Services Development Fund (FSDE).

Source: PAD, Annex 1.

whether there are plausible grounds for arguing that delivery of those outputs has led (or is likely to lead) to the expected outcomes.

22. The chain of expected inputs, outputs and outcomes (Table 2) is derived from the PAD. According to the ICR, during implementation the project's objectives and components were not changed and the project was not formally restructured. Therefore, the Table 1 results chain is a valid template for the ex-post evaluation. Each of the next sections begins with a presentation of ICR material bearing on the results chain, followed by a discussion of the relevant IEG findings.

INPUTS

23. During this first phase of the INCAGRO program, the World Bank financed 80 percent and the government 20 percent.¹ Although the project components were not revised there was some reallocation of funds. Resources were shifted from FTA to FSDE, because the number of FTA subproject proposals was lower than expected at appraisal. Also, during implementation the terms of the FTA were modified to allow for establishment of a special fund for indigenous communities (*Huchuy Ayni*) and the development of a plan to reach more women farmers. Counterpart funding was not always timely but by project end the government's contribution exceeded by US\$1.1m the amount expected at appraisal.²

OUTPUTS

24. *Policy and program coordination.* Although it was an effective administrator of the competitive funds the implementation unit did not coordinate effectively with INIA and the Ministry of Agriculture and this contributed to the government's failure to approve a strategic plan for development of INIA.³ The ICR notes that "the project did not significantly influence policies with respect to agricultural research and extension".⁴ IEG found nothing in the course of its 2008 mission to challenge this observation

25. By project end there were five regional offices, two more than expected at appraisal. Eighteen of the 23 Departments of Peru were covered.⁵ The regional units performed well but were overburdened. The staff in each office was responsible for liaison with regional authorities, organizing calls for proposals, preliminary screening of proposals, arranging training courses, subproject supervision and reporting.⁶ IEG found that, based on visits to INCAGRO offices in Tarapoto, Huancayo and Piura, the office staff were too few to allow for close supervision of each subproject.

1. INCAGRO (2009).

2. ICR (2005), Annex 2, p. 17.

3. ICR (2005), p. 8.

4. ICR (2005), p. 4.

5. ICR (2005), Annex 1, p. 15 for appraisal projection; Table 5 in this report for actual numbers

6. ICR (2005), p. 4.

26. *Agricultural Technology Fund.* Thirty-one adaptive research subprojects were financed (see Table 4 below); the appraisal target was 51 (Table 2). There was also a shortfall in the delivery of extension subprojects: 61, compared to the 123 expected.¹ The ICR does not say how many innovations were diffused to farmers. Initially, proposals from the Sierra were weaker than those received from the Costa and the Selva, calling for additional training and the addition of a pilot initiative for indigenous communities in the region. After 2002 the rigor of the competitive process was stepped up with an insistence that subproject proposals be linked to business plans. IEG found that among the more successful extension projects there were several based on export-oriented producer associations that had obtained ‘fair trade’ certification (Box 3). However, subproject completion reports were of uneven quality and often did not contain the information needed to assess outreach to farmers or economic benefits.

Box 3. A Successful Extension Subproject: Promoting Organic Cocoa

The subproject sought to boost the competitiveness of small farmers in the *Selva Alta* by providing the technical assistance needed for them to switch from conventional to organic cocoa production. The aim was to work with 251 producers, each with an average of 3 hectares in cocoa, obtaining their certification as organic producers and boosting mean yields from 288 kg/ha to 540 kg/ha. The parties to the subproject were INCAGRO (which provided 43 percent of the financing), three producer cooperatives (37 percent), and an apex organization, Café Peru (20 percent). The subproject was highly successful. By the time it was completed 846 producers from the three cooperatives had received organic certification, entering into ‘fair trade’ deals with overseas buyers and thus substantially increasing their revenues compared to the preceding period when they sold to local intermediaries. Ninety-four percent of the beneficiaries reported they were satisfied with the technical assistance provided. Based on the increased returns to cocoa production, the farmers interviewed by IEG said that each of the cooperatives is now willing to pay for continuing extension services. The cooperatives supply working capital credit to their members; but the need for additional financing to cover the cost of replanting has not yet been fully met.

Source: Informe de cierre, Contrato No. 05-2003-II-AG-INCAGRO/FTA; *Memoria del concurso de premiación a la calidad en proyectos de innovación agraria*, Lima: INCAGRO, 2008; IEG visit to subproject site.

27. *Institutional strengthening.* FSDE subprojects were smaller than expected (US\$94,538 per project compared to the US\$250,000 envisaged). Sixty-one subprojects were financed (see Table 4 below); almost three times the expected number. But overall the ICR reports that limited progress was made toward the goal of developing strategic research and extension services owing to the weakness of the existing institutions and the failure to promote better communication between them. IEG found no evidence to dispute this statement in the ICR and also formed the impression that FDSE subprojects were too small and too diffuse to achieve the critical mass that strategic services entail. Some of these projects are of doubtful sustainability (Box 4).

1. ICR (2005), Annex 1, p. 15

Box 4. A Strategic Research Subproject: Developing a Plant Source of Omega Fatty Acids

Sacha Inchi (*Plukenetia volubilis*) is an oilseed native to the Amazon basin that has attracted attention in recent years because it is a significant plant source for Omega fatty acids whose health benefits have been widely proclaimed. Owing to the depredation of fish sources of fatty acids there is a growing demand to find alternative, sustainable supplies from the plant world. Given the large potential demand, claims have even been made that the crop could be attractive to Peruvian farmers as a substitute to coca production. The plant has a productive life of four years during which time it produces fruit continuously, providing a steady income to the farmer. The number of Peruvian growers of the crop is unknown but it is estimated that, nationwide, about 3,000 hectares are under cultivation. There are major constraints to expanding production. The little seed that is available on the market is of variable quality and the plant is susceptible to fungi and nematodes. There is no parallel development at the international level: e.g., none of the CGIAR research centers is working on the crop. Thus, sachu inchi could be presented as an ideal candidate for strategic research funding: returns are uncertain and likely to be long-term but the potential rewards are high given rich country interest in herbal panaceas. An INIA research station (El Porvenir, Tarapoto) submitted proposals to the FDSE competitive fund and so far two subprojects have been financed. Between 2004 and 2007, subproject spending totaled US\$138,000, 42 percent from INCAGRO/FDSE, 46 percent from INIA and 12 percent from other public research agencies. The aim is to build up a germplasm bank from which to develop pest-resistant varieties that can ultimately be certified and sold. So far results have been mixed. The stock of genetic material has grown substantially following collection of wild varieties from several sites in Peru, researchers have been trained and several experimental plantings have been staged; but none of the plants has survived, succumbing to nematodes and failing to withstand damp conditions. No viable varieties have yet been produced. INIA has insufficient resources to continue the work once the FDSE financing comes to an end.

Source: Informe de cierre, Contrato No. 006-2003-II-AG-INCAGRO/FDSE; IEG visit to El Porvenir station.

INTERMEDIATE OUTCOMES

28. *Co-financing.* INCAGRO financed 48 percent of the cost of the 153 subprojects approved in 2001-2005.¹ This is substantially less than indicated in the ICR (which reports that the INCAGRO share began at 75 percent, falling to 65 percent in 2003 owing to budget constraints).² Thus, co-financing by partners (service providers and farmers) appears to have been much higher than reported. Much of this co-financing—how much is not clear—was not in cash but in kind. IEG found that partner co-financing was not well accounted for (see “Efficiency” section below). It also found that the level of participation by private agribusiness firms was less than expected. The PAD set as a target 15 percent FTA subproject financing by the private sector.³ Of the 92 FTA subprojects financed in 2001-2005, only 10 involved private firms as service providers (equal to 10 percent of the total investment in FTA subprojects). For these private-sector-led subprojects, the co-financing share averaged 39 percent, compared to 53 percent for all the FTA subprojects. This hardly amounted to the ‘private-sector led’ extension model envisaged at appraisal.⁴

1. INCAGRO database, 2001-2005 subprojects.

2. ICR (2005), p. 5.

3. PAD (1999), Annex 1, p. 26.

4. PAD (1999), p. 4; ICR, p. 2.

29. *Farmer coverage.* The PAD target was for 20,000 farmers to participate in research and extension subprojects and adopt new technologies. The ICR reports that direct beneficiaries numbered ‘10,334 approximately’ but that about 35,000 farmers benefited in total (including indirect beneficiaries—although it is not clear how these were counted). According to a recent estimate, between 2001 and 2008, taking into account both the original and the follow-on operation, INCAGRO subprojects benefited 38,347 producers.¹

FINAL OUTCOMES

30. *Increase in incomes and productivity.* The PAD projected that real incomes of direct beneficiaries of FTA subproject would increase by 30 percent. The ICR contains no estimate of the increase in income. The appraisal target of an average productivity increase of 30 percent for FTA subprojects involving adaptive research trials was not re-visited in the ICR. IEG was not able to verify these outcomes directly but the available studies cast some doubt on the level of income and productivity impact (see “Efficiency” section below).

31. *Improved natural resource management.* The PAD states that 30,000 hectares would be brought under improved management but the ICR makes no reference to this figure. It does note, however, that 10 percent of all subprojects were directly related to natural resource management. IEG observed in the course of field trips that various subprojects had successfully enabled farmers to substitute organic for conventional, chemical-using approaches to farming and some modest reduction in overall environmental degradation was probably achieved.

ACHIEVEMENT OF PROJECT OBJECTIVES

32. IEG rates the achievement of the specific objectives of the project as follows:

- (a) “Improve management of public investment in agricultural technology” (*Rating: Modest*). The lack of dialogue between INCAGRO, INIA and the Ministry of Agriculture reduced the scope for improved management and the government wavered in its commitment to this objective. The first-phase of the proposed three-phase program was too limited in resources (US\$14 million) to achieve the level of reform projected in the PAD.
- (b) “Involve producers in planning and financing adaptive research and extension services” (*Rating: Modest*). Although the decentralized process for selecting between these types of subproject proposals was sound the number of subprojects financed was roughly half the expected number.
- (c) “Develop plans for increasing capacity for strategic research and extension support services” (*Rating: Modest*). The number of this category of subprojects was about three times what was expected but they were too small to make a difference and the participating institutions remained weak and poorly coordinated.

33. Weighing up these three ratings, the project’s progress toward its objectives (efficacy) is rated as **modest**.

1. Benites & Wiener, 2008.

Efficiency

34. At appraisal, based on an assessment of FTA research and extension projects, an economic rate of return of 39 percent was estimated. A similar approach was adopted at completion. Annex 3 of the ICR states that 75 adaptive research and extension subprojects were funded through FTA (although the figures in Annex 1 add up to 79). Annex 3 further elaborates that 29 of the 75 subprojects were selected for evaluation, noting that “the selection was mainly based on data availability and is therefore not a formally randomized selection” (p. 18). The aggregate economic rate of return for the 29 subprojects is 34 percent. But because selection was not randomized the results for the 29 project subset cannot be taken as a guide to the performance of all 75 subprojects.

35. A separate cost-benefit analysis was carried out by Barrantes and others (2004), covering a wider range of subprojects. This was subject to the same constraints. The selection of subprojects was not randomized; it was limited to those for which adequate data were available. In this case, the cohort was 101 subprojects implemented between 2001 and 2004. Since only 6 subprojects from the cohort had been completed the analysis was mostly *ex ante* (like that of the ICR). Of the 101 subprojects only 41 had enough economic data to allow costs and benefits to be estimated. The estimated rate of return for these 41 projects is higher than that in the ICR—the mean exceeds 70 percent for each of the four categories of service funded; mean returns are highest for the categories of strategic research and information and training—but variance is also higher in these categories (Table 3).

Table 3. Two Estimates of the Economic Rate of Return for Non-Random Samples of Subprojects

	Fund and Service Category			
	Fund FTA		Fund FDSE	
	Extension	Adaptive Research	Strategic Research	Information and Training
(a) ICR				
N of subprojects	29			
Mean ERR	34%			
% of subprojects with ERR <13%	NA			
% of subprojects with ERR 13-50%	NA			
% of subprojects with ERR >50%	NA			
(b) Barrantes				
N of subprojects	19	10	8	4
Mean ERR	76%	75%	114%	237%
% of subprojects with ERR <13%	11%	20%	38%	50%
% of subprojects with ERR 13-50%	32%	10%	-	
% of subprojects with ERR >50%	57%	70%	62%	50%

Source: ICR (2005); Barrantes et al (2004).

36. Although the sample size is 25 percent or more for each of the four service categories, given the non-randomness of its selection not much faith can be placed in these estimates as a guide to the overall rate of return to the project. (The Barrantes study scales up the findings

to the universe of INCAGRO subprojects, estimating an overall rate of return of 76 percent, and a net present value of US\$35 million—but this assumes that the subprojects for which there is incomplete information are comparable to those with better information when, in fact, the shortage of data may well reflect a lower economic viability of the subproject).

37. Did co-financing enhance efficiency? The co-financing requirement facing partner agencies and producer groups should, in principle, have helped to ensure beneficiary commitment to a satisfactory outcome and closer scrutiny of economic viability when the proposals were prepared. At appraisal, the level of co-financing by service category was set at between 5 percent and 35 percent; but the ex-post level of co-financing recorded by INCAGRO was substantially higher—between 48 percent and 56 percent (Table 4).

Table 4. INCAGRO—Co-financing Financing Levels and Total Subproject Cost

Fund & Service Category (N of subprojects, 2001-2005))	Co-Financing Levels		Total Subproject Cost (US\$)	
	As stipulated in the Project Appraisal Document	Actual level (2001-2005)	As stipulated in the Project Appraisal Document	Actual level (2001-2005)
FTA				
Extension (N=61)	At least 5%	48%	Maximum US\$150,000	US\$85,265
Adaptive Research (N=31)	At least 25%	49%	Maximum US\$300,000	US\$118,189
FDSE				
Strategic Research (N=39)	At least 35%	56%	Maximum US\$250,000	US\$132,622
Training (N=17)		50%		US\$89,647
Information (N=5)		53%		US\$118,936

Source: INCAGRO database (for subprojects approved from 2001 to 2005).

38. On the other hand, the actual level of co-financing was probably overestimated because partners were able to make their contribution in kind as well as cash. In-kind contributions took the form of land, labor (e.g., research workers whose salaries were paid outside INCAGRO could devote part of their time to INCAGRO subprojects), materials, and the loan of existing equipment and facilities (e.g., laboratories). Monetizing these diverse contributions must have been difficult and there was ample margin for inconsistent accounting—not to mention pledging of resources that were not ultimately delivered. (Perhaps for this reason the PAD for the follow-on project insisted more strongly that contributions be made in cash.¹ Also, the operating manual for the follow-on project has a special section on “non-monetary inputs”, emphasizing that it is the responsibility of the regional offices of INCAGRO to check that these are actually provided.)²

39. There is also some evidence that pours doubt on the returns to agricultural technical assistance in areas covered by the project (although not INCAGRO subprojects specifically). A study by Escobal (2003; 2005) assessed the returns to technical assistance comparing

1. PAD (2005), p. 43.

2. INCAGRO (2007), Section 20, p. 14.

1,021 producers who had received technical assistance with 1,111 producers who had not received such assistance, spread across ecologically representative zones of the country (selected randomly). Although the study included 340 INCAGRO beneficiaries these represented only a minority of the producers with technical assistance and the study was too close to the start up of INCAGRO to estimate the specific impact of INCAGRO. But the findings are still important because the operating environment was the same as that for INCAGRO. It emerged that for four out of six activities there was no significant difference between the ‘with’ and ‘without’ groups in terms of net income per hectare (Table 5). The evidence is all the more robust because steps were taken to filter out the effect of exogenous influences on income—the ‘withs’ were propensity score matched against the ‘withouts’ by education, assets, risk perception and access to credit.

Table 5. Impact of Technical Assistance on Producer Income, 2003 and 2005

Farming Activity (Date of research)	Sample size		Net income per hectare (producers <u>with</u> technical assistance) (Peruvian Soles)	t-test of significant difference between <u>with</u> and <u>without</u> producers
	N of Producers <u>with</u> technical assistance (via INCAGRO)	N of Producers <u>without</u> technical assistance		
Potato (2003)	200 (100)	200	2,410	p=0.01
Coffee (2003)	300 (150)	300	732	NS
Rice (2003)	180 (90)	180	2,338	p=0.01
Yellow maize (2005)	101 (-)	155	217	NS
Cotton (2005)	102 (-)	152	3,023	NS
Cattle (2005)	138 (-)	124	-560	NS

Source: Escobal, 2003; 2005

NS No significant difference between ‘with’ and ‘without’ groups matched on education, assets and other characteristics.

40. The Escobal study also assessed capacity for producers to co-finance extension and adaptive research, on the assumption that the INCAGRO subsidy was transitory and that the producers themselves would ultimately be obliged to shoulder the burden now borne by INCAGRO. It emerged that in the coffee and potato growing areas included in the study net incomes from these crops were high enough to cover technical assistance costs; but such was not the case in the rice growing areas. This is partly driven by crop marketing arrangements. In the case of coffee and potato, producers tended to have forward contracts for their crop, securing better prices and quality premiums than (rice) producers dependent on the spot market. But rice producers covered by the study were also less well educated, had fewer assets and had less access to credit than coffee and potato producers.

41. Furthermore, the study found that INCAGRO beneficiaries were more educated, owned more land, were less risk averse, had easier access to credit and enjoyed higher living standards than respondents in the sample that had not been funded by INCAGRO. Non-users of extension services were significantly less informed about the range of services available and more skeptical about the value of these services. This suggests that there are significant barriers to extending the reach of INCAGRO to include less well-off producers. Note, however, that the first phase of the INCAGRO program (the focus of this assessment) did not present itself as a targeted intervention when it was appraised; although, during implementation, some adjustments were made to ensure greater coverage of indigenous communities in the Sierra.

42. A recently completed independent evaluation (led by a Brazilian team that included EMBRAPA researchers) found that the economic rate of return from INCAGRO (2001-2006) varied between 25 percent and 37 percent.¹ The positive return stands up to sensitivity analysis: it would take a 25 percent increase in costs and a 25 percent drop in benefits to drive the rate of return down to the threshold of unacceptability (12 percent). The study was based on a random sample of 49 subprojects (almost one-quarter of the universe), stratified by region, by subproject type (research, extension or training), by period, and by the performance rating applied to subprojects by the INCAGRO team. The evaluation found that 53 percent of aggregate net benefits were captured by the Selva region, 27 percent by the Costa and 20 percent by the Sierra (the poorest region). Of the 739 farmers interviewed, 59 percent reported that they adopted new technologies during the period that INCAGRO was implemented; by the producers' own reckoning, adoption was one-quarter attributable to the project, three-quarters attributable to other factors.

43. This study has two flaws. First, there was no control group, comprising farmers not exposed to INCAGRO. Second, the pre-project baseline was constructed using farmer recall. Both of these shortfalls raise the possibility that the impact of INCAGRO was overestimated. Relying on farmers to estimate to what extent INCAGRO was responsible for their adoption of new technologies was a poor substitute for a comparison between treatment and control groups.

44. Nevertheless, despite these flaws there is ample evidence in this latest study that the project had a solid impact on technology adoption and farm incomes. Also, given the small size of the project and the challenging environment it is striking what was accomplished—the network of regional project administration and technical assistance was impressive (if overstretched). IEG rates efficiency as **substantial**.

Project Development Outcome

45. Based on the sub-ratings of substantial relevance, modest efficacy and substantial efficiency, IEG's overall rating of project development outcome is **moderately satisfactory** (Table 6).

Table 6. Derivation of the Project Development Outcome Rating

Relevance	Efficacy	Efficiency	Project Development Outcome
	Objective (a): Modest		
Objectives: Substantial	Objective (b): Modest		
Design: Substantial	Objective (c): Modest		
Rating: Substantial	Rating: Modest	Rating: Substantial	Rating: Moderately Satisfactory

46. INCAGRO has developed its own method for rating subproject outcomes. Table 7 summarizes the results for subprojects approved between 2001 and 2005, showing that, on a three-point scale, 56 percent occupied the middle rating ("moderately satisfactory").

1. Ministerio de Agricultura/INCAGRO, (2009).

Subprojects in the Costa and Sierra regions achieved more ‘satisfactory’ ratings than those in the Selva. By service type, strategic research, training and information subprojects rated more highly than adaptive research and extension projects. The success of adaptive research and extension subprojects hinged more on the institutional capacity of producer associations, which was probably weaker than that of the institutes involved in leading the strategic research initiatives. (INCAGRO management acknowledges the problems associated with weak producer associations, the difficulty of obtaining finance for fixed capital costs and complementary investments, and the inadequate flow of information about business opportunities in agriculture.¹)

Table 7. Outcome Rating of Subprojects

Rating, 2001-2005 Subprojects	RATING BY REGION				RATING BY SERVICE TYPE			
	All Subprojects, N=153 (%)	Costa N=46 %	Sierra N=59 %	Selva N=48 %	Training and Information N=22 %	Strategic Research N=39 %	Adaptive Research N=31 %	Extension N=61 %
Satisfactory Rating: (3)	21	26	31	4	27	38	13	11
Moderately Satisfactory Rating: (2)	56	41	55	71	55	54	55	59
Unsatisfactory Rating: (1)	23	33	14	25	18	8	32	30
Total	100	100	100	100	100	100	100	61
Mean rating	2.0	1.9	2.2	1.8	2.1	2.3	1.8	1.8

Source: INCAGRO database.

Risk to Development Outcome

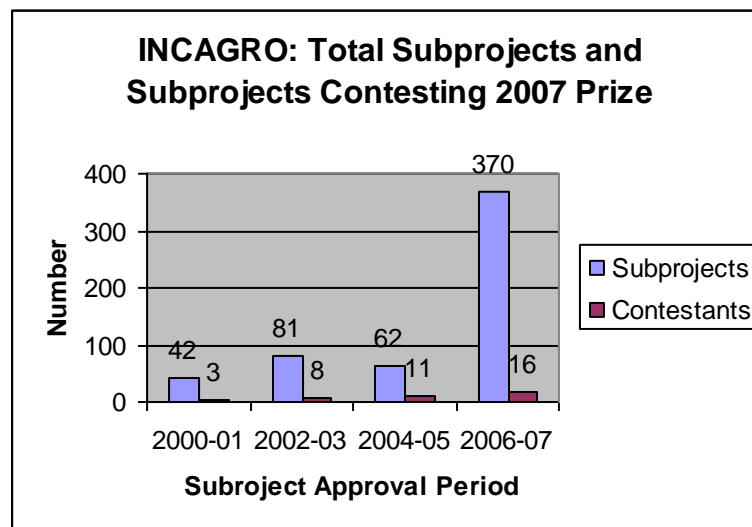
47. In assessing risks, a distinction can be drawn between, on the one hand, measures that INCAGRO has taken to disseminate and consolidate the competitive fund model and subproject results; and, on the other hand, the extent to which the operating environment is conducive to sustainability.

48. INCAGRO says that the competitive funding model it developed has already left its mark on other institutions. The INCAGRO funding process influenced the design of the government’s Fund for Innovation, Science and Technology (FINCYT); the information system was copied by the Private Sector Investment Program (PSI), which is supported by Dutch bilateral aid, as well as by the IFAD-sponsored Management of Natural Resources in the Southern Highlands Project (MARENASS); and advice on the design of the operating manual was provided to the IADB-supported Rural Market Access Program (PROSAAMER) (Benites & Wiener, 2008).

1. Benites & Wiener, 2008.

49. In 2007 INCAGRO introduced a prize for the best subprojects, inviting applications from all subprojects approved since the start of Phase I (Figure 2).¹ Of the 555 subprojects approved up to 2007, only 38 participated in the contest (and 9 of these were not co-financed by INCAGRO). Seventy-one percent of the contestants had had their subprojects approved since 2004; and in about one-half of these cases the subproject was still under implementation. This could mean that subprojects from the earlier phase of INCAGRO were less prize-worthy (although the barley subproject that took the 2007 prize for innovative research was approved in 2000); or that, if they had been prize-worthy once, this was no longer the case in 2007. Or it may simply mean that the contest was underpublicized so that many of the prize-worthy did not hear of it. In any event, these results suggest that the prize offers only limited support to consolidating the contribution made by the subprojects.

Figure 2. INCAGRO: Total Subprojects and Subprojects Contesting 2007 Prize



Source: Benites & Wiener (2008) for total number of subprojects; INCAGRO (2008) for number of contestants.

50. In 2006, the Ministry of Agriculture launched an on-line agricultural information system which involves 10 Peruvian institutions, including INCAGRO.² Filtering by project and by keyword search on farm activity, the search engine picks up none of the INCAGRO subprojects approved before 2006 (not even the prize-winning barley project referred to in the previous paragraph); and coverage from 2006 onwards is patchy—many of the INCAGRO subprojects approved after that date are not in the database. This suggests that the dissemination of subproject results needs strengthening; and that the scope for using this information system for learning from INCAGRO experience is yet limited. The preparation of books, booklets and brochures on the INCAGRO achievements are a more direct and traditional means of dissemination but since most of these are only of recent production, it is too early for IEG to judge their effectiveness in getting the INCAGRO experience “out”.

1. INCAGRO (2008)

2. Ministerio de Agricultura (2006)

51. There is another risk to the survival of the INCAGRO model. The attempt to establish a culture of paying for extension services has been undercut by the operation, simultaneously and in the same region, of other projects offering free services.¹ One such service was provided in the Sierra by the (Bank-supported) National Program of Watershed Management (PRONAMACHCS). In the Amazon, IEG found that ‘alternative development’ programs funded by the US government’s bid to suppress coca cultivation also offered free extension services.

52. A further risk derives from the limited engagement of INCAGRO with regional governments. Although the competitive funding mechanism for FTA subprojects is fully decentralized and INCAGRO has a network of regional offices the approved subprojects are not, for the most part, known to regional governments. In this respect, INCAGRO’s experience differs from that of another competitive fund visited by IEG—Fondo Empleo—where regional governments are actively involved in setting priorities for subprojects.

53. On a more positive note, the concerns about INCAGRO’s future and the terms of its integration with INIA²—which were very marked when IEG conducted its mission in November 2008—seem since to have lessened. The Ministry of Agriculture is now using the INCAGRO initiative to allocate roughly US\$10 million to farmers under the Free Trade Agreement with the United States. Also, INCAGRO’s network of seven regional offices (threatened with closure at the time of the mission) will be kept going—although they will now be housed within INIA facilities to reduce costs. INIA and INCAGRO are now jointly developing a proposal for the third phase of the adaptable program loan.³

54. Another consideration is the positive results from the comprehensive impact evaluation (not available when IEG conducted its mission). These indicate that the subprojects financed by INCAGRO produced a significant economic rate of return which stands up to sensitivity analysis (see “Efficiency” section), suggesting that the project had a solid impact on technology adoption and farm incomes. Based on these considerations IEG rates the risk to development outcome as **moderate**.

Monitoring & Evaluation

55. The ICR notes that “while the Monitoring and Evaluation Unit has successfully set up a web-page, there is still much more information on the competitive processes than on the actual operations and results of the subprojects”.⁴ Transmission of data between field and headquarters was not as smooth as it should have been. IEG concurs with these findings. The

1. Gutiérrez (2007), pp. 23-24.

2. The merger of INIA and INCAGRO was part of a broader process of restructuring aimed to simplify the administrative structure of the Ministry of Agriculture and its affiliated agencies (Supreme Decree 014-2008, June 20, 2008).

3. The aide-memoire for the Bank supervision mission of 26-28 January, 2009 includes details of the terms of the INCAGRO-INIA integration. The Borrower confirmed this in its comments (Appendix B).

4. ICR (2005), p. 9.

mission found that the quality of subproject completion reporting was uneven. INCAGRO could supply only 18 of the 54 randomly-selected completion reports that IEG requested.

56. On the other hand, the recently completed independent impact evaluation was comprehensive and—despite some methodological caveats referred to above—presented convincing results. The scale of the evaluation suggests a stepping up of Borrower commitment since the implementation phase of the first project. On the strength of this, IEG rates monitoring and evaluation as **substantial**.

Bank Performance

QUALITY AT ENTRY (RATING: SATISFACTORY)

57. The analytic work underpinning the project could have been stronger. Striking by its absence is any backing from a review of public expenditures on agriculture and an assessment of what reforms were fiscally sustainable. (Fiscal impact estimates were added at appraisal of the follow-on project however.)¹ The Bank’s 2002 country assistance evaluation expressed some skepticism about the need for a research and extension project, suggesting that the (unpublished) agriculture sector work conducted by the Bank in FY1998 had set the wrong priorities. “Protection levels increased in the late 1990s and the coverage of distortions broadened. Strengthening agricultural research and extension... is less relevant than the other needed reforms. Pushing ahead with a demand-driven but publicly-financed strategy for agricultural research and extension before liberalizing the sector—in particular lowering tariffs and surtaxes and removing subsidies from water users in the irrigated coastal areas—could lead to a use of government resources for agricultural research in areas of comparative disadvantage where interest groups are strong”.²

58. However, the same evaluation finds justification for the partial attempt at institutional reform adopted by the Bank around this time, which was reflected in the design of INCAGRO. The evaluation concludes that the government was no longer committed to the holistic modernization of the state and the fiscal effort that this entailed. “Given these constraints, the decision to attempt an incremental approach to public sector modernization by building in institutional reform components into individual loans was reasonable”³.

59. On balance, IEG finds that the project was a limited but nevertheless valid response to lagging agricultural productivity. The thinking underpinning the project was in line with best practice at the time. The project’s design is defensible on the pragmatic grounds that, in the policy environment of the late 1990s, it was not possible to attempt the needed, comprehensive restructuring of the public sector apparatus for agricultural technology development and transfer. The loan amount was correspondingly modest. Also, given the government’s lack of support for decentralization (acknowledged by the country assistance evaluation) it is not

1. PAD (2005), pp. 77-79.

2. World Bank (2002), pp. 12-13.

3. World Bank (2002), p. 6.

realistic to suggest that the project should have given a role to regional and local governments in helping to define, finance and implement the research and extension agenda.

SUPERVISION (RATING: MODERATELY SATISFACTORY)

60. The ICR acknowledges that during supervision the Bank had little dialogue with INIA or the Ministry of Agriculture.¹ By limiting the dialogue to INCAGRO, the Bank reduced the contribution to reforming the overall system. During the last 16 months of project implementation, the Bank and the implementation unit devoted most of their efforts to preparing for Phase II, leading to a neglect of Phase I activities. Closer attention could have been given to monitoring a sample of subprojects systematically.

61. Overall, Bank Performance is rated **moderately satisfactory**.

Borrower Performance

GOVERNMENT (RATING: MODERATELY SATISFACTORY)

62. During project gestation the overall climate was not conducive to institutional restructuring. Government had lost the resolve to push forward the radical public sector reform that had been launched in 1990. Power was concentrated increasingly in the Presidency and the Ministry of Economy and Finances and there was little engagement with the line ministries; the Ministry of Agriculture was particularly isolated. The 2002 country assistance evaluation rated the outcome of the Bank's 1995-2000 program as unsatisfactory, largely because it was fiscally unrealistic. "A missing ingredient throughout the 1990s in Peru was an interaction between macro-economic planning and sector needs. Macro-economic planning was carried out taking existing resource availability as a given and no calculation was made of what increase in the tax-to-GDP ratio was needed to meet sector goals".² The report went on to criticize the government's record on institutional development and its lack of sustained investment in physical and human capital.³ Project teams "were dismantled after donor funds ceased, leaving the technical capacity of ministries much as it had been before their establishment and endangering the sustainability of project achievements. In fact, an increase in the fiscal effort was necessary to sustain the largely foreign-financed efforts".⁴

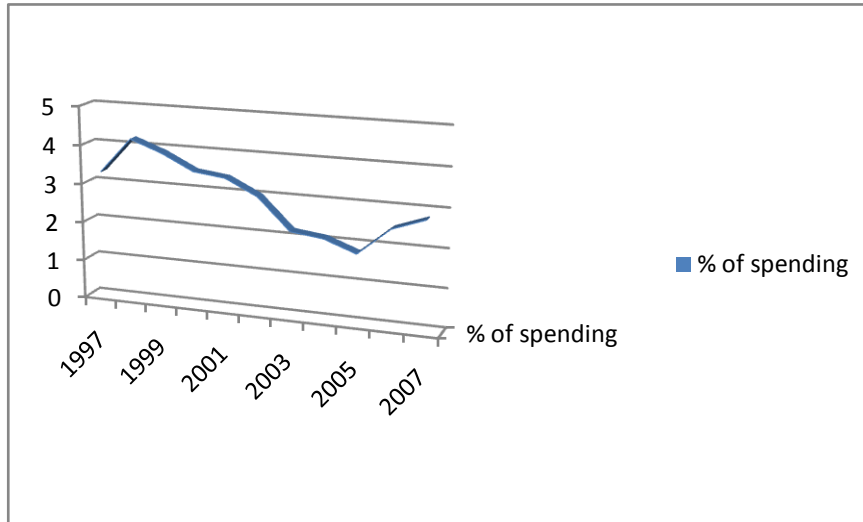
1. ICR (2005), p. 10.

2. World Bank (2002), p. 14.

3. World Bank (2002), p. 18.

4. World Bank (2002), p. 24.

Figure 3. Peru: Public Spending on Agriculture as % of Total Public Spending



Source: Ministerio de Economía y Finanzas (Annual Reports).

63. The first-phase of the INCAGRO project coincided with a tight fiscal environment. Public spending on agriculture and livestock fell from a mean of 3.8 percent of total government spending in 1997-1999 to 2.4 percent in 2005-2007 (Figure 3).¹

64. During project implementation the broader government context was no more favorable. “Public administration suffered from poor accountability, inadequate policy coordination, and the absence of a coherent public sector pay and employment system. Organizational confusion, duplication of programs, and excessive centralization” hindered government performance.²

65. The government was initially supportive of the project. It signed a Letter of Sector Policy in October, 1999 which supported the development objective of the project, namely the establishment of a decentralized agricultural technology innovation system led by the private sector. But following project approval by the Bank in November 1999 government took almost one year to sign the loan agreement so that the loan only became effective in January 2001. During implementation, unlike in the preparation phase, the various administrations were less supportive of the scope of reform entailed by the project, particularly as it bore on INIA. At one point, without consulting INCAGRO, the government summarily broadened the mandate of INIA to include extension services. The implementation unit commented on the implications of this restructuring but received no response from government.³

1. Ministerio de Economía y Finanzas, Annual Reports.

2. World Bank (2006b), p. 2.

3. ICR (2005), p. 8.

IMPLEMENTING AGENCY (RATING: SATISFACTORY)

66. The ICR notes that the management team in Lima was strong but “a weakness has been the shortage of professional staff in the Decentralized Units, whose role has become increasingly important as more projects require supervision at the same time as new proposals have to be reviewed and relationships built up with local authorities”.¹ IEG concurs with this finding. Although the staff it encountered in Lima and in the Units were highly dedicated they also appeared to be overstretched. The implementing agency shares some responsibility with the Bank for the weak dialogue with INIA and the Ministry of Agriculture although it must also be conceded that INCAGRO faced an uphill battle in this respect given the limited support shown by government during the implementation period, and given the continuing fiscal uncertainties. Overall, IEG considers that the management and staff in the implementing agency did the best that could be expected, given the unpromising operating environment and the resource limitations.

67. The overall rating of Borrower Performance is **moderately satisfactory**.

1. ICR (2005), p. 11.

Appendix A. Basic Data Sheet

AGRICULTURAL RESEARCH AND EXTENSION PROJECT (LOAN NO. 4519)

Key Project Data *(amounts in US\$ million)*

	<i>Appraisal estimate</i>	<i>Actual or current estimate</i>	<i>Actual as % of appraisal estimate</i>
IDA Loan	9.60	8.12	85
Cofinancing	2.78	2.98	107
Government	1.44	2.53	176
Total project cost	13.82	13.63	99

Cumulative Estimated and Actual Disbursements *(US\$ million)*

	FY01	FY02	FY03	FY04	FY05
Appraisal estimate	0.8	3.0	7.0	9.6	9.6
Actual	0.6	4.2	5.4	7.8	8.1
Actual as % of estimate	75	140	77	81	84

Project Dates

	<i>Original</i>	<i>Actual</i>
Departure of Appraisal Mission		01/15/1999
Appraisal		06/20/1999
Board approval		11/23/1999
Effectiveness	01/01/2000	01/23/2001
Mid-Term Review	06/15/2003	09/19/2003
Closing date	06/30/2003	01/31/2005

Staff Inputs *(staff weeks)*

	<i>Actual/Latest Estimate</i>	
	<i>N° Staff weeks</i>	<i>US\$US\$('000)</i>
Identification/Preparation	54.7	149.5
Appraisal/Negotiation	29.99	111.4
Supervision	44.72	168.0
Completion	6.77	26.0
Total	136.18	454.9

Mission Data

	Date (month/year)	No. of persons	Specializations represented	Performance rating	
				Implementation status	Development objectives
Identification Preparation	05/25/1998	3	Task Manager, Senior Adviser, Consultant		
	11/30/1998	3	Task Manager, Consultants (2)		
Appraisal/ Negotiation	02/21/1999	5	Task Manager, Senior Adviser, Consultants (3)		
	06/21/1999	2	Task Manager, Consultant		
Supervision 1	03/22/2001	2	Task Manager, Procurement Specialist	S	S
Supervision 2	03/28/2003	3	Task Manager, Monitoring & Evaluation Specialist, Financial Management	S	S
Supervision 3	04/11/2003	1	Task Manager	S	S
Supervision 4	09/19/2003	4	Lead Agriculturalist/Task Manager, Lead Agricultural Economist, Agricultural Economist, Operations Analyst	S	S
Supervision 5	03/17/2004	4	Task Manager, Principal Agriculturalist, Operations Analyst, Agriculturalist	S	S
Supervision 6	11/04/2004	5	Task Manager, Senior Agriculturalist, Operations Analyst, Senior Finance Officer, Senior Financial Management Specialist	S	S
ICR	01/17/2005	2	Task Manager, Consultant	S	S

Performance Rating: S: Satisfactory

Other Project Data

Borrower/Executing Agency:

FOLLOW-ON OPERATIONS

Operation	Loan Number	Amount (US\$ million)	Board date
Agricultural Research and Extension APL, Phase 2	L7285	25.0	31 March 2005

Appendix B. Borrower Comments

Para: *Monika Huppi, Manager Sector Evaluation Division IEG*

De: *Javier Ramírez-Gastón, Director Ejecutivo, (e) INCAGRO*

Ref: *DRAFT PROJECT PERFORMANCE ASSESSMENT REPORT, Agricultural Research and Extension Project (Loan no. 4519)*

Fecha: *May 19, 2009*

Estimada Sra:

De acuerdo a lo solicitado en su comunicación de junio 8, le remitimos información complementaria que seguramente servirá para enriquecer vuestro informe final en un tema crucial abordado por el PPAR. Esto se agrega a los documentos que hemos remitido anteriormente.

El *Draft* PPAR destaca la *“ausencia de un diálogo productivo y cooperación entre el proyecto, INIA y MINAG como un factor importante que frustró el objetivo de mejorar la gestión de la inversión pública en tecnología agrícola”* (ix). Al respecto es importante tener en cuenta lo siguiente:

1. En marzo 2008, el gobierno promulgó la ley de Organización y Funciones del Ministerio de Agricultura (DL 997). En esta, el MINAG definió como una de sus funciones específicas (art. 6) *“Conducir el Sistema Nacional de Innovación Agraria”* y *“Desarrollar y promover la investigación, capacitación, extensión y transferencia de tecnología para el desarrollo y modernización del sector”*. En este mismo dispositivo (tercera disposición complementaria final), se modifica la denominación del Instituto Nacional de Investigación Agraria por la de Instituto Nacional de Innovación Agraria, con la responsabilidad de diseñar y ejecutar la estrategia nacional de innovación agraria.

2. Luego, en junio 2008, se aprobó el DL 1060 por la cual se regula el sistema nacional de innovación agraria. Este dispositivo da la responsabilidad de ente rector del sistema al INIA, y entre otras funciones se dispone el desarrollo de fondos concursables para *“promover la investigación...”*

3. Estos dos dispositivos no pueden entenderse al margen de la experiencia positiva del proyecto y la relación que se estableció entre INIA, MINAG e INCAGRO desde el 2001. Al respecto sólo mencionar tres hechos:

3.1 Existe una clara relación conceptual y de enfoque de política de ambos dispositivos con el enfoque de INCAGRO y con el proyecto “Estrategia Nacional de Innovación Tecnológica Agraria y Agroindustrial del Perú” que INIA desarrolló en el año 2002 con el financiamiento y apoyo conceptual de INCAGRO (Ver libro “verde” del INIA, 2002) como resultado de dicho documento, el INIA logró duplicar su presupuesto institucional en el 2003, nivel que ha mantenido hasta la fecha; constituyéndose en un hito importante en la historia reciente de dicha institución.

3.2 En el 2004, durante el proceso de formulación del estudio de factibilidad de la fase II, se intensificó el diálogo, principalmente con las diversas instancias del MINAG, donde se discutió la manera de intensificar la relación interinstitucional tripartita, decidiéndose por el establecimiento de una instancia de coordinación permanente para el diseño de la política de C&T+i agraria. Esto se concretó a pocos meses de iniciada la fase II, enero 2006 cuando se constituyó el Comité de Coordinación de Políticas en Ciencia, Tecnología e Innovación Agraria (RM 0256-2006-AG), con representantes de las tres partes MINAG, INIA e INCAGRO; en ese entorno se elaboró el estudio de prospectiva “El futuro de la innovación tecnológica en el Perú”(Proyecto Quo Vadis). Este comité tuvo una vida intensa toda la primera mitad del 2006. El cambio gubernamental de julio 2006 postergó el proceso hasta marzo del 2007, se debe recordar que en ese período hubo dos cambios ministeriales en el MINAG;

3.3 El nuevo ministro, a principios del 2007, convocó al INIA e INCAGRO a colaborar con el MINAG en el proceso de reforma del Ministerio; esto concluyó con la ley de marzo del 2008 que se menciona arriba. Fueron muchas sesiones de trabajo entre MINAG, INIA e INCAGRO en la que se compartió la experiencia y el enfoque del proyecto y se discutió la orientación de la reforma ministerial y el lugar que debía tener la política de C&T+i en la modernización agraria. En ese sentido, nos parece esencial destacar que la experiencia del proyecto y las relaciones tripartitas mencionadas fueron un insumo importante para orientar el enfoque de ambos dispositivos y para reafirmar la importancia de continuar con los fondos concursables como mecanismo importante para promover la I&D+i agraria en el país.

4. El IEG concordará con nosotros que las condiciones institucionales están asociadas a un gran número de factores externos que el propio proyecto y los *stakeholders* no controlan directamente, y que la maduración de las condiciones institucionales tienen un ritmo y caminos no lineales y asume formas que no siempre son fácilmente perceptibles. Si el informe ICR del 2005 no aquilató positivamente el impacto que INCAGRO I tuvo en el INIA hasta el 2003, una mirada posterior, como la que realiza el PPAR, no debería soslayar el hilo conductor entre lo acontecido en el 2002 y lo madurado en el 2008, máxime el hecho que se pueden observar un conjunto de hitos, como el estudio del proyecto Quo Vadis y la RM 0256-2006 que permiten percibir que el diálogo tripartito no se paralizó y abonó en la reforma ministerial del 2008 y el DL 1060.

5. Finalmente, queremos valorar la visión del PPAR porque nos permite observar que no siempre los procesos siguen las dinámicas que se habían planificado y que las expectativas muchas veces son bastante optimistas respecto a la complejidad de la realidad social e institucional. Al respecto, nos parece importante resaltar que i) el modelo de acompañamiento del banco con supervisiones periódicas, MTE, PPAR etc y ii) el diseño del proyecto en tres fases (Adaptable Program Loan), son mecanismos que han permitido dar una importante cuota de flexibilidad para adecuar los esfuerzos del proyecto a la velocidad y características de los cambios de nuestro entorno. En ese sentido, la Fase III que se está diseñando aprovechará los actuales avances en el diálogo interinstitucional, y podrá perfilar mejor las nuevas metas del proyecto.

Se anexa:

RM 0256-2006

Primeras páginas de libro Verde del INIA

Annex 6: Colombia

Agricultural Technology Development Project

Summary

This report assesses the performance of the Colombia Agriculture Technology Development Project (PRONATTA). The project was supported by an IBRD loan (No. 3871-CO) of US\$51.0 million, which was approved on April 20, 1995. The loan closed on December 31, 2003, two years behind schedule.

The project's specific development objectives were five-fold: (a) to promote the development and testing of technical packages especially appropriate for small farmers; (b) to promote private sector participation in agricultural research; (c) to improve the quality and efficiency of agricultural research by introducing a demand-driven, competitive selection system that would co-finance projects with universities and private and public sector entities; (d) to support decentralization of agricultural research and extension activities by strengthening regional centers, training agricultural extension agents, and disseminating information; and (e) to revitalize underused assets in Colombia's research services system.

The project comprised: (a) *Technology Development and Adaptation* (planned cost, US\$53.6 million; actual cost, US\$46.3 million), which provided grants for competitively-selected, demand-driven subprojects in applied and adaptive research and technology transfer; and (b) *Institutional Development* (planned cost, US\$30.4 million; actual cost, US\$39.6 million), which included establishment of a coordination unit in the Ministry of Agriculture, setting up of a national and regional panels to evaluate subproject proposals, training and the launch of an agricultural technology information system. By an amendment to the loan agreement in August 1999 US\$15 million was reallocated to help fund disaster relief following an earthquake that year.

IEG rates **Outcome** as moderately satisfactory. The objectives of the project were substantially relevant, both in terms of Colombia's development priorities and good practice thinking in the Bank about approaches to agricultural research. Most of the project's output targets were met or exceeded—particularly so for training—and the project substantially achieved 3 of its 5 objectives, although it was not as instrumental as expected in leading to greater participation by non-government research providers. One of the biggest contributions was a strengthening of the public research agency, CORPOICA. Efficiency was compromised, however, by the small size and diffuse nature of the subprojects, the difficulty of accounting for the sizeable in-kind component of beneficiary co-payments and the failure to ensure that subprojects were based on business plans.

The **Risk to Development Outcome** is rated moderate. Government has remained committed to the competitive fund principle and substantial learning took place under PRONATTA that has been applied to the follow-on project. There is now a stronger focus on linking subprojects to commodity ("value") chains and increasing the engagement with, and co-financing by, producer associations, helping to ensure that the selection of

subprojects is more strategic and geared to increasing agricultural competitiveness (gaining momentum from the new free trade agreement with the United States).

IEG rates **Bank Performance** as satisfactory. The project was well designed and the arrangements for cross-government coordination proved effective. The Bank's project team had a close and productive dialogue with the Ministry of Agriculture throughout the implementation.

Overall, **Borrower Performance** is rated satisfactory, reflecting the sustained commitment shown by government during preparation and implementation and the efficient performance of the project coordinating unit in managing the process for selecting subprojects and supervising disbursements. In addition to tracking the financial performance of subprojects more attention could have been given to monitoring subproject outcomes at the farm level, but IEG acknowledges the constraints on field visits that resulted from high levels of insecurity in the Colombian countryside during the period of implementation.

The **Lessons** learned from this project are discussed in the main report which draws on IEG's findings about the performance of competitive grant schemes for agricultural research and extension in four Latin American countries (Brazil, Colombia, Peru and Nicaragua). Taking the four countries as a whole, with the exception of Peru, there is a lack of hard evidence about the ultimate impact of the investments made—the extent to which farmers adopted new technologies developed through research and extension subprojects, and the related change in productivity and incomes.

The assessment also concludes that the principle of competition between alternative service providers breaks down where the range of providers is limited (a problem at the municipal level and for small countries) and many of the potential providers lack the skills needed to prepare viable sub-project proposals. The model is more likely to strengthen the strongest players in the field than it is to reduce the disparities between the strong and the weak. Summing up, the competitive fund approach is a useful adjunct to the broader public sector apparatus for agricultural research and technology transfer; it is not a substitute.

Principal Ratings

AGRICULTURAL TECHNOLOGY DEVELOPMENT PROJECT

	<i>ICR*</i>	<i>ICR Review*</i>	<i>PPAR</i>
Outcome	Satisfactory	Satisfactory	Moderately Satisfactory
Institutional Development Impact**	Substantial	Substantial	n.a.
Risk to Development Outcome	n.a.	n.a.	Moderate
Sustainability***	Likely	Likely	n.a.
Bank Performance	Satisfactory	Satisfactory	Satisfactory
Borrower Performance	Satisfactory	Satisfactory	Satisfactory

* The Implementation Completion Report (ICR) is a self-evaluation by the responsible Bank department. The ICR Review is an intermediate IEGWB product that seeks to independently verify the findings of the ICR.

**As of July 1, 2006, Institutional Development Impact is assessed as part of the Outcome rating.

***As of July 1, 2006, Sustainability has been replaced by Risk to Development Outcome. As the scales are different, the ratings are not directly comparable. f5/7p

Key Staff Responsible

<i>Project</i>	<i>Task Manager/Leader</i>	<i>Division Chief/ Sector Director</i>	<i>Country Director</i>
Appraisal	William B. Johnson	Vicente Ferrer	Yoshiaki Abe
Completion	Matthew A. McMahon	Mark E. Cackler	Isabel M. Guerrero

Background

1. In Colombia, as in most Latin American countries, agricultural research was originally centered on a state-run national institute (initially, ICA; subsequently CORPOICA). Initially, the Bank sought to strengthen this institution. An earlier Bank-supported operation—the Agricultural Research and Extension Project that closed in June 1992—was designed to improve and expand ICA’s research activities to help Colombia raise its agricultural output at competitive costs. The completion report noted that the project met its targets (such as building and equipping facilities at research stations and training research personnel), thereby expanding Colombia's capacity to develop useful agricultural technology to improve and increase production. But following a lead taken by the Colombian government, the Bank shifted, in the 1990s, from supporting the national institute model to a competitive fund model.

2. In 1989 the government set up the National System for Agricultural Technology Transfer (Decree No. 1946), replacing ICA with a research and extension framework that was intended to be more responsive to farmer needs. The staff of ICA was cut from 6,700 to 1,600. In 1993 the agency was split in two: ICA maintained responsibility for plant and animal health, quarantine, input regulation, and public research coordination and supervision; research and technology transfer were moved to the new institution, CORPOICA, a joint venture between the government and various producer associations, universities, and regional institutions. CORPOICA, with a staff of 3,500, took over ICA's 13 main research stations and 66 regional research centers and their staff. Responsibility for extension was devolved upon municipal governments, creating a multitude of small units (UMATAs), most of which, in the absence of continuous, earmarked transfers from central government were doomed to wither on the vine.

3. But these government initiatives do not capture the full story. What sets Colombia apart from the other countries covered by this evaluation is the importance of commodity-specific producer associations, the oldest of which (coffee) dates back to the 1928. Between them, thirteen producer associations accounted for about one-third of Colombia’s public (nonprofit) agricultural research staff and spending in 2006.¹ Many of these producer associations have their own research institutes (CENIs), funded partly from a government-regulated cess on commodity revenues.

4. Both PRONATTA and the follow-on Agricultural Transition Project (PTA) have a small farm focus. They also (but PTA more than PRONATTA) sought to promote research linked to commodity chains based around the producer associations. Reconciling these two objectives is not straightforward. Only a minority of small-scale farmers are affiliated with producer associations. The data on the number of small farmers and the number of affiliations are highly approximate. About 40 percent of the roughly 1.1 million small-scale farmers in Colombia (defined as producers operating less than five hectares), are connected to producer associations. The vast majority of these affiliations

1. Stads & Romano (2008), p. 1.

(about 80 percent) are accounted for by small coffee growers.¹ Reaching out to the large number of such producers not in coffee is a challenge.

5. Despite an uptick in government spending on agricultural research in 2008, taking a longer perspective, investment levels have been comparatively modest. In 2006 Colombia invested \$0.50 in agricultural research for every \$100 of agricultural output, which was lower than the corresponding ratio in 1996 (0.61) but slightly higher than the 1981 ratio (0.43).² The 2000 ratio for Colombia was also lower than the reported 2000 average for Latin America and the Caribbean (1.19), the developing world (0.56), and the global average (0.98).³

6. Public spending on agricultural research and extension was equivalent to 0.5 percent of agricultural GDP in 2003. To put this in perspective, in Latin American countries, spending on agricultural research averaged 0.9 percent of sector GDP in 1995. In Brazil and Colombia in 1996 (the latest date for which comparable, cross-country data are available), spending on agricultural research was respectively 1.7 percent and 0.5 percent of agricultural GDP.

7. This assessment focuses on the first-phase project (PRONATTA) of an innovative program of agricultural research and extension that was launched in 2000. To a lesser extent it considers progress under the follow-on project (PTA) which was approved in 2005 and is still underway. IEG's approach to the evaluation is summarized in Box 1.

Box 1. IEG Approach

During the November 2008 mission to Colombia, IEG interviewed the principal agencies involved in the project (PRONATTA/PTA, CORPOICA and the Ministry of Agriculture). Field trips were staged to three areas of Colombia—Cordoba (on the Caribbean coast), Cundinamarca (in the central sierra) and Meta (eastern savanna). IEG interviewed farmers and staff of the regional implementing agencies in each location. A preliminary list of sites to visit was proposed by IEG and PRONATTA arranged visits to a subset of the projects on that list, selection based on time and logistical considerations. In addition to these site visits, IEG drew a random sample of the 93 subprojects completed between 1999 and 2004. PRONATTA supplied documentation on each of these subprojects from its archive. IEG also drew on an institutional impact assessment (Echeverri Perico, 2002) and an economic impact assessment (Sain, 2004). In addition, IEG polled groups familiar with the project (PRONATTA staff, CORPOICA staff, and service providers, such as NGOs and universities) to determine how positively they rated the various aspects of the competitive fund model. The poll items were the same for each of the four Latin American countries included in this IEG assessment and the results are presented in the overview report, which compares findings across the four countries and derives lessons.

OBJECTIVES AND COMPONENTS

8. “As part of Government's National Agricultural Technology Transfer Program, the Project aims to achieve the following objectives:

1. Based on a 2005 estimate from the Inter-American Institute for Agricultural Cooperation (IICA), cited in World Bank (2005a), p. 106.

2. ASTI (2008), p. 9.

3. Beintema & Stads (2008).

- (a) Introducing a new approach, in support of the National System for Agricultural Technology Development and Transfer, including with measures to build institutional capacity, which would promote the development and testing of technical packages especially appropriate for small farmers, and to develop new technology;
- (b) Promoting private sector participation in agricultural research;
- (c) Improving the quality and efficiency of agricultural research by introducing a demand-driven, competitive selection system that would co-finance projects with universities and private and public sector entities;
- (d) Support decentralization of agricultural research and extension activities by strengthening regional centers, training agricultural extensionists, and disseminating information;
- (e) Revitalizing underused assets, both physical and human, that presently exist within Colombia's research services system".¹

9. The project supported three types of research. Strategic research encompassed subprojects directed toward medium-term national priorities, and was expected to lead to applied and later possibly adaptive, research. Applied research supported subprojects of potential immediate use to farmers (in such areas as sustainable production systems, integrated pest management, post-harvest technologies, fisheries, and environmental management). Adaptive research took the results of applied research and adjusted them, as necessary, to local conditions, through field trials typically involving extension personnel (notably, UMATA staff) and farmers. Support to the three types of research was expected to amount to US\$54 million, or two-thirds of project costs (Table 2).

10. The project objectives and components included elements of extension but without comprehensive support to the institutional apparatus of extension services (which was assumed to be provided for outside the project through the network of local government extension agencies, or UMATA). Thus, the project financed training of UMATA staff and other extension professionals, while also funding information diffusion through meetings, field days, radio and television spots, and publications. The training subcomponent was expected to absorb 17 percent of project costs (Table 2).

Table 1. Expected and Actual Cost of Components

Component	(A) Expected cost (US\$ million)	(B) Actual Cost (US\$ million)	(B)/(A) (%)
(a) Technology Development & Adaptation	53.6	46.3	86
(b) Institutional Development	30.4	24.6	81
(Management & Coordination)	(5.7)	(8.3)	146
(Supervision & Panels)	(8.2)	(2.2)	27
(Training)	(14.0)	(14.0)	100
(Information System)	(2.6)	(0.1)	4
(c) Disaster Relief	NA	15.0	-
Total project cost	84.0	85.9	102

Source: ICR (2004). NA Not Applicable (at appraisal). Following a severe earthquake in January 1999, the Bank acceded to the government's request to devote US\$15 million from the project to disaster relief.

11. Objectives and components were not revised during implementation but US\$15 million was reallocated to disaster relief (following the 1999 earthquake) and US\$4.2

1. World Bank (1995), p. 9.

million was canceled, mainly because of a shortfall in government counterpart funding for subprojects.

PROJECT INSTITUTIONAL FRAMEWORK

12. Oversight of PRONATTA was vested in an Executive Council, led by the Vice-Minister of Agriculture responsible for policy coordination and including the heads of the national science foundation (COLCIENCIAS), the Integrated Rural Development program (DRI) and the Agricultural Unit in the Department of National Planning (DNP). A project management unit, housed in the Ministry of Agriculture, served as the administrative arm of the Executive Council, reporting to the Vice-Minister. A National Panel of technical experts, including representatives from the universities and private sector, was appointed by the Council to review, select, validate, and adjust all research and training subproject proposals implemented under the Project. The National Panel presented the portfolio of selected subprojects to the Council for approval, based on submissions from five Regional Panels which served as the first subproject selection filter.

13. The Regional Panels were intended to ensure that subprojects responded to local priorities and, in particular, the needs of small-scale farmers. Each regional panel contained up to five professionals, appointed by the Executive Council on recommendations from the Agricultural Secretariats in the administrative regions. The work of the Regional Panels was supported in turn by five field-level coordination units responsible for promoting and administering the first rounds of the competitive process. Strategic research subprojects were vetted solely by the National Panel; all other research and extension training subprojects passed through the Regional Panels.

14. Under the follow-on project (PTA), the project management unit remained housed in the Ministry of Agriculture. The staff changed and continued to be recruited from outside the Ministry. The unit remained the same size and still reported to the Vice-Minister. The PRONATTA apparatus of panels and regional coordinating units was replaced by a new structure built around 20 primary production chains. Each of the chains had its own Regional Council and Technical Secretariat. The selection of subprojects was guided by research agendas prepared for all 20 of the targeted production chains. The research agendas were intended to be long-term and strategic in nature and to counter the tendency in the previous project to disperse resources across a wide range of subprojects that were not always well linked to markets or based on sound business plans. The small farm focus of PRONATTA was retained but the extension training element was dropped. Instead, there was a new initiative to strengthen plant and animal health regulatory bodies (including ICA), partly to facilitate access to US markets under the prospective free trade agreement.

Relevance

15. Relevance assesses the appropriateness of project development objectives in relation to country priorities and Bank country and sector strategies; and the suitability of project design for achieving project objectives.

RELEVANCE OF OBJECTIVES

16. In the early 1990s the government pushed to open up the Colombian economy and the initial impact on the agriculture sector was devastating: output contracted sharply following the removal of tariffs and the scaling back of protection. It was therefore imperative to take measures to boost agricultural productivity. PRONATTA responded to that need by seeking to make agricultural research more efficient and more relevant. The appraisal report noted that past agricultural research projects in Colombia had been overly academic, failing to meet the research needs of small farmers. PRONATTA sought to address that issue. The continuing relevance of project development objectives to Bank-wide agricultural strategy is equally clear: the best expression of this is the inclusion of specific modules on public/private sector roles and competitive funds in the research and extension chapters of the ‘good practice manual’ issued by the anchor in 2005.¹ IEG rates the relevance of project objectives as **substantial**.

RELEVANCE OF DESIGN

17. The institutional framework for the project (concisely and lucidly set out in the appraisal report) was fully in line with the Bank’s conception of good practice in agricultural research, and remained so throughout project implementation. The system of national and regional panels encouraged a rigorous and transparent selection of subprojects. Although project coordination was not run by career professionals in the Ministry of Agriculture, the oversight arrangements entailed by the Executive Council allowed for project results to be owned and incorporated by the Ministry (and the Department of National Planning). The administrative autonomy of the project coordinating unit probably ensured that subproject approvals and disbursements were handled more speedily than if the Ministry had been directly responsible.

18. There was one problem with the design arrangements. PRONATTA excluded municipal extension units (UMATAs) as implementing agencies of subprojects (treating them purely as beneficiaries of training provided by the project).² This possibly reduced the prospects for a smooth transfer of technology. On the other hand, leaving out the UMATA’s may have been a pragmatic decision, based on the early evidence of their underfunding and patchy coverage.

19. Despite this caveat, on balance the relevance of project design is rated **substantial**.

Efficacy

20. Efficacy assesses to what extent the project’s stated objectives were realized. This report systematically analyzes whether the expected inputs, outputs and outcomes actually materialized (the results chain). This provides a basis for the subsequent discussion of progress toward objectives. To the extent possible progress toward objectives is assessed against evidence bearing on intermediate and final outcomes

1. World Bank (2005a).

2. Sain (2004), p. 30.

Table 2. Results Chain—Expected Inputs, Outputs and Outcomes

Inputs (Components)>	Outputs>	Intermediate Outcomes>	>Final Outcomes
<p>(1) Technology Development and Adaptation Strategic and Applied Research Subprojects, 60 percent loan financed (US\$26.8 million)</p> <p>Adaptive Research Subprojects, 50 percent loan financed (US\$26.8 million)</p> <p>(2) Institutional Development Management and Coordination Unit (MCU);</p> <p>National and regional panels to screen subprojects; Technical assistance for subproject preparation (US\$7.1 million)</p> <p>Regional coordinating units (US\$9.6 million)</p> <p>Training, to manage subproject identification, preparation and implementation (including training in extension) (US\$11.1 million)</p> <p>Technology Information System (US\$2.6 million)</p>	<p>MCU established and Operational Manual prepared before loan effectiveness</p> <p>Annual Operating Plans (POAs) prepared by MCU</p> <p>Executive Council established, representing Ministry of Agriculture, National Science Foundation (Colciencias) and National Planning Department (DNP)</p> <p>At least 3 regional panels and 3 coordinating units set up within 6 months of loan effectiveness</p> <p>Agricultural Development Plans (ADPs) prepared by municipal extension units (UMATAs) following meetings between the farmers, UMATA staff, and the mayor of each municipality [1,000 municipalities]</p> <p>ADPs consolidated at the departmental level into zonal plans [31 departments]</p> <p>Subproject proposals reviewed by National Panel and approved by Executive Council</p> <p>Subproject proposals screened for environmental impact by Panel and MCU</p> <p>Completion reports prepared for each subproject by respective implementing agency</p> <p>Midterm review by Bank conducted no more than 30 months after loan effectiveness; Operational Manual modified in light of findings</p> <p>Plan for Future Operation of project institutions submitted by government within 6 months of loan closing</p>	<p>More efficient process for agricultural research</p> <p>Increased co-financing of subprojects by private sector and universities (13 percent of total project cost)</p> <p>Enhanced collaboration between public and private research agencies</p> <p>Better linkage between research and extension, with increasing responsiveness to small-scale farmer needs (building on existing UMATA/DRI extension system “that works very well” , SAR, p. 28)</p>	<p>Help some 350,000 farmers by improving yields, introducing higher value crops, and promoting environmentally sound practices</p> <p>Increase incomes and employment for farmers, laborers, and the rural population at large</p> <p>[The project is described as a targeted intervention, with small-scale farmers the primary beneficiaries, SAR, p. iii]</p>

Source: PAD, Annex 1.

(defined in Table 2). Where such evidence is lacking or insufficient, IEG considers data on outputs, considering whether there are plausible grounds for arguing that delivery of those outputs has led (or is likely to lead) to the expected outcomes.

21. The chain of expected inputs, outputs and outcomes (Table 2) is derived from the PAD. According to the ICR, during implementation the project's objectives and components were not changed and the project was not formally restructured. Therefore, the Table 2 results chain is a valid template for the ex-post evaluation. Each of the next sections begins with a presentation of ICR material bearing on the results chain, followed by a discussion of the relevant IEG findings.

INPUTS

22. Owing to the disaster relief reallocations, actual spending on the original project components was 83 percent of what was expected. The ICR shows that the main cutback was applied to regional strengthening (down by US\$9.6 million, or 12 percent of expected total project cost).¹ Development of the information system was also squeezed. The cuts applied to the Bank's share of project funding, not to the government contribution.

OUTPUTS

23. The Executive Council was set up as planned, along with the national panel. The target for regional panels was exceeded—with 5 being established, not 3 as originally envisaged. Six funding rounds were realized, resulting in the financing of 636 subprojects (Table 3). The ICR made no reference to the municipal agricultural development plans that were envisaged in the appraisal report (see Table 2 above); and IEG found no evidence of these. But the ICR reported that the UMATAs were strengthened.² It also reported that the number of persons trained (1,256) exceeded the appraisal target (940)—many of these were UMATA agents.³

Table 3. Number of subprojects submitted, evaluated, and approved by funding round

Funding Round	1 st	2 nd	3rd	4th	5th	6th	
Year	1995	1995	1996	1997	1998	2000	
N of subprojects...							Total
...submitted	405	362	507	890	901	714	3,779
...evaluated	181	330	377	776	760	550	2,974
...approved	46	57	68	147	130	188	636
...financed	76*	57	68	140	130	165	636
Approved/Submitted	11%	16%	13%	17%	14%	26%	17%

Source: Ministerio de Agricultura (2003).

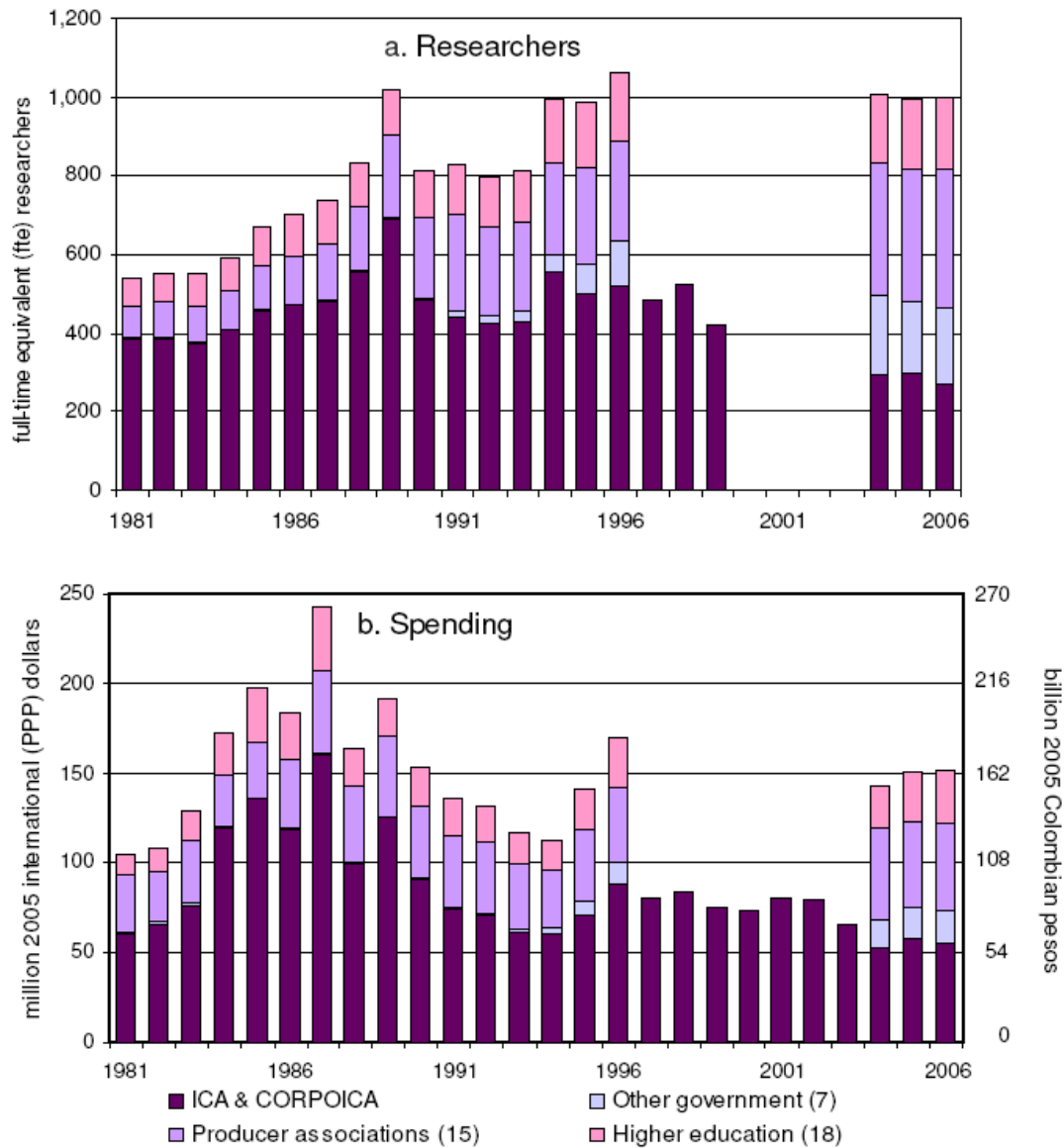
*Thirty subprojects were carried forward from a preliminary funding round conducted in 1994.

1. World Bank (2004), p. 18.
2. World Bank (2004), p. 6.
3. World Bank (2004), p. 16.

INTERMEDIATE OUTCOMES

24. One of the expected outcomes was a diversification of research providers. There has, indeed, been diversification in Colombia but: first, the level of diversity was already high before PRONATTA (the role of producer association research institutes has long been notable); second, diversification has mainly involved reallocation between the various nonprofit agencies (including government) with limited involvement of private-for-profit firms; and third, the level of diversification induced by PRONATTA was actually less than for the public agricultural research system as a whole—with producer associations and universities being relatively underrepresented.

Figure 1—Composition of public agricultural R&D staff and spending, 1981-2006



Source: Stads & Romano/ASTI (2008), p. 6.

25. Figure 1 shows how, over the long term, the share of government in nonprofit research has declined, with a sharp fall in the number of CORPOICA researchers.¹ Table 4 compares PRONATTA with the overall system of public research capturing the more limited role that producer associations and universities played in PRONATTA. Notable was the high proportion of projects approved for temporary unions between nongovernment natural resource organizations and farmer groups. However, according to researchers interviewed by IEG, these unions sometimes only existed on paper: the farmers who originally signed up were poorly informed about what was going on and not interested to participate actively in the subproject because they saw little immediate benefit to themselves.²

Table 4. Agencies Conducting Public Agricultural Research

<i>Research Agency</i>	<i>Share of Spending on Public Agricultural Research (%)</i>	
	<i>(a) PRONATTA Subprojects (2001)</i>	<i>(b) All Agricultural Research (2006)</i>
CORPOICA	35	35
Other government	4	13
Producer Associations	5	34
Universities	9	19
Others	47*	-
Total	100	100

Source: (a) Echeverri Perico (2002), pp. 11-12; (b) Stads & Romano (2008), p. 1.

*Comprises the following agencies: temporary unions between communities and various implementing agencies—mainly NGOs (29 percent); NGOs (12 percent); and unidentified others (6 percent)

26. One of the concerns is that there were gaps in research coverage inherent in this pattern of participation. In the view of one influential commentator, CORPOICA should fill the gaps left by the commodity-specific research institutes (CENIs) associated to the various producer associations; but CORPOICA is failing to do so.³ Given the limited engagement of producer associations with the competitive process during PRONATTA's implementation there was little scope for identifying these gaps. (Under the follow-on project, PTA, engagement picked up substantially.) Not all commodities have their own CENIs (fruit and horticulture crops are underserved). Some producer associations (e.g. FEDEGAN, which represents beef producers) have the means to fund research but have chosen not to do so. Many small-scale, subsistence-oriented, producers are not represented by producer associations. The competitive model is not, by itself, able to resolve these various expressions of patchy coverage.

27. The producer associations are nonprofit private entities. Data on research by private-for-profit companies is hard to come by but this source of research funding is probably limited in Colombia; and was largely absent from PRONATTA. Private firms prefer to import technology rather than develop it in Colombia. "Many multinational agro biotech companies use Colombia as a base of operations for the

1. Stads & Romano (2008), p. 6.

2. This is based on IEG interviews with CORPOICA staff members in November 2008.

3. This is based on IEG's November 2008 interview with the Sociedad de Agricultores de Colombia, an apex institution with which most producer associations in Colombia are affiliated.

Andean and Central American region but have a comparatively small local R&D component that focuses largely on the testing and screening of improved germplasm developed elsewhere”.¹ Multinationals account for less than 5 percent of Colombia’s full-time agricultural research staff.²

28. Finally, was the link between research and extension strengthened? All the evidence from interviews and field visits staged by IEG suggests that this was not the case. Once subprojects were complete, the path to adoption of useful findings by farmers was unclear to the IEG mission. Indeed, the government now acknowledges the need to strengthen technology transfer.³

FINAL OUTCOMES

29. According to the ICR, PRONATTA met its appraisal target of benefiting 350,000 farmers (200,000 of these being served “indirectly”, based on estimates of spillovers to neighboring producers); 98 percent of subprojects had satisfactory outcomes; and the average annual household income of producers increased by US\$ 1,533 as a result of adopting technologies developed under the project. The weakest region in terms of subproject development and performance was Costa Caribe. The rate of return of its subprojects was lower than other regions and subprojects were also less likely to be profitable.⁴ IEG was not able to substantiate these estimates owing to methodological concerns about the 2004 report on which they are based (see “Efficiency” section below) and the absence of a more rigorous impact evaluation in the period since the loan closed.⁵

ACHIEVEMENT OF PROJECT OBJECTIVES

30. IEG rates the achievement of the specific objectives of the project as follows:

- (a) “Introducing a new approach, in support of the National System for Agricultural Technology Development and Transfer, including with measures to build institutional capacity, which would promote the development and testing of technical packages especially appropriate for small farmers, and to develop new technology” (*Rating: Substantial*). PRONATTA supported the National System (particularly CORPOICA) and, based on the random sample of subprojects reviewed by IEG, most of the initiative sponsored were appropriate for small-scale farmers.
- (b) “Promoting private sector participation in agricultural research” (*Rating: Modest*). Private nonprofit agencies (producer associations and NGOs) participated to a lesser extent in the competitive funds model than their participation in the overall research system. (Also, producer association

1. Stads & Romano (2008), p. 5.

2. Beintema et al (2006), p. 302.

3. Ministerio de Agricultura/Departamento Nacional de Planeación (2007), p. 27.

4. Sain (2004), p. 22.

5. The Bank Region’s management reported that an impact assessment study is being planned.

funding of CORPOICA is negligible.) Private for profit institutions barely participated at all in the subproject competitions—and their support of the total package of agricultural research funding is, by all accounts, insignificant.

- (c) “Improving the quality and efficiency of agricultural research by introducing a demand-driven, competitive selection system that would co-finance projects with universities and private and public sector entities” (*Rating: Substantial*). The competitive grants scheme was well designed, placing a premium on rigor and transparency in the selection of subprojects. IEG’s poll of knowledgeable informants (which included a large number of researchers) found that a majority considered research quality under the demand-driven model to be sound. There was substantial co-funding of research subprojects by NGOs and beneficiaries (Table 4). Co-payments (by implementing agencies) somewhat exceeded the 50 percent level specified at appraisal.
- (d) “Support decentralization of agricultural research and extension activities by strengthening regional centers, training agricultural extensionists, and disseminating information” (*Rating: Modest*). The regional capacity building and information system components were cut back (and project-specific regional institutions were dismantled at project end). The project trained several local extension professionals.
- (e) “Revitalizing underused assets, both physical and human, that presently exist within Colombia’s research services system” (*Rating: Substantial*). PRONATTA provided a boost to CORPOICA (which won more subproject contests than any other entity), helping to ensure that its staff and infrastructure were more fully used than they might otherwise have been.

31. Weighing up these ratings, the project’s progress toward its objectives (efficacy) is rated as **substantial**.

32. How highly did PRONATTA itself rate the subprojects? The project management unit developed a validated self-assessment system where each subproject was rated on five dimensions by the implementing agency at project completion; based on information in the completion report the coordinating unit could endorse the proposed score or propose an alternative (Table 5).

Table 5. Self-Assessed Ratings of a Random Sample of Subprojects

N of Subprojects	CORPOICA	Other Agency	Total
Not Rated	12	29	41
Low Rating (0.0-2.5)	2	3	5
High Rating (2.6-5.0)	20	27	47
Total	34	59	93

Source: PRONATTA database

Note: Refers to the overall rating assigned by the Project Coordinating Unit based on review of the subproject completion report.

33. Table 5 shows that:

- There were gaps in the self-assessment: 44 percent of the sampled subprojects were not rated.

- CORPOICA subprojects were more likely to have been self-assessed: they accounted for 37 percent of all subprojects in the sample; and 29 percent of those not rated.
- CORPOICA subprojects were more likely to be highly rated: they accounted for 37 percent of all subprojects in the sample; and 43 percent of those that were highly rated.

Efficiency

34. No rate of return was estimated at appraisal. This was a demand-driven project, making it impossible to determine *ex ante* what subprojects would be financed. A 2004 ‘impact evaluation’ estimated the economic returns to PRONATTA based on a random 17 percent sample of subprojects (N=106), stratified by region and by type of subproject.¹ The sample covered two phases of project implementation, comprising 50 subprojects completed on or before January 31, 2001 and 56 projects completed after that date. The mean economic rate of return was 88 percent. This estimate (which was endorsed by the ICR) compares favorably with an earlier estimate of returns for the overall research and extension system in Colombia—50 percent for research and 21 percent for extension.² The rate of return was higher for applied research than (in descending order) for adaptive research and training (Table 6).

Table 6. Economic Rate of Return by Subproject Category (Percentage)

Overall ERR	88
By Project Type	
Adaptive Research	101
Applied Research	66
Training	84
By Region	
Amazonia	103
Centro-Oriente	130
Costa Caribe	40
Occidente	59
Orinoquia	93
By Executing Agency	
University	68
NGO	43
Temporary Alliance	122
Mixed	68
Other	21

Source: Sain (2004)

35. There are some problems with the 2004 study. The information on the subprojects was obtained not from farm-level surveys of subprojects but from ‘expert estimates’, based on the parameters of ‘typical’ subprojects. This was not an independent evaluation: the experts comprised persons with “direct experience of PRONATTA, including subproject implementing agencies, beneficiaries, and

1. Sain (2004).

2. Romano (1987).

selection panel members”.¹ Such persons may have had a vested interest in putting a positive gloss on subproject outcomes. A further weakness is that the project coordinating unit took no steps to conduct a performance audit of a random sample of subprojects, its work primarily being limited to administering disbursements.²

Table 7. Subprojects—Total Spending, Mean Size and Funding Sources

	(a) All Subprojects (N=636)	(b) IEG Sample (N=94)
Total spending on subprojects (millions of current pesos)	65,589.7	15,757.4
Mean spending per subproject (millions of current pesos)	103.1	167.6
Share of subproject cost covered by PRONATTA (World Bank) ('cofinanciacion')	42%	48%
Share of subproject cost covered by executing agency ('contrapartida')	58%	52%

Source: (a) Ministerio de Agricultura (2003), p. 27 & p. 31; (b) PRONATTA database. (Mean exchange rate: US\$1.00 = 1,750 pesos).

36. There are various efficiency concerns. First, there is the question of whether the projects were too small and too diffuse to have critical mass. According to the appraisal report, subprojects should not run for more than three years and their cost should not exceed US\$50,000 per year.³ Assuming a ceiling cost of US\$150,000 per subproject, the actual mean cost per subproject was well below this threshold: US\$58,914, based on the universe; US\$95,771 based on IEG’s random sample of subprojects (Table 7). Second, the accounting of subproject costs was problematic because a large part of the co-payment was rendered in kind not in cash. The cash proportion of co-payments by implementing agencies averaged 11 percent and had fallen as low as 3 percent by 2008.⁴ Third, selection of subprojects took little account of business plans and capacity for self-financing, and PRONATTA made no provision for operation and maintenance costs—making it more likely that subprojects would disappear once project funds dried up. The inability of IEG to find field evidence of randomly sampled (non-CORPOICA) subprojects (see Section 6) suggests that many have indeed disappeared.

37. Based on these considerations, IEG rates efficiency as **modest**.

Project Development Outcome

38. Adding up the component criteria assessed above IEG rates project development outcome as **moderately satisfactory** (Table 8).

1. Sain (2004), p. 5.

2. This is based on a November 2008 interview with PTA staff.

3. World Bank (1995), p. 47.

4. This is based on an interview conducted by IEG in Colombia in November 2008.

Table 8. Derivation of the Outcome Rating

Relevance	Efficacy	Efficiency	Outcome
Objectives: Substantial Design: Substantial	Objective (i): Substantial		
	Objective (ii): Modest		
	Objective (iii): Substantial		
	Objective (iv): Modest		
	Objective (v): Substantial		
Rating: Substantial	Rating: Substantial	Rating: Modest	Rating: Moderately Satisfactory

Risk to Development Outcome

39. PRONATTA made the case for the competitive fund model. According to the ICR, PRONATTA has had a lasting effect on other institutions. COLCIENCIAS has developed several competitive science and technology funds, five of which are relevant to agricultural research.¹ But there was no provision for subproject sustainability (Box 2). While PRONATTA has developed a viable competitive funds model, there is little or no incorporation of project results in the sector policymaking process and there is no provision for subprojects to become self-financing, meaning that they will surely disappear once PRONATTA funds are used up.² There was limited scope for consolidating lessons learned; or strengthening existing institutions. Only 36 percent of subprojects received feedback or learned lessons from other subprojects.³ The (weak) decentralized extension units (UMATAs) had little interaction with PRONATTA.⁴

40. The failure to make explicit attempts to promote transfer of the technologies developed by PRONATTA has been identified as one of the project's chief weaknesses; along with the limited ownership of PRONATTA by the broader sector policymaking process.⁵ In interviews with IEG, staff from various CORPOICA research stations acknowledged that there were no data on the level of adoption of technologies promoted by PRONATTA subprojects; and no budgetary provision for subproject follow up. One researcher noted that, for bureaucratic reasons, subproject completion reports were sometimes submitted before the results were in. Someone else observed that with respect to an adaptive research subproject designed to promote more effective techniques for reducing tick infestation of livestock, the

1. The National Program for Basic Sciences, the National Program for Agricultural Science and Technology, the National Program for Biotechnology, the National Program for Maritime Science and Technology, and the National Program for Environmental Science and Technology (ASTI (2008), p. 12).

2. Sain (2004), pp. 30-31.

3. Echeverri Perico (2002), p. 13.

4. Echeverri Perico (2002), p. 14.

5. Sain (2004), p. 37.

producers abandoned the new techniques as soon as the subproject ended because “there was no back up in the form of a continuing service of technical assistance”.¹

Box 2. The Competitive Funding Model for Agricultural Research in Colombia: A Critical View from COLCIENCIAS

The Colombian Institute for Science and Technology Development (COLCIENCIAS) has its own agricultural science program and its own experience with implementing a competitive fund model. The leadership of COLCIENCIAS is therefore well-placed to offer an informed perspective on the Ministry of Agriculture’s experience with competitive funds, beginning with PRONATTA and continuing with PTA. (COLCIENCIAS was represented on the committees charged with oversight of both PRONATTA and PTA.)

COLCIENCIAS staff interviewed by IEG expressed the view that the competitive fund model is superior to the previous arrangements where research funds were directly assigned by government. This previous model lacked transparency and rigor and sometimes promoted research that was not relevant to producers and consumers. The competitive funding model has improved over time. As it has moved away from funding of diffuse subprojects to those linked to production chains, there is more uptake of findings by producer associations.

But the model has a number of limitations. First, in the case of PRONATTA/PTA specifically, the available funds cover the investment costs of subprojects, but neglect operation and maintenance costs and do not include value added tax, factors that reduce the pool of service providers able or willing to compete, even serving as a disincentive to CORPOICA participation. [The Ministry of Agriculture responded that, under PTA, 10 percent of the financing provided by the Ministry to subprojects can be used for operation and maintenance; it also noted that *public* universities, at least, do not pay value added tax].

Second, the competitive model neglects basic research and tends to overlook cross-cutting themes relevant to a wide range of subprojects. Adaptive research subprojects might, for example, derive fertilization techniques from old US textbooks while neglecting fundamental issues of soil chemistry specific to Colombia; the soil constraints are common to many subprojects but learning is often not shared between them. In general, producer associations are not interested in helping to fund basic research with a long-term payoff, limiting their attention to immediate problems (e.g. white fly infestation).

Third, a random sample of the subprojects that receive financing needs to be audited, providing a check against inappropriate use of funds. The cost of these audits is typically not built into the funding model. Fourth, the norms applied to competitive funds in Colombia stipulate that there be a mandatory evaluation of impact; but this is not always carried out. [PRONATTA/PTA has not been subject to rigorous impact evaluation; CORPOICA staff told IEG that there are “never any funds for impact evaluation”]. COLCIENCIAS establishes norms in this respect but does not have regulatory powers.

Source: IEG interviews in Colombia with staff at COLCIENCIAS in November 2008.

41. IEG drew up a random sample of subprojects to visit. None of the subprojects involving implementing agencies other than CORPOICA could be traced. Based on the contact addresses and phone numbers given when the subproject was approved an attempt was made to locate persons associated with the subproject. These persons either could not be found; or they reported that the subproject was no longer operating. Also, the internet database set up to facilitate the search for agricultural research innovations (Agricultural Technology Information System or SITA) has been shut down. These findings suggest that although the project was successful in terms of the process for producing research, and in terms of the number of subprojects delivered, its long-term

1. This is based on IEG’s November 2008 interviews with CORPOICA staff.

impact was probably less than intended. Results were somewhat diffuse. Nevertheless, significant learning was accomplished in the course of PRONATTA implementation. This led to improvements to the design of the follow-on project, PTA. The impact of PTA is likely to be less diffuse than PRONATTA because the project targets selected production (or “value”) chains. The Ministry of Agriculture is emphasizing the chains most likely to be affected by the Free Trade Agreement with the United States, aiming to enhance Colombia’s competitiveness. This focused approach is less risky than the previous, scattershot method. Under PTA an attempt has been made to be more strategic in selecting subprojects, taking into account the recommendations from a series of commodity-specific issues papers (“Agendas”) that are keyed to the value chains. Although there has been some delay in the preparation of the Agendas, IEG found the general approach to be sound.

42. There are other factors which increase the prospects for sustainability of the competitive fund model. First, the broader trend toward decentralization that has been evident for several years in Colombia is consistent with the general terms of the model. Second, the public research apparatus of CORPOICA has the installed capacity to be a strong contender in future funding rounds and by participating it will tend to pull up the level of competition. Building on experience under PRONATTA, CORPOICA has developed an internal competitive system for research funding, which amounts to a pre-qualification of bids submitted in the subproject funding rounds. Third, the follow-on project has introduced an improved model for co-financing by the producer associations. These associations are well placed to contribute to technology transfer (helping to make up for the deficiencies in the UMATA extension system). Broader engagement with the producer associations will help to strengthen private sector development, increasing the competitiveness of Colombian agriculture. Fourth, the follow-on project has been implemented in close coordination with the Ministry of Agriculture (facilitated by locating the project management unit in the Ministry). Last but not least, government funding for agriculture has increased significantly in the past couple of years, partly driven by the government’s commitment to enhance rural security—through the Agro-Ingreso Seguro program. The Ministry of Agriculture has allocated at least double the amount of resources that the Bank has assigned through the follow-up project, a significant measure of its commitment to the competitive fund model. In short despite concerns about the sustainability of results generated by individual subprojects financed under PRONATTA, IEG finds that in the light of progress since that loan closed the appropriate rating for Risk to Development Outcome is **moderate**.

Monitoring & Evaluation

43. IEG sought to evaluate how far the self-assessment process had matured by the end of the project. From its initial sample of 94 subprojects, IEG randomly selected 11 of the 24 subprojects evaluated by PRONATTA in 2003-2004. Table 9 summarizes salient information from the completion reports of these 11 subprojects. The number of adopters averaged 28 percent of the population served (with two out of the eleven subprojects recording neither persons served nor adopters). There is no correlation between the overall rating assigned to the subproject by the PRONATTA self-assessment or the level of adoption. The logic of the rating system is hard to

fathom because some projects with no or low adoption are rated relatively high. (This may cast doubt on the soundness of the overall reckoning that 94 percent of completed subprojects had performed satisfactorily.)¹ Eight out of the 11 subprojects that fell in the sample were implemented by CORPOICA, higher than that agency's overall share of subproject implementation (35 percent).

Table 9. Subprojects randomly selected by IEG (from 2003-2004 evaluation cycles)

Subproject Project ID	Overall Self-Assessed Rating (Scale: 1.0-5.0)	Number of People Served	Number of people adopting by subproject end	Cost (millions of current pesos)	Executing agency	Type of subproject
201251020	4.5	39	28	340.4	CORPOICA	Adaptive
201763424	4.2	11	30	339.0	University	Adaptive
201504040	3.9	400	350	341.4	CORPOICA	Applied
201681150	4.4	1,628	14	336.1	CORPOICA	Adaptive
201442037	3.8	975	200	339.1	CORPOICA	Adaptive
201854008	3.6	1,536	600	188.7	CORPOICA	Applied
201232011	3.5	--	--	338.8	CORPOICA	Applied
201523519	4.2	464	160	332.1	CORPOICA	Applied
201472111	3.4	232	37	316.9	CORPOICA	Adaptive
201082081	1.7	--	--	249.6	NGO	Adaptive
201193032	4.0	345	132	296.0	NGO	Applied
Mean	3.7					

Source: PRONATTA database

Mean 2003-2004 exchange rate: US\$1.00 = 2,755 pesos

44. There is little evidence that the present staff coordinating PTA has built on evaluation lessons learned from PRONATTA. (Staff responsible for M&E arrangements under the follow-on project told IEG that they had not examined the PRONATTA model.) Although a coordinating unit for the two projects has existed in the Ministry of Agriculture since 1995 it is not apparent that there has been any cumulative development of evaluation capacity. While the management information system allows for effective tracking of subproject disbursements, no systematic approach has been designed for capturing impacts.

45. There was no rigorous independent impact evaluation of PRONATTA and, despite repeated Bank requests, little progress toward conducting such an evaluation for PTA.² Following a PTA supervision mission in September 2008 the Bank reported, "None of the members of PTA [i.e., the coordinating unit] has had experience in conducting impact evaluations, or has received relevant academic training, or has had close contact with persons or institutions that have realized impact evaluations...PTA needs to identify ways to acquire this expertise".³ The

1. Ministerio de Agricultura (2003), p. 27.

2. World Bank (2008), pp. 9-10; World Bank/Ministerio de Agricultura (2008); Consejo Privado de Competitividad (2008), p. 165.

3. World Bank (2008), p. 1.

neglect of impact evaluation is also evident at CORPOICA. In a videoconference with CORPOICA research stations, IEG asked how many stations had conducted impact evaluations: five out of eight responded that they had no experience of rigorously evaluating the effect of the technologies they developed. Lack of budget and an outlook characterized by ‘short-termism’—these are the reasons given for neglecting impact evaluation.

46. IEG rates monitoring and evaluation as **modest**.

Bank Performance

QUALITY AT ENTRY (RATING: SATISFACTORY)

47. The design of PRONATTA was fully consistent with government and Bank strategy for Colombia and was also in accord with thinking on good practice for agricultural research projects. Problems associated with the weakness of the municipal extension agencies (UMATA) were not the responsibility of those who designed the project. The Executive Council was a sound way to ensure representation of key government constituencies in project oversight.

SUPERVISION (RATING: SATISFACTORY)

48. Field visits by the Bank in Colombia were seriously constrained by the security situation. Between approval of the project in April 1995 and February 1997 there was only one supervision mission (involving just the task team leader).¹ This was a critical period because three of the six subproject contests were completed by the end of 1996. But after that supervision shifted to the regular two missions per year cycle, and was well staffed with 3-5 persons taking part in each mission. The Bank’s project team had a close and productive dialogue with the Ministry of Agriculture throughout the implementation and together with it played an important role in advocating for the project following the 1999 earthquake when there were demands in some government quarters to use a larger share of project funds for disaster relief.

49. The overall rating of Bank Performance is **satisfactory**.

Borrower Performance

GOVERNMENT (RATING: SATISFACTORY)

50. The government gave its full support to the preparation and implementation process, and counterpart funding was generally in line with appraisal expectations, although the Ministry of Finance was sometimes late in releasing the budget. The Ministry of Agriculture and the National Department of Planning remained closely engaged with the project throughout the period of preparation and implementation and have continued to show a high level of commitment.

1. World Bank (2004), p. 22.

IMPLEMENTING AGENCY (RATING: SATISFACTORY)

51. The project coordinating unit was well staffed and, for the most part, managed the process for selecting subprojects and supervising disbursements expeditiously. The ICR notes that the coordinating unit was implicated in the delay in implementing the 2000 cohort, resulting in a summary winding up of 94 subprojects in order to meet the three-year deadline specified by the project design.¹ More attention could have been given to tracking subproject outcomes (rather than the narrow focus on financial performance) but, once again, IEG acknowledges that the security situation in Colombia reduced the scope for field visits. Following the 1999 earthquake the PRONATTA were effective in advocating for the project, which reduced the volume of project resources diverted to disaster relief.

52. The overall rating of Borrower Performance is **satisfactory**.

1. World Bank (2004), p. 10.

Appendix A. Basic Data Sheet

AGRICULTURAL TECHNOLOGY DEVELOPMENT PROJECT (LOAN NO. 3871)

Key Project Data *(amounts in US\$ million)*

	<i>Appraisal estimate</i>	<i>Actual or current estimate</i>	<i>Actual as % of appraisal estimate</i>
IDA Loan	46.8	51.0	109
Cofinancing	0.0	29.9	0
Government	39.0	33.0	85
Total project cost	85.5	113.9	133

Cumulative Estimated and Actual Disbursements *(US\$ million)*

	FY96	FY97	FY98	FY99	FY00	FY01	FY02	FY03	FY04
Appraisal estimate	12.2	20.4	26.5	34.7	44.9	51.0	51.0	51.0	51.0
Actual	1.4	3.2	6.1	13.7	31.7	37.2	42.0	46.6	46.8
Actual as % of estimate	11	16	23	39	71	73	82	91	92

Project Dates

	<i>Original</i>	<i>Actual</i>
Departure of Appraisal Mission		07/20/1990
Appraisal		03/24/1995
Board approval		04/20/1995
Effectiveness	07/20/1995	08/25/1995
Mid-Term Review	10/01/1998	09/14/1998
Closing date	12/31/2001	12/31/2003

Staff Inputs *(staff weeks)*

	<i>Actual/Latest Estimate</i>	
	<i>N° Staff weeks</i>	<i>US\$US\$('000)</i>
Identification/Preparation	106.8	183.0
Appraisal/Negotiation	54.5	174.0
Supervision	99.5	422.0
Completion	9.5	52.0
Total	270.3	831.0

Mission Data

	<i>Date (month/year)</i>	<i>No. of persons</i>	<i>Specializations represented</i>	<i>Performance rating</i>	
				Implementation status	Development objectives
Identification Preparation	1990	1	Agricultural Economist	S	S
	1991	1	Economist	S	S
	1992	3	Economist (2), Financial Analyst	S	S
	1993	3	Financial Analyst, Agriculturalist, Economist	S	S
Appraisal/ Negotiation	09/13/1993	4	Task Manager, Economist, Agriculturalist (2)	S	S
	04/24/1994	7	Task Manager, Agriculturalist, Economist, Financial Analyst, Environmentalist, Counsel	S	S
Supervision 1	11/17/1995	1	Senior Agriculturalist	S	S
Supervision 2	02/05/1997	5	Task Manager, Monitoring and Evaluation, Extension, Research, Financial Specialist	S	S
Supervision 3	03/19/1998	4	Task Manager, Senior Agriculturalist, Research, Financial Specialist	S	S
Supervision 4	09/25/1998	4	Task Manager, Senior Agriculturalist, Agricultural Economist, Financial Analyst	S	S
Supervision 5	06/06/1999	2	Task Manager, Financial Analyst	S	S
Supervision 6	12/09/1999	3	Task Manager, Research Specialist, Financial Analyst	S	S
Supervision 7	05/11/2000	3	Task Manager, Financial Specialist, Rural Development Specialist	S	S
Supervision 8	10/31/2000	3	Task Manager, Financial Analyst, Procurement Specialist	S	S
Supervision 9	01/25/2002	3	Task Manager, Agricultural Economist, Procurement Specialist	S	S
Supervision 10	09/20/2002	1	Task Team Leader	S	S
Supervision 11	02/21/2003	3	Task Manager, Financial Specialist, Procurement Specialist	S	S
Supervision 12	07/25/2003	2	Task Manager, Operations Analyst	S	S
ICR	12/19/2003	5	Task Manager, Agricultural Economist (2), Operations Officer, Project Assistant	S	S

Performance Rating: S: Satisfactory

Other Project Data

Borrower/Executing Agency:

FOLLOW-ON OPERATIONS

<i>Operation</i>	<i>Loan Number</i>	<i>Amount (US\$ million)</i>	<i>Board date</i>
Agricultural Transition	L7313	30.0	28 June 2005

Annex 7: Brazil

Agricultural Technology Development Project

Summary

This report assesses the performance of the Brazil Agricultural Technology Development Project (PRODETAB). The project was supported by an IBRD loan (No. 4169-BR) of US\$60.0 million, which was approved on May 22, 1997. The loan disbursed fully and, after two extensions, closed on December 31, 2005, three years behind schedule.

The project's development objective was to increase the efficiency and sustainability of resource use in the Brazilian National Agricultural Research System (SNPA) by: (a) stimulating the transition in the SNPA from its current heavy reliance on public sector research carried out by the national organization Empresa Brasileira de Pesquisa Agropecuaria (EMBRAPA) to a more integrated and diversified system of Agricultural Research Technology Development and Transfer led by EMBRAPA; (b) increasing the role of clients in the definition of research and technology transfer priorities and implementation; (c) refocusing public sector research on quintessential public goods; and (d) helping EMBRAPA to reorient its current structure to address issues of decentralization and diversification of the SNPA.

The project comprised: (a) a *Competitive Grants* component (planned cost, US\$72.0 million; actual cost US\$54.1 million) financed agricultural research subprojects, based on the rigorous evaluation of proposals from a variety of providers, including universities and agencies in the individual Brazilian states as well as EMBRAPA; (b) an *Institutional Strengthening* component (planned cost, US\$44.7 million; actual cost US\$63.6 million) financed the upgrade of infrastructure at EMBRAPA's various centers and the state research centers, as well as funding training of EMBRAPA staff and the development of links between EMBRAPA and the international agricultural research system and research institutions in the USA and European Union; and (c) an *Administration, Monitoring and Evaluation* component (planned cost, US\$3.3 million; actual cost, US\$1.0 million).

IEG rates **Outcome** as satisfactory. The objectives and the design of the project were substantially relevant, addressing important issues on the agricultural research agenda (including development of family farms and poorer regions) and building on EMBRAPA's solid foundations and research tradition. The project exceeded its targets in terms of the number of subprojects generated and the investments in institutional strengthening—even if there was limited progress on diversification of research providers. The project made an efficient use of resources: output targets were exceeded and actual total project costs were slightly less than expected at appraisal (even though the project closed three years behind schedule). The money used to strengthen EMBRAPA had a clear positive impact on the agency's institutional capacity and undoubtedly benefited the national research effort. Even though the absence of follow-up on PRODETAB subprojects makes it impossible to assess the rate of adoption of technologies and the ultimate impact on incomes and employment, based on an analysis

of risks and assumptions in the results chain, there are plausible grounds to assume that the outputs delivered by the project had a positive farm-level impact.

The **Risk to Development Outcome** is rated moderate. Based on the proportional weight of the project components, PRODETAB's primary focus was on strengthening the public sector research system. The project helped strengthen EMBRAPA's staff and infrastructure, as well as building up the state research agencies and other research providers. These achievements have been sustained since the loan closed, making for an overall strengthening of Brazil's capacity to continue as a major player in the international agricultural research field.

IEG rates **Bank Performance** as satisfactory. Quality at entry and supervision were generally sound and the Bank provided first-rate technical support throughout the design and implementation phases. More attention could have been paid, however, to developing an outcome-oriented system of monitoring for the competitively-funded subprojects that lent themselves to this approach, as envisaged at appraisal. **Borrower Performance** is also rated satisfactory. The government showed a sustained commitment during preparation and implementation; and EMBRAPA's administration of the project was sound.

The **Lessons** learned from this project are discussed in the main report which draws on IEG's findings about the performance of competitive grant schemes for agricultural research and extension in four Latin American countries (Brazil, Colombia, Peru and Nicaragua). Taking the four countries as a whole, with the exception of Peru, there is a lack of hard evidence about the ultimate impact of the investments made—the extent to which farmers adopted new technologies developed through research and extension subprojects, and the related change in productivity and incomes.

The assessment also concludes that the principle of competition between alternative service providers breaks down where the range of providers is limited (a problem at the municipal level and for small countries) and many of the potential providers lack the skills needed to prepare viable sub-project proposals. The model is more likely to strengthen the strongest players in the field than it is to reduce the disparities between the strong and the weak. Summing up, the competitive fund approach is a useful adjunct to the broader public sector apparatus for agricultural research and technology transfer; it is not a substitute.

Principal Ratings

AGRICULTURAL TECHNOLOGY DEVELOPMENT PROJECT

	<i>ICR*</i>	<i>ICR Review*</i>	<i>PPAR</i>
Outcome	Satisfactory	Satisfactory	Satisfactory
Institutional Development Impact**	Substantial	Substantial	n.a.
Risk to Development Outcome	n.a.	n.a.	Moderate
Sustainability***	Likely	Likely	n.a.
Bank Performance	Satisfactory	Satisfactory	Satisfactory
Borrower Performance	Satisfactory	Satisfactory	Satisfactory

* The Implementation Completion Report (ICR) is a self-evaluation by the responsible Bank department. The ICR Review is an intermediate IEGWB product that seeks to independently verify the findings of the ICR.

**As of July 1, 2006, Institutional Development Impact is assessed as part of the Outcome rating.

***As of July 1, 2006, Sustainability has been replaced by Risk to Development Outcome. As the scales are different, the ratings are not directly comparable. f5/7p

Key Staff Responsible

<i>Project</i>	<i>Task Manager/Leader</i>	<i>Division Chief/ Sector Director</i>	<i>Country Director</i>
Appraisal	Uma J. Lele	Constance A. Bernard	Gobind T. Nankani
Completion	Jorge A. Munoz	Laura Tuck	John Briscoe

Background

1. Brazil accounts for about one-half of total agricultural research expenditures in Latin America, dwarfing the three other countries in this IEG evaluation.¹ In 1996, when PRODETAB, the Brazil project that is the focus of this assessment, was formulated, total spending on agricultural research was 8.5 times higher in Brazil than in Colombia, the next best-equipped country of the four under consideration. Brazil had almost five times as many agricultural researchers as Colombia, and research spending was equivalent to 1.7 percent of agricultural GDP in Brazil compared to 0.5 percent in Colombia.²

2. Agricultural research in Brazil is dominated by the Brazilian Agricultural Research Corporation (EMBRAPA), created in 1973. This public corporation is a semi-autonomous agency that falls under the jurisdiction of the Ministry of Agriculture and (in 2000) derived 94 percent of its funding from government sources.³ In 1996, EMBRAPA accounted for 59 percent of total spending on agricultural research and employed 44 percent of all full-time equivalent agricultural research staff (Table 1). The next largest player was the agricultural research system of the individual states. By comparison, the participation of private (for profit) entities was negligible.

Table 1. Brazil—Composition of Agricultural Research Expenditures and Researchers, 1996

	Number of agencies*	Spending [Million 1999 international dollars /(%)]	Researchers [N of full-time equivalents /(%)]
Public			
EMBRAPA	1	828.4 (59)	2,092.0 (44)
State government agencies	22	286.3 (21)	1,762.4 (37)
Higher education institutions	28	160.3 (11)	559.2 (12)
Nonprofit institutions	5	38.5 (3)	117.0 (2)
CEPEC**	1	24.9 (2)	89.0 (1)
Private			
For profit enterprises	11	56.0 (4)	175.0 (4)
TOTAL	68	1,394.4 (100)	4,794.6 (100)

Source: Beintema, Pardey and Avila (2006), p. 263 and p. 270. *Refers to number of agencies sampled in the ASTI study cited hereby Pardey et al (2006); the percentage shares are adjusted to reflect the assumed weight of each agency in the universe. **Cacao Research Center (a federal government agency).

3. Although EMBRAPA's budget increased almost eight-fold in real terms in the two decades after its creation (Figure 1), there were substantial year-to-year variations in funding that hampered EMBRAPA operations.⁴ The preparation and implementation of PRODETAB (1996-2005) coincided with a downturn in government spending on

1. Pardey et al (2006), p. 257.

2. Pardey et al (2006), p. 362. (EMBRAPA estimates that agricultural research accounted for 1.05 percent of agricultural GDP in 1996, falling to 0.55 percent by 2003. See Alves and de Oliveira (2005), p. 77.)

3. Pardey et al (2006), p. 272.

4. Lele and Bresnayan (2000), p. 167.

EMBRAPA, which was part of a broader process of fiscal retrenchment.¹ The monetary values in Figure 1 include the proceeds of loans such as PRODETAB. These loans were not large enough to offset the government cutbacks; but they nevertheless softened the blow—helping EMBRAPA to keep up its staff training program, for example. (Annual disbursements from the World Bank component of PRODETAB averaged US\$12 million over the five years of the project, just 2 percent of EMBRAPA’s annual budget and around 1 percent of Brazil’s total agricultural research spending.)²

Figure 1. Evolution of EMBRAPA Budget (‘000 Reais of 2006)



Box 1. IEG Approach

During the December 2008 mission to Brazil, IEG interviewed the principal agencies involved in the project (EMBRAPA and the state research institutes). IEG traveled to Brasilia, Fortaleza, Recife and Florianopolis, visiting research stations and field sites in each of these regions. A preliminary list of sites to visit was proposed by IEG and EMBRAPA arranged visits to a subset of the projects on that list, selection based on time and logistical considerations. In addition to these site visits, IEG drew a random sample of the projects sponsored by PRODETAB, focusing on Family Agriculture* and Natural Resources, the two main areas of research. EMBRAPA supplied documentation on each of these projects from its archive, together with a number of related studies. In addition, IEG polled groups familiar with the project (staff at EMBRAPA and the state research institutes and other service providers) to determine how positively they rated the various aspects of the competitive fund model. The poll items were the same for each of the four Latin American countries included in this IEG assessment and the results are presented in the overview report, which compares findings across the four countries and derives lessons.

*"Family Agriculture" refers to small-scale farms, loosely defined—whether poor or less poor. "The number of family farms in Brazil is estimated at 4.3 million, 53 percent of which are located in the Northeast [a poor region], 21 percent in the South [a less-poor region]" (World Bank, 1997, p. 23)

1. Alves and de Oliveira (2005).

2. Pardey et al (2006), p. 276.

Objectives and Components

4. The Project Appraisal Document contains the following statement of development objectives:

“The project seeks to increase efficiency and sustainability of resource use in the Brazilian National Agricultural Research System (SNPA) by: (a) stimulating the transition in the SNPA from its current heavy reliance on public sector research carried out by the national organization Empresa Brasileira de Pesquisa Agropecuaria (EMBRAPA) to a more integrated and diversified system of Agricultural Research Technology Development and Transfer (ARTDT) led by EMBRAPA; (b) increasing the role of clients in the definition of research and technology transfer priorities and implementation; (c) refocusing public sector research on quintessential public goods; and (d) helping EMBRAPA to reorient its current structure to address issues of decentralization and diversification of the SNPA”.¹

5. Table 2 shows the component cost breakdown.

Table 2. Expected and Actual Cost of Components

Component	(A) Expected cost (US\$ millions)	(B) Actual Cost (US\$ millions)	(B)/(A) (%)
(a) Competitive Grants System	72.0	54.0	75
(b) Institutional Strengthening	41.9	63.6	152
(c) Administration, Monitoring and Evaluation	6.1*	1.0	32
Total project cost	120.0	118.6	99

Source: World Bank (2006), p. 31. *Includes physical and price contingencies.

6. Selection of subprojects under the competitive grants system was keyed to five priority areas, consistent with “the objectives of poverty alleviation and environmental sustainability as well as increased productivity and efficiency through access to advanced technologies and increased role for the private sector”: (a) family farms; (b) advanced technologies; (c) natural resource management; (d) agribusiness; and (e) strategic studies.²

7. Grants of up to US\$10,000 were available to help bidders prepare proposals—but award of a preparation grant did not guarantee that a proposal would be approved. Grants for approved projects were either classed as small (US\$25,000-US\$40,000) or large

1. The Loan Agreement formulates project objectives somewhat differently. There is no reference to EMBRAPA’s lead role or the need to focus public sector research on public goods. (“The objective of the Project is to increase efficiency and sustainability of resource use in the SNPA, in order to address SNPA’s deficiencies in the areas of competitiveness, environmental sustainability and poverty alleviation, by: (a) stimulating the transition in the SNPA from its current heavy reliance on public sector research to a more integrated and diversified research system, such transition to be reflected through a more diversified source of funding and increased range of research participants; (b) increasing the participation of agricultural research clients in the definition of technology transfer and implementation; and (c) creating, developing and disseminating knowledge and technologies for the Borrower’s agricultural, forestry and agro-industrial sectors”.)

2. World Bank (1997), p. 22.

(US\$40,000-US\$500,000), the latter reserved for projects with longer gestation lags and a multi-disciplinary focus. Each project was expected to involve from two to five subprojects and at least two institutions, each of which was to execute at least one subproject. The shares of project costs financed by participants were: 10 percent (public agencies other than EMBRAPA), 15 percent (EMBRAPA) and between 20 and 50 percent (private firms, based on their size and financial viability).¹

PROJECT INSTITUTIONAL FRAMEWORK

8. Project implementation arrangements were—at the outset at least—designed to provide a counterweight to EMBRAPA. The National Advisory Council (NAC) was taken out of EMBRAPA and given broader responsibilities for the National Agricultural Research System (SNPA), led by the Ministry of Agriculture. A sub-council of this body, chaired by the President of EMBRAPA, was created to provide oversight of PRODETAB. The transformed NAC was intended to represent both the potential beneficiaries and funders of agricultural research and technology transfer (small and large farmers, agribusiness, environmental, consumer and international trade interests) and the potential suppliers of research including outstanding scientists, representatives of universities and state research and extension systems. An Executive Council (EC), chaired by EMBRAPA, and assisted by a PRODETAB secretariat was responsible for approving the financing of subprojects submitted to it by sub-committees for each of the five priority research areas. The EC had 9 members, 5 from EMBRAPA. The EC and its supporting apparatus was the Bank’s primary interlocutor for the project—meaning that, for all intents and purposes, EMBRAPA was the prime mover behind project implementation, although NAC retained formal veto power. (As it turned out, NAC never had any weight—it was too difficult to convene the members in a timely fashion; there was no real counterweight to EMBRAPA).²

Relevance

9. Relevance assesses the appropriateness of project development objectives in relation to country priorities and Bank country and sector strategies; and the suitability of project design for achieving project objectives.

RELEVANCE OF OBJECTIVES

The Brazilian government has assigned a high priority to agricultural research, treating it as a key element of sector development.³ Thus, in general terms, PRODETAB was relevant to the development priorities established by Brazil. The specific objectives of PRODETAB were also consistent with EMBRAPA’s strategy for 1995-1998, which included a call for “closer collaboration with other institutions in the national agricultural research system”, “promotion of private sector resource mobilization so that EMBRAPA

1. World Bank (1997), p. 22.

2. World Bank (2006), p. 22.

3. World Bank (1997), p. 5.

can focus on more strategic, long-term and interdisciplinary research” and stronger downstream linkages with farmer’s organizations, and state research and extension services”.¹ The overarching goal of PRODETAB was to increase the efficiency of the national agricultural research system; empowering weaker players in the research arena and encouraging competition between them was a plausible way to achieve this. In particular, the appraisal document singled out the need to give a bigger role to the private sector (the extent of whose involvement in research was not well mapped), to bolster the weak state research systems, and to draw more fully on the universities (which contained as many agricultural researchers as the combined federal and state government systems).

10. A report produced by the Bank after the mid-term of PRODETAB implementation gives a clear sense of the trajectory that the project’s framers had in mind for agricultural research in Brazil. First, spending on agricultural research would rise as a proportion of agricultural GDP, mirroring the trend in developed countries. Second, the share of public spending in total spending on agricultural research would fall, while private spending would rise. Third, public research spending would be increasingly limited to quintessential public goods (that is, long-term research generating benefits that are not easily appropriated by the private sector, such as reduced soil erosion). Fourth, universities would capture an increasing share of public research spending, the share of government agencies shrinking correspondingly. Fifth, local and state research and technology transfer systems would assume a bigger role, focusing on applied and adaptive research, while central government agencies would play a smaller role, geared to addressing strategic research needs.²

11. Each of the five trends envisaged bears on the institutional framework for technology development, rather than the higher goal of raising agricultural productivity. This was perhaps a pragmatic accommodation, a reluctance to promise too much in terms of end results when the basis was a series of small, short-term projects. The statement of objectives in the Loan Agreement does, however, single out the need to ensure that agricultural research addressed issues of “competitiveness, environmental sustainability and poverty alleviation”.³

12. But there was a hint of equivocation in the way that the project objectives were framed. EMBRAPA was scheduled to play a more circumscribed role in a diversified system; and yet retain leadership of the system. The first objective cited in the project appraisal document refers to: “(i) stimulating the transition in the National Agricultural Research System (SNPA) from its current heavy reliance on public sector research carried out by...EMBRAPA to a more integrated and diversified system...led by EMBRAPA”. At one level this could mean that the state (through EMBRAPA) would continue to provide the financing but would leave much of the responsibility for conducting research to other agencies. At another level the message could be read as “diversification is fine provided it does not compromise EMBRAPA’s preeminent role in the system”. It is striking that the statement of objectives in Project Appraisal Document

1. EMBRAPA’s strategy is quoted in World Bank (1997), p. 5.

2. Lele and Bresnyan (2000), pp. 163-164.

3. See footnote, p. 135.

makes EMBRAPA's leadership role explicit; but the project objective statement in the Loan Agreement makes no reference to EMBRAPA.

13. IEG gives priority to what is common to, and explicit within, the project objective statements in both the appraisal document and the Loan Agreement: the striving to create a more diversified and better integrated research system. This, rather than the strengthening of EMBRAPA, was the project's primary purpose. Indeed, the appraisal documents notes that while previous agricultural research projects in Brazil had concentrated their support on EMBRAPA, and while "partnerships and competition with other public and private agricultural R&D institutions were limited", PRODETAB was intended to be qualitatively different.¹ Improved diversification and integration of the research system remains today a priority for government and for the country partnership strategy of the Bank,² and for this reason the relevance of project objectives is rated **substantial**.

RELEVANCE OF DESIGN

14. In terms of institutional strengthening, the project had a solid foundation on which to build, simplifying design challenges. First, with the assistance of the World Bank and the Inter-American Development Bank dating back to the 1970s, EMBRAPA had not only built but also managed to maintain excellent research facilities and a well-trained research staff (43 percent with PhDs). Second, Brazilian agricultural scientists had experience in preparing high-quality research proposals and competing. Third, EMBRAPA could take account of lessons learned from previous Brazilian competitive research schemes in areas of science and technology outside agriculture.³

15. Above all, PRODETAB made sense for EMBRAPA. The introduction of a competitive grant scheme gave EMBRAPA greater funding flexibility and the opportunity to build new partnerships. The new Brazilian Constitution of 1998 limited the allocation of federal resources to states, and these cuts disrupted the partnerships that EMBRAPA had previously created with state research centers through the medium of its leadership on the National Agricultural Research System.⁴ PRODETAB offered a way round this impasse.

16. The biggest design challenge was how to draw on EMBRAPA's strengths without crowding out the other players in the national research system. The design of the project

1. World Bank (1997), p. 6.

2. According to the 2008-2011 Country Partnership Strategy, "The partnership of EMBRAPA and the private sector has been successful in developing high-yielding, regionally adapted, and conservation-focused technologies for Brazil's tropical agriculture. EMBRAPA, the private sector, state extension agencies and NGOs need to step up these public-private partnerships to mainstream these and future by developing innovative organizational and financial mechanisms... The Bank would also continue its historically strong relationship with EMBRAPA, with the goal of promoting public-private partnerships for the formation of productive market chains and for development of technologies for adaptation of agriculture to climate change", World Bank (2008), Annex, pp 29-31.

3. Lele and Bresnyan (2000), p. 166.

4. Reifschneider (2000), p. 78.

ultimately consolidated EMBRAPA's preeminence. Although the designers of the project took the National Advisory Committee out of EMBRAPA, NAC proved to be a dead letter. On the other hand, EMBRAPA was better placed than any other agency to manage the project. The Bank argued that: "The placement of PRODETAB within EMBRAPA, which has a well-established infrastructure, while it was originally controversial among non-EMBRAPA scientists, has enabled the development of a credible competitive grants program that has processes and standards in place equivalent to those of other major competitive grants programs such as the US".¹

17. A major issue was how to redress the institutional disparities between Brazil's regions (the variation in their capacity to conduct agricultural research), thus enabling full, countrywide participation in competitive funding schemes. The south and south-west regions of Brazil were more competitive than the north and north-east. This held true both for research programs within EMBRAPA and outside it. When PRODETAB was prepared, nearly two-thirds of EMBRAPA researchers were concentrated in the south and south-west. Regional differences among the state research systems and universities were even sharper. In some states, research and extension systems were absent altogether, and in others the size of the research establishment was a small fraction of those in the larger states. At the preparation phase, even in relatively well-funded states (e.g., Sao Paulo and Minas Gerais), state funding had been unstable and declining and state governments had not made capital investments in research for several years.²

18. In principle at least, PRODETAB was intended to help tackle these disparities. NAC and EC would use the information provided by the monitoring system to identify areas in which the number and quality of subproject proposals were insufficient relative to the target allocations so that more resources could be allocated to weaker institutions and more challenged regions.³

19. The main constraint on project success lay in the absence of sound and stable institutions for transmitting new technologies to farmers. The federal service of agricultural extension had been largely dismantled in the 1990s, leaving the initiative to agencies in the individual states. The extent and quality of coverage varied significantly between regions. This was less of a constraint for better off farmers, many of whom were sufficiently educated to be able to search for the information they need (increasingly, over the Internet). But small-scale farmers were left out. A representative survey of rural families in 1996-1997 found that only 2 percent of farmers with less than 10 ha received technical assistance, compared to 8 percent for medium-scale farmers (10-50 ha), and 31 percent for large-scale farmers (over 50 ha).⁴ The authors of a Bank study that analyzed these data concluded: "One factor that seems to benefit farmers more or less equally across land sizes is technical assistance, which has a relatively large impact on revenues; having access to it

1. Lele and Bresnyan (2000), pp. 172-74.

2. World Bank (1997), p. 24.

3. World Bank (1997), pp. 19-22.

4. World Bank (2001), p. 135.

increases farm revenues by between 7 percent and 11 percent. Policies that increased access to technical assistance would benefit poor and non-poor farmers alike”.¹

20. The design of PRODETAB did not address this gap in technology transfer, a gap that was particularly likely to limit the project’s impact on small farmers. On the other hand, it would be unreasonable to argue that the project should have taken on the reintroduction of a national extension system: because there was no political will for this; because it is by no means clear that extension along the traditional lines is the best answer nowadays to technology transfer; and because it would have made the project unwieldy.

21. On balance, there are three important reservations about design. First, without reinventing the extension system, IEG finds that project design could have made space for more reflection on the issue of technology transfer: it could have funded some analytic work on alternatives to traditional extension. Second, in view of the lengthy period needed for research development and transfer, and the difficulty of attributing ultimate changes in productivity and incomes to projects of this nature, it was all the more important to define very carefully what would constitute acceptable measures of subproject success: the project appraisal document is silent about the sorts of output and outcome indicators that needed to be included in the logical framework of the subprojects. For these reasons, IEG rates design relevance as **modest**.

Efficacy

22. Efficacy assesses to what extent the project’s stated objectives were realized. This report systematically analyzes whether the expected inputs, outputs and outcomes actually materialized (the results chain). This provides a basis for the subsequent discussion of progress toward objectives. To the extent possible progress toward objectives is assessed against evidence bearing on intermediate and final outcomes (defined in Table 2). Where such evidence is lacking or insufficient, IEG considers data on outputs, considering whether there are plausible grounds for arguing that delivery of those outputs has led (or is likely to lead) to the expected outcomes.

23. The chain of expected inputs, outputs and outcomes (Table 3) is derived from the PAD. According to the ICR, the project’s objectives and components were not changed during implementation and the project was not formally restructured. Therefore, the Table 4 results chain is a valid template for the ex-post evaluation. Each of the next sections begins with a presentation of ICR material bearing on the results chain, followed by a discussion of the relevant IEG findings.

INPUTS

24. Funding for competitive grants subprojects was 25 percent less than expected. The ICR gives various reasons for this. In the first four of the seven funding contests (staged between 1997 and 1999), less than one-fifth of the submitted proposals resulted in financing, reflecting EMBRAPA’s concern to set a very high standard; many submissions

1. World Bank (2001), p. 149.

Table 3. Results Chain—Expected Inputs, Outputs and Outcomes

Inputs (Components)>	Outputs>	Intermediate Outcomes>	>Final Outcomes
<p>Funding for competitive grant subprojects (US\$72 million)</p> <p>Investments in knowledge acquisition (training courses, study tours, consultant services etc) (US\$ 20.2 million)</p> <p>Investments in goods and equipment (US\$20.3 million)</p> <p>Satellite Communication System (US\$2.5 million)</p> <p>Project administration, including Management Information System, and Monitoring and Evaluation System (US\$5.0 million)</p>	<p>Establishment of a new institutional framework, including the National Advisory Council and the Executive Council, with broad representation of stakeholders</p> <p>Funding of 250 agricultural research subprojects, spread across five priority areas: (i) family farms; (ii) advanced technologies; (iii) natural resource management; (iv) agribusiness; and (v) strategic studies</p> <p>Participation in the competitive grant system by a wide variety of research providers, with agencies other than EMBRAPA accounting for 33 percent of resources and coordinating 30 percent of subprojects</p> <p>Training at EMBRAPA (N=64 staff) and state research centers (N=100 staff)</p> <p>Investment in the infrastructure of 20 of EMBRAPA's decentralized research units and 10 state research centers</p> <p>Increased earnings from sale of EMBRAPA services and technologies, such as hybrid seed (rising from 7 percent to 15 percent of EMBRAPA's budget)</p> <p>400 scientific and extension publications originating from funded subprojects</p> <p>Staff exchanges and study tours with advanced research institutes in USA and Europe (plus CGIAR)</p> <p>Strategic studies completed</p> <p>Satellite Communications, Management Information System and M&E established, including baseline for National Agricultural Research System</p>	<p>The quality of research is increased, based on rigorous competition between would-be service providers</p> <p>Public research institutions focus on public good research</p> <p>EMBRAPA's decentralized research units are strengthened</p> <p>State-level capacity for research and technology transfer is augmented</p> <p>Public-private partnerships are developed</p> <p>International research collaboration is enhanced</p>	<p>A research and technology transfer system that responds more effectively than the previous system to the challenges of:</p> <p>(i) boosting the productivity and competitiveness of the agricultural and agro industrial sector;</p> <p>(ii) managing natural resources; and</p> <p>(iii) alleviating poverty</p>

Source: World Bank (1997).

were rejected for lack of proper documentation.¹ Second, project funds went further than expected because, although the number of subprojects was almost double appraisal estimates, their mean cost was lower than expected; and the depreciation of the real increased the buying power of the dollars borrowed. Third, uncertainties with respect to government funding led EMBRAPA to restrict the publicity given to bidding events and to limit the number of partnerships.² The investment in training and other forms of knowledge acquisition was 31 percent higher than expected while spending on goods and equipment (e.g., laboratory facilities) was 23 percent lower than anticipated at appraisal.

OUTPUTS

25. Over the course of 7 bidding rounds (from January 1997 to February 2001), 139 projects (comprising 464 subprojects) were approved (Table 4). The mean cost was US\$115,000 per subproject (compared to the appraisal expectation of 250 subprojects costing US\$288,000 each). No ex ante distribution between the priority research areas was specified at appraisal. The ex post distribution suggests that family agriculture was relatively squeezed, this research area accounting for one-third of the proposals submitted but capturing just over one-fifth of the financing. Research areas more likely to contain public good elements (natural resources, advanced technology and strategic studies) accounted for two-thirds of committed resources, which is consistent with specific objective (c) of the project.

Table 4. Distribution of Projects by Area of Research Priority

Priority Area	Proposals Submitted Number (%)	Proposals Approved Number (%)	Resources Committed R\$ million (%)
Family Agriculture	245 (33)	41 (30)	18.6 (22)
Natural Resources	203 (27)	39 (28)	26.7 (32)
Advanced Technology	177 (24)	35 (25)	23.6 (29)
Agribusiness	92 (12)	15 (11)	9.8 (12)
Strategic Studies	37 (5)	9 (6)	3.9 (5)
Total	754 (100)	139 (100)	82.6 (100)

Source: World Bank (2006), pp. 8-9.

26. EMBRAPA assumed a larger role in coordinating projects and implementing subprojects than any other institution; but universities and state research centers were also significant players (Table 5). The 139 projects generated by PRODETAB employed 2,010 scientific staff, 46 percent from EMBRAPA, 31 percent from universities and 11 percent from state research centers.³ EMBRAPA preferred partnerships with universities and private firms to partnerships with state research agencies or other units of EMBRAPA, and it made little attempt to partner with technical assistance or extension agencies.⁴

1. World Bank (2006), p. 8.

2. World Bank (2006), p. 18.

3. EMBRAPA (2006), p. 19.

4. Argollo de Souza (2003), pp. 40-41

27. The number and range of agencies that participated in PRODETAB is larger than Table 5 suggests because, for each subproject, there were a number of informal partners involved, in addition to the entity formally identified as responsible for implementation—including 130 private firms, which contributed with staff, equipment and, to a small extent, cash.¹

Table 5. Participation of Different Entities

	Projects Coordinated		Subprojects Implemented		Resources Committed	
	<i>Number</i>	<i>Percent</i>	<i>Number</i>	<i>Percent</i>	<i>R\$ million</i>	<i>Percent</i>
EMBRAPA	93	67%	220	47%	41.9	50%
Universities	21	15%	147	31%	25.0	30%
State research agencies	18	13%	67	14%	9.8	12%
Foundations	3	2%	5	1%	0.8	1%
NGOs	2	1%	10	2%	1.7	2%
Producer associations	1	1%	2	1%	0.8	1%
Private firms	--	--	7	1%	1.0	1%
Extension agencies	--	--	4	1%	0.5	1%
Others	1	1%	8	2%	1.5	2%
Total	139	100%	470	100%	83.0	100%

Source: EMBRAPA (2006), p. 8.

28. Participant co-payment quotas were mainly rendered as hours worked; yet estimates of the numbers of persons actively involved in projects were imprecise.² IEG verified that labor input accounted for the bulk of reported co-payment. For the first ten PRODETAB projects approved, personnel costs accounted for an average of 76 percent of recorded co-payment; for the last ten projects approved, the share was 88 percent.³ (But in the Southeast—the best-equipped region in terms of research infrastructure and staff quality—personnel costs accounted for only 53 percent of counterpart financing; this suggests that better-endowed institutions probably had a more capital-intensive research profile).⁴

29. With respect to the training component of PRODETAB, targets were amply exceeded in the case of EMBRAPA—354 staff trained against the appraisal estimate of 64—but for the state research centers the target was little more than half met (65 persons trained, compared to the 110 expected). The allocation per capita seems generous, given that few received doctoral training abroad: the average cost per person trained was US\$48,512 (less admittedly than the US\$80,000 or so projected at appraisal).

30. Other output targets were exceeded. The number of EMBRAPA decentralized stations and state research centers receiving new infrastructure and equipment was, respectively, 40 and 23—double the appraisal target. Also exceeded was the share of

1. EMBRAPA (2006), pp. 16-17.

2. Argollo de Souza (2003), pp. 43-44.

3. EMBRAPA (2006), Annex 5.

4. Argollo de Souza (2003), Annex 5, p. 7.

EMBRAPA non-budget revenues from the sale of products, processes and services (17 percent compared to the target of 15 percent). The competitively funded research that was supported generated 604 publications (the forecast was 400). Finally, EMBRAPA's links with advanced research institutions, including 'virtual laboratories' (LABEX) in the United States and Europe were consolidated, and the investment in satellite communications put researchers and administrators in closer touch with each other throughout Brazil. Overall, there was a significant strengthening of institutional capacity, the biggest winner being EMBRAPA.

31. At appraisal the highest risk facing the project was identified as the inability of extension services to transfer the research results generated owing to budget cuts.¹ A further concern was that the poorer regions—the North and Northeast—would be marginalized from the competitive funding process. Indeed, at midterm, cognizant of the continuing gravity of these risks, the Bank recommended that “EMBRAPA should ensure that weaker institutions and less successful areas of the country receive a fair share of technical assistance funds to strengthen their competitive position”.² By project end this had not happened. The distribution of competitive funding resources had accentuated rather than offset existing regional imbalances: the North and Northeast captured only one-quarter of the funds committed, compared to the 41 percent garnered by the Southeast, which is Brazil's research powerhouse (Table 6).³ Also, only 4 technical assistance and extension agencies participated and NGO participation was lower than expected (Table 5). Of the 2,010 technical staff involved in PRODETAB projects only 8 were described as extension specialists.⁴ Finally, the low share of funding captured by research on family agriculture (Table 5) suggests that PRODETAB's contribution to poverty alleviation may ultimately have been more limited than intended.

Table 6. Distribution of Projects by Region

Priority Area	Proposals Submitted Number (%)	Proposals Approved Number (%)	Resources Committed R\$ million (%)
Center West	122 (16)	30 (22)	17.5 (21)
Northeast	157 (21)	30 (22)	16.1 (19)
North	58 (8)	9 (6)	4.7 (6)
Southeast	222 (29)	48 (35)	33.7 (41)
South	195 (26)	22 (16)	10.6 (13)
Total	754 (100)	139 (100)	82.6 (100)

Source: World Bank (2006), p. 9.

1. World Bank (1997), p. 12.

2. Lele and Bresnyan (2000), p. 189.

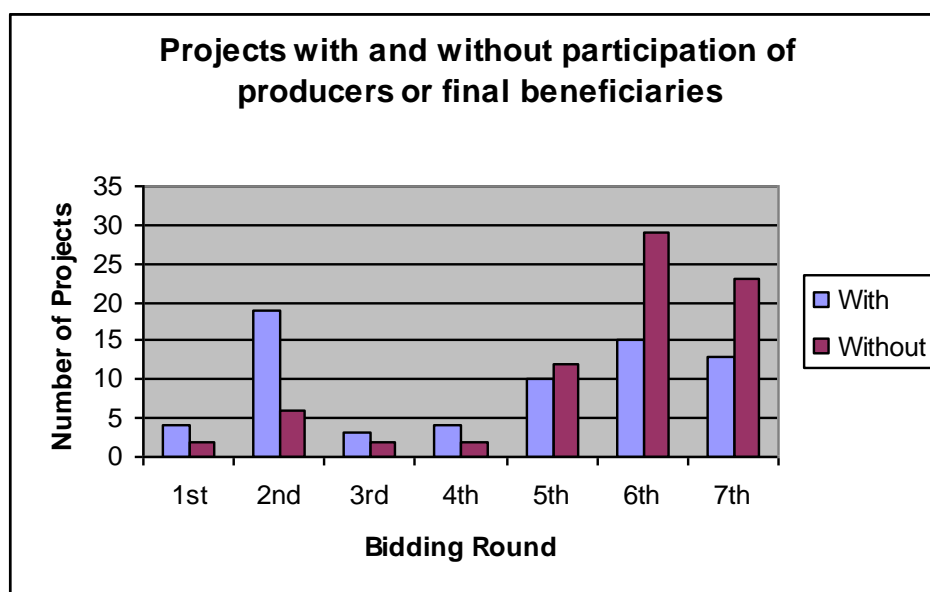
3. In the south-east projects from a number of top-rank institutions were approved, including the State University of Campinas, the Campinas Agro-Economic Institute, the Federal University of Vicosa (World Bank, 2006, p. 11).

4. EMBRAPA (2006), Annex 4.

INTERMEDIATE OUTCOMES

32. The ICR acknowledged that the project appraisal document “may have conveyed the impression that the transfer of project-generated technology was part of project design and that poverty reduction would be measurable in its lifetime”, thereby raising unrealistic expectations.¹ Although the project did sponsor dissemination activities (including “600 training courses in the countryside”)² this was no guarantee that information was picked up by farmers, technologies were adopted and, as a result, poverty was reduced. With hindsight, the ICR concluded, five years was too short an implementation period for PRODETAB. “Much greater time is needed...to evaluate impact on the ground, including poverty effects. Expectations expressed by the mid-term review were overly optimistic in this regard”.³ When IEG conducted its mission in 2008 there was still no clear picture of PRODETAB-specific impact; and evidence presented below in paragraphs 3.15-3.16 and 4.1 bears this out.

Figure 2. Declining Trend in Participation



33. Less than one-half of the PRODETAB projects involved participation of producers or final beneficiaries (48 percent overall).⁴ Projects approved in later bidding rounds were less participatory (Figure 2), reflecting changes in the proportional weight of the different research areas. Towards the end there were more strategic research and advanced technology projects, these lending themselves less to participation: these research projects accounted for 31 percent of approved projects but 43 percent of the projects that did not work with end-users. On the other hand, family agriculture accounted for 30 percent of approved projects but only 24 percent of projects not involving participation.

1. World Bank (2006), p. 5.

2. World Bank (2006), p. 7.

3. World Bank (2006), p. 12.

4. EMBRAPA (2006), Annex 5.

34. It could be argued that all family agriculture projects (and many of the natural resource management projects) should have been participatory in nature, in order to maximize prospects for technology transfer. On the other hand, IEG examined the final reports for each of the 41 family agriculture projects that were approved, finding that the lack of technology transfer was explicitly identified as a problem in only 4 cases. But there is no ready way to be sure if this means that there really was no problem; or whether it signifies that technology transfer was not on the researcher's radar screen.

FINAL OUTCOMES

35. For each of the 139 projects approved under PRODETAB there is an aggregate data sheet describing the main project characteristics and findings.¹ The sheet includes a section that compares expected with actual results. A quick scan of the data sheets shows that there are few quantitative data reported, and what few are reported are limited to the results obtained column, making it impossible to assess what the targets were and whether they were achieved.

36. In 2003 a consultant commissioned by EMBRAPA analyzed the 25 projects that had been completed by May 30 of that year. The consultant sent a questionnaire to each of the project teams asking for information on results achieved. Eighteen of the 25 teams responded and 14 of these reported that the project had led to an increase in productivity.² But the aggregate data sheets for these 14 projects show that for the most part targets were not set (Table 7).³

Table 7. Gaps in Results Reporting of PRODETAB Projects

Code Number of Projects with a reported increase in productivity	Expected Results Quantified	Actual Results Quantified
019	✓	✓
117		✓
123		
005	✓	✓
013		
031		✓
048		
084		✓
112		✓
115		✓
132		
161		
162		
043		

Source: Argollo de Souza (2006), Annexes 4 and 6.

1. EMBRAPA (2006), Annex 5.

2. Argollo de Souza (2003), Annex 6.

3. Argollo de Souza (2003), Annex 4.

37. The same consultant observed that there was often a confusion of activities with outcomes and a tendency to report that expected outcomes were 100 percent achieved when the appropriate comment was that the expected activities were fully completed.¹ His report notes that PRODETAB management sponsored various training events to try to improve the logical framework of projects. But IEG compared the aggregate data sheets for projects approved early on with those approved toward the end of the implementation period and found no evidence of a tightening up in the specification of expected and actual outcomes.

ACHIEVEMENT OF PROJECT OBJECTIVES

38. IEG rates the achievement of the specific objectives of the project as follows:

- (a) “Stimulate the transition in the National Agricultural Research System (SNPA) from its current heavy reliance on public sector research carried out by EMBRAPA to a more integrated and diversified system led by EMBRAPA” (*Rating: Substantial*). At the level of subprojects and resources committed (Table 5) EMBRAPA remained the single largest player but the universities and state research agencies had a significant role (42 percent of resources between them), which is consistent with diversification. Private firms (nonprofit and for profit) played a marginal role; but the project objectives did not target these agencies. Moreover, the extensive subcontracting arrangements allowed for a level of diversification that went beyond that reflected in the list of formal coordinators and implementers for the various research initiatives (paragraph 26).
- (b) “Increase the role of clients in the definition of research and technology transfer priorities and implementation” (*Rating: Substantial*). By definition, the competitive fund model was more demand-driven than the system of directly assigning research money and, based on responses to an IEG poll of informed participants, the process appears to have been fair and transparent. A distinction needs to be made between responsiveness to client needs and participation: although 52 percent of PRODETAB projects involved no participation of producers or final beneficiaries in actual implementation (paragraph 32) this does not mean that the selection of these initiatives was not client-driven; moreover, ‘clients’ is not limited to farmers. The strategic research and advanced technology projects (which absorbed one-third of resources) were less likely to lend themselves to participatory implementation; but the process for identifying these initiatives was participatory because it involved a range of stakeholders, including consumer groups and industry.
- (c) “Refocus public sector research on quintessential public goods” (*Rating: Substantial*). IEG is not able to state categorically which of the 139 projects financed by PRODETAB were “quintessentially” of a public goods nature because, in practice, there are few pure public goods and the line between public and private is debatable. But research areas more likely to contain public good elements (natural resources, advanced technology and strategic studies) accounted for two-thirds of committed resources (Table 4).

1. Argollo de Souza (2003), p. 44.

- (d) “Help EMBRAPA reorient its current structure to address issues of decentralization and diversification of the SNPA” (*Rating: Modest*). PRODETAB investments strengthened the infrastructure and staffing of EMBRAPA’s decentralized units and (to a lesser extent) the individual state research agencies; although universities and state research agencies had an important role to play in PRODETAB—which speaks of diversification—it is not clear that the project led EMBRAPA to embrace the principle of diversification as a goal; not surprisingly perhaps, its primary concern was to build up its own strength.

39. Weighing up these ratings, the project’s progress toward its objectives (efficacy) is rated as **substantial**. The overarching objective—“increase efficiency and sustainability of resource use in the national agricultural research system”—was also substantially achieved, as sections 4 and 6 demonstrate.

Efficiency

40. The appraisal report includes estimates of economic rates of return of between 27 percent and 146 percent for representative projects in the PRODETAB areas of family agriculture, natural resource management and advanced technologies. “For methodological, data and other reasons, the ICR does not attempt to replicate that analysis”.¹ Instead, the ICR quoted the results of a 2006 EMBRAPA study which analyzed the impact of a sample of 12 technologies.² There are three problems with this approach. First and foremost, none of the twelve technologies was developed under PRODETAB auspices; the study was conducted to fulfill one of the preconditions for approval of a project that came after PRODETAB (Agrofuturo, financed by the Inter-American Development Bank). Second, all 12 technologies were generated by EMBRAPA. Even if PRODETAB examples were included, this would not be a sufficient means to evaluate a project that was intended, *ex ante*, to sponsor diversification of research provision; and which, *ex post* included a significant participation by universities and state research institutes. Third, it is not clear on what basis the sample was drawn; it does not appear to be random because each of the 12 projects was generated by a different decentralized unit of EMBRAPA, suggesting that the selection was intended to showcase the diversity of EMBRAPA’s work rather to make a statistically rigorous evaluation of the efficiency of EMBRAPA’s use of resources.

41. Each year since 1997 EMBRAPA has published a ‘Social Balance’ report on the impact of technologies developed under its auspices. But the reports contain no explicit mapping of the technologies to the projects that generated them making it impossible to use this source as a basis for evaluating PRODETAB. EMBRAPA informed IEG that the Social Balance is derived from ‘impact assessment’ reports prepared by each of the 37 decentralized units of EMBRAPA. This impact assessment comprises a subset (‘at least 3’) of the technologies developed by each unit, limited to technologies where sufficient time has elapsed for adoption to be feasible. (It is not clear if the subset is randomly or

1. World Bank (2006), p. 34.

2. Castelo Magalhaes (2006).

purposely selected; or if all projects beyond a given threshold of elapsed time are eligible for selection.) None of the impact assessment reports provided to IEG by EMBRAPA correspond to PRODETAB projects. EMBRAPA explained that this is because the PRODETAB technologies are “very recent” (although the first projects were approved in 1997), so that none have so far been picked up by the assessment process.

Table 8. Characterization of PRODETAB Project Results

Project Number	Project focus	Physical (Expected [E]; Actual [A])	Net benefits (economic and/or financial)	Number of direct beneficiaries
019 01-97	(RN) Improving breed of zebu cattle	A : Yield	--	A: 327 farms
084 01-97	(RN) Improving nitrogen fixation of pulses	--	--	--
161 01-98	(RN) Improving maize resistance to eco-stresses	A: Stem thickness	--	--
016 01-01	(RN) Improving water basin management	--	--	--
024 01-01	(AF) Making horticulture more sustainable	A: Yield	--	--
029 01-01	(AF) Improving cotton varieties	A: Yield	--	--
035 01-01	(AF) Improving organic milk production	A: Yield	Organic price premium; profitability	--
051 01/01	(AF) Improving frog meat processing	A: Fresh vs. frozen properties	--	--
055 01/01	(RN) Improving river basin conservation	A: Water quality (e.g. salinity)	--	--
061 01-01	(RN) Improving irrigation efficiency	--	--	--
052 01-01	(AF) Improving lime cultivation	A: Sugar content, acidity; yield	--	--
139 02-01	(AF) Improving properties of capsicum pepper	A: Yield	--	--

Source: A random sample of PRODETAB Project Completion Reports, constructed by IEG. E Expected; A Actual; RN Natural Resources; AF Family Agriculture.

42. In order to understand the type of results generated by PRODETAB, IEG studied the completion reports of 12 projects randomly selected from the two areas of research with the largest number of projects, family agriculture and natural resources (Table 8).¹ The 12 completion reports give considerable detail on inputs (how grant money was spent) and carefully catalogued ‘intellectual’ outputs (refereed articles, book chapters, conference presentations, pamphlets, theses, etc). The substantive results of the research are mainly couched in physical terms (particularly yield response and product characteristics). The large number of blank cells in Table 8 tells the story. In only one of the 12 cases examined is there any estimation of economic or financial return. There is usually no ex ante specification of benefits, making it hard to assess how successful projects were. Also, there

1. Not to be confused with the 12 subprojects referred to in the ICR (mentioned in an earlier paragraph of this IEG report).

is only one case where the number of direct beneficiaries is given (that is, farmers or end-users of the technology who collaborated in its development).

43. Arguably, the content of these reports reveals what researchers have the biggest incentive to display: evidence of intellectual productivity (rather than end results). It could be countered that the three-year span of a PRODETAB project was too short to expect significant farm-level impact. Indeed, the net benefits from some of these projects may be captured in a future Social Balance report. But the Social Balance leaves out non-EMBRAPA projects and it is not clear how representative the chosen projects are of the EMBRAPA universe. Moreover the Social Balance framework doesn't lend itself to an estimate of the efficiency of competitive funds relative to other models of research financing. As the ICR conceded, "Estimation of whether the competitive grant scheme is the least-cost, most efficient and sustainable option for agricultural research—as called for in the project appraisal document—awaits formal study".¹

44. These are important shortcomings but they are not decisive for the overall rating of efficiency. A more important consideration is that, overall, the project exceeded its output targets and it did so within the cost envelope established at appraisal. Moreover, 54 percent of actual project costs were devoted to institutional strengthening and the relevant indicators are infrastructure built, people trained and research published, rather than farm-level results. The money used to strengthen EMBRAPA had a clear positive impact on the agency's capacity as a research leader. There is a further consideration. The principle of "constellated subprojects"—whereby each 'project' within PRODETAB had 3-5 associated subprojects—probably increased the scope for transferring learning between subprojects, thereby enhancing efficiency. (With respect to the four countries covered by this IEG assessment, "constellation" was peculiar to Brazil.) IEG rates efficiency as **substantial**.

Project Development Outcome

45. Adding up the component criteria assessed above IEG rates project development outcome as **satisfactory** (Table 9).

Table 9. Derivation of the Outcome Rating

Relevance	Efficacy	Efficiency	Outcome
	Objective (a): Substantial		
Objectives: Substantial	Objective (b): Substantial		
Design: Modest	Objective (c): Substantial		
	Objective (d): Modest		
Rating: Substantial	Rating: Substantial	Rating: Substantial	Rating: Satisfactory

1. World Bank (2006), p. 15.

Risk to Development Outcome

46. There are three levels of risk to PRODETAB outcomes. First, will the positive outcomes of the 139 projects financed by PRODETAB be sustained? Second, will the competitive funding model endure? Third, will the institutional strengthening of EMBRAPA prove resilient?

47. The first of these questions is the hardest to answer. On the one hand, PRODETAB or no PRODETAB, EMBRAPA has made a spectacular contribution to productivity growth—not least in developing the technology needed to open the infertile soils of the *cerrado* to export agriculture.¹ Some of the technologies developed under PRODETAB may eventually have a big payoff—even if there is no sign of this so far. The primary concern is the lack of solid evidence for evaluating just how positive the PRODETAB project outcomes were; and the gap in the results chain linking PRODETAB-supported researchers to the end user. (The risk was foreseen at appraisal and re-emphasized at midterm when the Bank suggested that one-year grants—additional to the original two to three years of project funding—might help to improve the prospects for technology transfer.)²

48. The completion reports for individual PRODETAB projects carefully count the intellectual outputs and the dissemination events (open days at research stations, etc.) but there is next to no quantification of the number of beneficiaries or the level of benefits. In a 2003 report it was observed that “various projects that have reached the end of their PRODETAB financing are continuing to be executed with support from other sources, involving both diffusion of results and new research and development activities”.³ But the percentage of projects showing this sort of sustainability was not given in the report; and data of this nature had not been collected by loan closing.

49. Second, what is the future for the competitive funding model? To begin with, the model predated PRODETAB and has vitality independently of it. PRODETAB did make a difference—it had a specific influence on the state research programs (Sao Paulo, Parana, and Pernambuco) that incorporated elements of the model. On the other hand, Agrofuturo, the follow-on research project financed by the Inter-American Development Bank, has dropped any sponsorship of the competitive model. IADB says that the loan that was approved for this project was only one-half of the anticipated amount, so that funds were only sufficient to finance EMBRAPA. This suggests that commitment to the diversification of research provision—a key objective of PRODETAB—is not strong.

50. Third, partly because of the consolidation made possible first by PRODETAB and then by Agrofuturo, the outlook for EMBRAPA seems promising. EMBRAPA was the prime beneficiary of PRODETAB. The project helped EMBRAPA to weather the downturn in federal spending of 1998-2003, making it possible to upgrade the training of

1. New York Times (2007).

2. Lele and Bresnyan (2000), p. 189.

3. Argollo de Souza (2003), p. 52.

research staff and broadening collaboration with research institutions in Europe and the United States. EMBRAPA is now much stronger, federal funding having picked up since 2006.

51. Brazil's need for external funds should not be exaggerated: less than 5 percent of national agricultural investments have come from external loans.¹ With or without further loans, EMBRAPA's position seems unassailable. The PRODETAB-sponsored National Advisory Committee that was supposed to reduce EMBRAPA's role in setting research priorities carried no weight; and there is no other agency that comes close to matching EMBRAPA for resources.

52. Based on the proportional weight of the project components, PRODETAB's primary focus was on strengthening the public sector research system. The project helped strengthen EMBRAPA's staff and infrastructure, as well as building up the state research agencies and other research providers. These achievements have been sustained since the loan closed, making for an overall strengthening of Brazil's capacity to continue as a major player in the international agricultural research field. Therefore, IEG rates risk to development outcome as **moderate**.

Monitoring and Evaluation

DESIGN

53. When the project was designed, the aim was "to bring the existing M&E system [i.e., EMBRAPA's system] up to the standards of the U.S. National Science Foundation and the Organization for Economic Cooperation and Development".² Yet the appraisal document contains no detailed provision for M&E. It notes that "EMBRAPA already has a well-developed information management system. However, a similar system will have to be developed for the project-financed activities in the National Agricultural Research System as a whole".³ Although there is an annex on "key quantitative indicators" these are all output-based (number of contracts signed, number of publications, number of staff trained, etc). There is no provision made for measuring the level of adoption of PRODETAB-generated technologies by farmers; or the impact on incomes and employment. In Annex 2 of the appraisal document the completion of an M&E design satisfactory to the Bank is listed as a condition of project effectiveness; but at the front of the document, the section on "Effectiveness Conditions" makes no reference to this.⁴

54. According to the ICR, the monitoring and evaluation system sponsored by PRODETAB was intended "to test the hypothesis that the competitive grant system was the least-cost and most-efficient option for carrying out certain forms of research and

1. Lele and Bresnyan (2000), p. 167.

2. World Bank (1997), p. 28.

3. Ibid.

4. World Bank (1997), p. 12.

technology transfer”.¹ But there was no provision made to compare the costs of competitively funded with directly assigned research.

IMPLEMENTATION

55. Actual spending on the “administration, monitoring and evaluation” component was only US\$1.0 million, one-third of the level anticipated at appraisal. This shortfall reflects the failure to develop a comprehensive system, capable of monitoring the national agricultural research system as a whole (rather than just EMBRAPA) and capturing outcomes as well as outputs (extending beyond EMBRAPA’s existing, well-established management information system).

56. At a conference during project implementation the Bank stated that the standard of PRODETAB monitoring actually exceeded that which prevailed in the US agricultural competitive grants system.² But, in a separate presentation at the same event, EMBRAPA acknowledged the lack of good monitoring and evaluation usually applied to competitive schemes and “tried to address this issue by organizing visits to individual projects, with the participation of members of the Executive Council with other scientists who act as project reviewers, using standardized forms for project assessment”.³ This was a sensible proposal but based on the final output—the completion reports of individual projects, a sample of which were reviewed by IEG—monitoring quality fell short of what it was reasonable to expect. Reporting focused on counting inputs and outputs rather than outcomes, there was no comparison of expected and actual results and no attempt to quantify the number of beneficiaries. This casts doubt on the claim in the ICR that the project was “an example of Best Practice in competitive grant system management and monitoring in relation to similar systems in other countries”⁴.

57. There was no substantial field-level research on adoption rates. An EMBRAPA study on the impact of a sample of 12 (non-PRODETAB) technologies noted that “the teams responsible faced difficulties based on the limited financial resources available for field work. In some cases it was not possible to systematically verify the benefits from the technologies based on a representative sample of farms; instead, this was substituted by conversations with extension workers and other local people”. The same source finds a lack of uniformity in the methodological approach adopted by the different decentralized units of EMBRAPA that contributed to the study.⁵

USE

58. The M&E data generated by PRODETAB were useful for day-to-day project management and disbursement tracking. But they did not have a broader application. The

1. World Bank (2006), p. 5.

2. Lele and Bresnyan (2000), p. 178.

3. Reifschneider (2000), p. 81.

4. World Bank (2006), p. 21.

5. Castelo Magalhaes et al (2006), pp. 239-240.

impact evaluations so far sponsored by EMBRAPA (outside the auspices of PRODETAB) have not allowed for project-level attribution of research outcomes; and they do not cover agencies other than EMBRAPA.

IEG rates monitoring and evaluation as **modest**.

Bank Performance

QUALITY AT ENTRY (RATING: MODERATELY SATISFACTORY)

59. The project was prepared rapidly, internalizing key lessons from earlier research projects.¹ EMBRAPA has acknowledged the considerable value that the Bank added to the project preparation process, by bringing to bear experience from designing competitive grant schemes in other countries.²

60. In various respects, quality at entry was solid. The design of the competitive funding process allowed for rigorous and transparent evaluation of research proposals, and also provided grants for the preparation of proposals. The clustering of subprojects around a unifying theme helped to ensure critical mass as well as facilitating exchange between large numbers of participants. The review process helped unsuccessful applicants design better proposals for submission in the next bidding round.

61. On the other hands there were some shortfalls which, taken together, explain why quality at entry is rated moderately satisfactory. First, the ICR acknowledged that the Bank underestimated how long it would take to embed the new procedures but stated that a longer period for implementation was probably not negotiable when the project was prepared.³ Second, the ICR also conceded that “the project was not designed to actually transfer the new technology developed to poor, small-farm clients in the Northeast and similar regions”.⁴ Third, project objectives were framed in a way that created uncertainty about the priority given to EMBRAPA: witness the discrepancy between the statements in the Project Appraisal Document and the Loan Agreement (paragraph 1.5 and footnote). Fourth, the lack of provision for an M&E system that would span the national agricultural research system and would capture outcomes as well as outputs was a weakness.

SUPERVISION (RATING: SATISFACTORY)

62. Supervision intensity was adequate with 16 missions over 8 years. The ICR notes that supervision “focused heavily on accelerating disbursements and resolving bureaucratic and other constraints on project execution”.⁵ The mid-term review was particularly thorough and involved internationally-renowned specialists. The quality of

1. World Bank (2006), p. 20.

2. Reifschneider (2000), p. 78.

3. World Bank (2006), p. 20.

4. World Bank (2006), p. 20.

5. World Bank (2006), p. 21.

supervision was acknowledged by PRODETAB counterparts interviewed by IEG. On the other hand, the Bank appears not to have pressed as much as it might have done with respect to the adequacy of arrangements for monitoring the individual projects and encouraging EMBRAPA to evaluate the long-term impacts attributable to the project.

63. The overall rating of Bank Performance is **satisfactory**.

Borrower Performance

GOVERNMENT (RATING SATISFACTORY)

64. The government was actively involved in project preparation and showed a high level of commitment. The project called for major changes in EMBRAPA's way of doing business, pushing for greater decentralization, making the decentralized units more autonomous and more accountable. The government backed these changes.

65. PRODETAB was implemented at a time of fiscal retrenchment. In order to reduce the fiscal deficit the federal government withheld as contingencies a sizeable portion of the annual budget allocations of public agencies, as well as delaying the release of available budget resource. This was an across-the-board cut back and the negative impact on the pace of PRODETAB implementation did not signal a specific lack of government commitment to the project—indeed, at the time, PRODETAB fared better than other Bank-supported projects. Funding shortages were most severe from 2001 through 2003.¹ By midterm Bank disbursements for PRODETAB were only one-third of the total loan (they should have been one-half) owing to cutbacks in counterpart funding and the devaluation of the Real (which required EMBRAPA to spend 80 percent more local currency to tap Bank counterpart funds than when the project was designed).²

IMPLEMENTING AGENCY (RATING: SATISFACTORY)

66. Locating project management in EMBRAPA made sense given its well-established infrastructure. The ICR notes that the long-standing relationship between EMBRAPA and the Bank helped to speed up the preparation of PRODETAB. The Executive Council performed transparently and fairly in reviewing project proposals. Fiduciary oversight by EMBRAPA was adequate. All proposals of US\$40,000 or more were reviewed ex post by the Bank on a random basis and no irregularities were found.³ On the other hand, EMBRAPA shares some responsibility with the Bank for gaps in the monitoring the outcomes of the competitively-funded projects that formed part of PRODETAB, which complicates the task of attributing results.

67. The overall rating of Borrower Performance is **satisfactory**.

1. World Bank (2006), p. 17.

2. Lele and Bresnyan (2000), p. 184.

3. World Bank (2006), p. 23.

Appendix A. Basic Data Sheet

AGRICULTURE TECHNOLOGY DEVELOPMENT PROJECT (PRODETAB) (LOAN NO. 4169)

Key Project Data (amounts in US\$ million)

	<i>Appraisal estimate</i>	<i>Actual or current estimate</i>	<i>Actual as % of appraisal estimate</i>
IBRD Loan	60.0	60.0	100
Cofinancing			
Government	60.0	58.6	98
Total project cost	120.0	118.6	99

Cumulative Estimated and Actual Disbursements (US\$ million)

	FY98	FY99	FY00	FY01	FY02	FY03	FY04	FY05
Appraisal estimate	14.9	29.2	42.9	54.8	60.0	60.0	60.0	60.0
Actual	5.3	13.0	17.8	22.2	27.7	33.1	42.6	45.3
Actual as % of estimate	36	45	41	41	46	55	71	76

Project Dates

	<i>Original</i>	<i>Actual</i>
Departure of Appraisal Mission		08/21/1996
Appraisal		03/17/1997
Board approval		05/22/1997
Effectiveness	08/24/1997	09/24/1997
Mid-Term Review	05/05/2000	05/05/2000
Closing date	12/31/2002	12/31/2005

Staff Inputs (staff weeks)

	<i>Actual/Latest Estimate</i>	
	<i>N° Staff weeks</i>	<i>US\$US\$('000)</i>
Identification/Preparation	23.9	99.5
Appraisal/Negotiation	5.1	27.2
Supervision	93.8	174.4
Completion	5.0	11.3
Total	126.8	312.4

Mission Data

	<i>Date</i> (month/year)	<i>No. of</i> <i>persons</i>	<i>Specializations represented</i>	<i>Performance rating</i>	
				Implementation status	Development objectives
Identification Preparation	04/27/1996	3	Agricultural Economists		
Appraisal/ Negotiation	01/21/1997	2	Agricultural Research Specialists		
Supervision 1	09//29/1997	1	Agricultural Economist	S	S
Supervision 2	12/14/1997	2	Agricultural Economist, Agricultural Research Specialist	S	S
Supervision 3	06/05/1998	1	Agricultural Economist	S	S
Supervision 4	01/25/1999	1	Agricultural Economist	S	S
Supervision 5	11/01/1999	1	Agricultural Economist	S	S
Supervision 6	05/05/2000	4	Agricultural Economist, Economist, Financial Management Specialist, Comp. Grants Specialist	S	S
Supervision 7	11/30/2000	1	Agricultural Specialist	S	S
Supervision 8	06/29/2001	1	Agricultural Specialist	S	S
Supervision 9	12/10/2001	1	Agricultural Specialist	S	S
Supervision 10	10/02/2002	1	Agricultural Economist	S	S
Supervision 11	04/24/200w	1	Agricultural Specialist	S	S
Supervision 12	06/12/2003	1	Agricultural Specialist	S	S
Supervision 13	10/01/2004	1	Agricultural Specialist	S	S
Supervision 14	04/01/2005	1	Agricultural Specialist	S	S
Supervision 15	06/10/2005	1	Agricultural Specialist	U	S
ICR	05/16/2006	1	Agricultural Specialist	S	S

Performance Rating: S: Satisfactory

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