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The World Bank

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Report No. 16776

IMPLEMENTATION COMPLETION REPORT

BRAZIL

THIRD AGRICULTURAL RESEARCH PROJECT

(Loan 3130-BR)

June 20, 1997

Natural Resources, Environment and Rural Poverty Division
Country Department I
Latin America and the Caribbean Region

CURRENCY EQUIVALENTS

Local Currency Unit: [1]	New Brazilian Cruzado (NCz$)		
Rate at Appraisal:	US$1	=	NCz$1
	NCz$1	=	US$1
Rate at Completion:	US$1	=	R$0.969

WEIGHTS AND MEASURES

Metric System

FISCAL YEAR OF BORROWER

January 1 to December 31

Vice President	**Shahid Javed Burki**
Director	**Gobind T. Nankani**
Division Chief	**Constance Bernard**
Task Manager	**Michael Carroll**

[1] A new currency, the Real (R$), was introduced in 1994.

ABBREVIATIONS AND ACRONYMS

CENARGEN	Centro Nacional de Recursos Genéticos e Biotecnologia *National Research Center for Genetic Resources and Biotechnology*
CNPA	Centro Nacional de Pesquisa de Algodão *National Center for Cotton Research*
CNPAB	Centro Nacional de Pesquisa de Agrobiologia (formerly CNPBS/UAPNPBS) *National Center for Agrobiological Research*
CNPAI	Centro Nacional de Pesquisa de Agricultura Irrigada *National Center for Irrigation and Drainage Research* (later subsumed in CPAMN)
CNPAT	Centro Nacional de Pesquisa de Agroindústria Tropical (formerly CNPCa -Cashew) *National Center for Tropical Agroindustrial Research*
CNPC	Centro Nacional de Pesquisa de Caprinos *National Center for Research on Goats*
CNPF	Centro Nacional de Pesquisa de Florestas *National Center for Forestry Research*
CNPGL	Centro Nacional de Pesquisa de Gado de Leite *National Center for Research on Dairy Cattle*
CNPMA	Centro Nacional de Pesquisa de Monitoramento e Avaliação de Impacto Ambiental (formerly CNPDA) *National Center for Research on Environmental Impact Monitoring and Evaluation*
CNPMF	Centro Nacional de Pesquisa de Mandioca e Fruticultura Tropical *National Center for Research on Cassava and Tropical Fruit Crops*
CNPS	Centro Nacional de Pesquisa de Solos (formerly SNLCS) *National Center for Soil Research*

CPAA	Centro de Pesquisa Agroflorestal da Amazônia Ocidental (formed from the former CNPSD and UEPAE-AM) *Center for Agroforestry Research of Western Amazonia*
CPAFs-AC/AP/RO/RR	Centros de Pesquisa Agroflorestal - Acre/Amapá/Rondônia/Roraima (formerly UEPAEs-AC/AP/RO/RR) *Centers for Agroforestry Research of Acre/Amapá/Rondonia/Roraima*
CPAMN	Centro de Pesquisa Agropecúaria do Meio Norte (formerly UEPAE-PI) *Center for Agricultural Research for the Mid North*
CPATC	Centro de Pesquisa Agropecúaria dos Tabuleiros Costeiros (formerly CNPCo - Coconut) *Center for Agricultural Research for the Coastal Plains*
CPATSA	Centro de Pesquisa Agropecuária do Trópico Semi-Arido *Center for Agricultural Research for the Semi-Arid Tropics*
CPATU	Centro de Pesquisa Agroflorestal da Amazônia Oriental *Center for Agroforestry Research of Eastern Amazonia*
CTAA	Centro Nacional de Pesquisa de Tecnologia Agroindustrial de Alimentos *National Research Center for Agroindustrial and Food Technologies*
DEC	Departamento de Programação Econômica e Desenvolvimento Comercial *Economic Planning and Commercial Development Department*
DOF	Departamento de Administração Orçamentária e Financeira *Budget and Financial Administration Department*
DPD	Departamento de Pesquisa e Difusão de Tecnologia *Research and Technology Dissemination Department*
DRM	Departamento de Administração de Materiais e Serviços *Materials and Services Management Department*
EMBRAPA	Brazilian Agricultural Research Corporation *Empresa Brasileira de Pesquisa Agropecuária*
IERR	Internal Economic Rate of Return
IDB	Inter-American Development Bank

NARS	National Agricultural Research System *Sistema Nacional de Pesquisa Agropecuária*
PAPP	Programa de Apoio Ao Pequeno Produtor *Northeast Rural Development Program*
PAT	Plano Anual de Trabalho *Annual Work Plan*
PRONAPA	Programa Nacional de Pesquisa e Desenvolvimento da Agropecuária *National Agricultural Research and Development Program*
SEA	Secretaria de Administração Estratégica *Strategic Management Secretariat*
SEP	Sistema EMBRAPA de Planejamento *EMBRAPA Planning System*
SPE	Secretaria de Programas Especiais *Special Programs Secretariat*
SPI	Serviço de Produção de Informação *Information Production Service*
SSE	Secretaria de Apoio aos Sistemas Estaduais *State System Support Secretariat*
SUDENE	Superintendência do Desenvolvimento do Nordeste *Superintendence for the Development of the Northeast*
UEPAE	Unidade de Execução de Pesquisa de Ambito Estadual *Unit of Research at State Level (now no longer exists)*

IMPLEMENTATION COMPLETION REPORT

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Preface

1. This is the Implementation Completion Report (ICR) for the Third Agricultural Research Project in Brazil, for which a loan in the amount of US$47.0 million was approved on October 24, 1989 and made effective on April 27, 1990. The loan was closed on June 30, 1996, compared with an originally scheduled closing date of June 30, 1995. Under a general review of the government's external loan portfolio, US$5.0 million of the loan was canceled in December 1994. The balance of US$42.0 million was fully disbursed.

2. This ICR was prepared by a mission of the FAO/World Bank Cooperative Program which visited Brazil in February, 1997 for the Natural Resources, Environment and Rural Poverty Operation Division, Department I (LA1ER) of the Latin America and Caribbean Region (LAC) in collaboration with Raimundo Caminha of the Bank's Recife Office and Michael Carroll, Task Manager (LA1ER). The ICR was reviewed by Constance Bernard, Chief, (LA1ER); Luis Coirolo, Brazil Portfolio Manager (LA1ER); and Orville Grimes, Projects Adviser (Country Department I). The report also includes comments provided by the Borrower.

3. The ICR is based on extensive material provided by the implementing agency, the Brazilian Agricultural Research Corporation (EMBRAPA), including a comprehensive project final report, material in Bank files in Washington and Recife, and visits to research stations which were major recipients of project finance.

IMPLEMENTATION COMPLETION REPORT

BRAZIL

THIRD AGRICULTURAL RESEARCH PROJECT
(Loan 3130 - BR)

Evaluation Summary

Introduction

1. Recognizing the importance of improved agricultural technology to sectoral and national development, the Brazilian Government in 1973 created the Brazilian Agricultural Research Corporation (EMBRAPA) with the mandate to execute, coordinate and promote agricultural research in the country. The Bank supported the institutional development of EMBRAPA and its technical programs with a first agricultural research loan (1249-BR) approved in FY76 and a second loan (2016-BR) approved in FY81. Both loans were seen as providing a technological underpinning to other Bank support for the agricultural sector, particularly to rural development, poverty alleviation and irrigation projects in the drought-prone Northeast of the country, and to area development projects in the northwest, on the southern fringes of the Amazon basin.

The Third Agricultural Research Project

2. **Objectives.** The Third Agricultural Research Project aimed to "support the execution, dissemination and assessment of the results of research programs designed to contribute to the formulation of sustainable agricultural production systems in two distinct agro-ecological areas. The project would also strengthen the capacity of EMBRAPA and the state research agencies to generate and disseminate technology, and increase the efficiency of the system of cooperative agricultural research between EMBRAPA and state governments in the Northeast through the adjustment of the ongoing research programs and the definition of appropriate procedures to consolidate these programs under the aegis of EMBRAPA"[2]. Particular lessons from the two previous projects to which the third project sought to respond were the need to address the continued relative weakness of public sector research in the Northern (Amazon) and Northeastern Regions; the need for a systems approach to technology generation and transfer; and the need for better research monitoring and evaluation.

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[2] Memorandum of the President, Report P - 5107 - BR of September 11, 1989.

3. **Components.** The project had five components: development of new production technologies in EMBRAPA research centers in the target regions (56% of base cost); support for research in other EMBRAPA centers (32%); testing of new methods and partnerships in technology transfer (4%); further evolution of the national agricultural research system (NARS) and of EMBRAPA's leadership role (4%); and impact assessment and studies (4%). The research corporations of state governments in the Northeast received training and consultancy support. The total cost was estimated at US$97.8 million, with a loan size of US$47.0 million. EMBRAPA was required to buy vehicles and computer equipment worth an additional US$9.1 million with its own funds. The project was prepared with Bank assistance and appraised in March/April 1989. The loan became effective in April 1990 and closed, after a 12-month extension, in June 1996. Under changes to the Loan Agreement, the Bank later agreed to participate in the purchase of computers and vehicles, and US$5.0 million was cut from the loan as part of a general rationalization of the government's portfolio of external loans.

4. **Design.** The project repeated the general formula of the two previous Bank projects, responding to needs as they were perceived at the time. On the evidence of EMBRAPA's past performance the project was consistent with the Borrower's implementation capacity. Risks due to a repetition of counterpart funding shortfalls were correctly identified. On the other hand, no monitoring indicators were specified at appraisal and there was no direct link between funded items and the specific research or other technical targets given in the Staff Appraisal Report (SAR). *De facto*, therefore, the project focused on the creation of institutional capacities for research rather than specified needs for new technology. No *ex ante* economic analysis was attempted, and the impossibility of attributing specific costs to identified research outputs precludes any reliable *ex-post* cost:benefit calculations.

Implementation Experience and Results

5. The early years of project implementation coincided with a period of unprecedented and unforeseen changes in Brazil's constitution and government, reforms in its macro-economic and trade policies, and a re-definition of the role of the public sector and its institutions. Serious counterpart funding difficulties flowed from these changes and greatly slowed initial disbursement. Delays were aggravated by cumbersome administrative processes within EMBRAPA and changes in government requirements for the clearance and approval of tender documents. Nevertheless, the government remained committed to the cause of agricultural research throughout this turbulent period and EMBRAPA, aided by Bank flexibility, worked hard to make up for delays when the turbulence subsided. At the same time EMBRAPA undertook a major reform of its priority-setting and planning system. Loan funds earmarked for preparation of recommendations and an action plan for evolution of the National Agricultural Research system (NARS) were, instead, redeployed flexibly for supporting consultancies and a workshop ancillary to this institutional reform.

6. The overall outcome of the project is rated as satisfactory. The project eventually achieved its major *de facto* aim, to which over 90% of costs were allocated, of strengthening the physical and intellectual capacity of EMBRAPA centers for agricultural research within, or in support of, the North and Northeast Regions. Although, as noted earlier, project funding

could not be directly linked to individual research objectives or programs, the project allowed EMBRAPA to strengthen a research portfolio which already converged in many respects with the technical objectives listed in the SAR. Useful technologies (e.g. improved varieties as well as production systems) and supporting knowledge (new biological control agents and better resource maps) continued to be generated from the EMBRAPA system. Reform of EMBRAPA itself, although supported rather than catalyzed by the project as envisaged, left the institution better prepared to fulfill its mandated role of leadership of the NARS and to promote more participation of entities outside the public sector. However, development of new partnerships with state governments in technology adaptation and transfer was undermined when, due to restrictions on public sector budgets at state level, complementary funding for these services fell short of the levels envisaged at appraisal.

7. The project was less successful in achieving the objectives of its smaller components. Although monitoring indicators were added at supervision, they focused more on physical implementation targets and did not allow assessment of the productive or institutional impact of the project. EMBRAPA's cooperation with state government agencies was limited, but some replicable experience was gained with other partnerships. Socio-economic studies intended to focus on the returns to research and adoptability of technologies produced limited relevant results.

8. By loan closure the revised loan amount of US$ 42.0 million had been fully disbursed. Final counterpart funding totaled US$ 44.8 million - as against the SAR figure when reduced by the same proportion as the Bank loan, but including vehicles and computer equipment, of US$ 53.4 million. The proportions of final expenditures under the main cost categories generally matched appraisal estimates. Physical targets, for buildings and other hardware as well as for "soft" items such as training, consultancies and technology demonstrations to farmers, generally equaled or exceeded targets. However the project's Mid-Term Review was postponed due to slow disbursements in the initial years, then canceled when subsequent acceleration meant that disbursement was already almost complete.

9. The generally satisfactory outcome of the project can be attributed to sustained government commitment to research in the face of various constraints, plus efforts by EMBRAPA to recover lost time once these constraints - and particularly a shortage of counterpart funding - had eased.

10. The project, being the successor to two projects previously rated as successful, was appraised by the Bank and designed in a rather routine manner. There were only six formal supervisions, with a critical two-year gap at a time of rapid local developments affecting the project. For lack of adequate allocation of resources to supervision at that time, Bank opportunities to improve outcomes of the minor components, particularly monitoring, technical control and socio-economic studies, were probably missed. But the Bank's generally supportive and flexible approach gave the Borrower greater freedom to control the evolution of its agricultural research system.

11. EMBRAPA has now achieved a degree of maturity at least as great as was envisaged at appraisal. The Institution is better placed to respond appropriately to the demands of technology users and to compete effectively for public or other funding in future. Given the high level of integration between project activities and the overall performance of EMBRAPA, these project-related gains are considered to have made a significant contribution to the sustainability of the institution. The sustainability rating therefore refers mostly to EMBRAPA's research structure rather than the project in isolation. They will be underpinned by a recently-negotiated fourth Bank loan for agricultural research, which contains a major element of competitive grant funding plus further support for weaker public institutions, especially in the northern and northeastern states.

Lessons Learned

12. The major lesson learned from the project is that a maturing agricultural research organization can be expected to apply external funding effectively provided that: (a) the government remains committed to its future; (b) it has forward-looking management; (c) it has adequately skilled and rewarded staff; and (d) it has a flexible lending partner. When dealing with such borrowers, the Bank's role, beyond supplying funds, should focus throughout the project cycle on ensuring these prerequisites.

IMPLEMENTATION COMPLETION REPORT

BRAZIL

THIRD AGRICULTURAL RESEARCH PROJECT
(Loan No. 3130 - BR)

1. PART I: PROJECT IMPLEMENTATION ASSESSMENT

A. STATEMENT/EVALUATION OF OBJECTIVES

1. As stated in the Memorandum of the President [3], the objectives of Brazil's Third Agricultural Project were to "support the execution, dissemination and assessment of the results of research programs designed to contribute to the formulation of sustainable agricultural production systems in two distinct agro-ecological areas. The project would also strengthen the capacity of the Brazilian Agricultural Research Corporation (EMBRAPA) and the state research agencies to generate and disseminate technology, and increase the efficiency of the system of cooperative agricultural research between EMBRAPA and state governments in the Northeast through the adjustment on the ongoing research programs and the definition of appropriate procedures to consolidate these programs under the aegis of EMBRAPA". The project aimed to respond to lessons learned from two previous phases of Bank support. Lessons concerned the need to address the continued relative weakness of research capabilities in the North and Northeast Regions, which had so far benefited less than elsewhere from newly generated technologies; the need to give more priority to a systems approach in generating and disseminating technologies better adapted to the situations of small farmers in these regions; the need for the national agricultural research system (NARS) to evolve, under EMBRAPA's leadership, to incorporate greater participation of research and extension agencies of Brazil's state governments, the private sector, NGOs, producer associations and farmers themselves; and the need for improved monitoring and evaluation of research programs.

2. Overall project objectives as stated in the Staff Appraisal Report (SAR) were to support agricultural research programs in the north and northeast as well as basic research to backstop these programs. An intention to finance upgrading of state research companies in the northeast as well as EMBRAPA centers had been eliminated at the Government's request during preparation, because under Brazil's new 1988 constitution sufficient funds were required to be provided by the states themselves. However, both the SAR and the MOP mention consolidation of state-level research components of the Bank's regional development projects in the Northeast Region under the aegis of EMBRAPA. A second general objective was "to increase the efficiency of the national agricultural research system by consolidating research planning and monitoring

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[3] Report P-5107-BR of September 11, 1989.

procedures within the various units and institutions belonging to the system under the coordination of EMBRAPA."

3. The project had five components.

- Development of new agricultural production technology at two regional and eight national commodity centers in the north and northeast (US$45.5 million; 56% of base cost).

- Research in support of regional programs at eight additional research centers, mostly outside the target regions, covering biotechnology, food technology, soil biology and management, irrigation and the environmental impact of agricultural development (US$26.5 million, 32% of base cost).

- Technology transfer, including testing of new methods, new collaborative partnerships and wider use of field tests and demonstrations (US$3.3 million, 4% of base cost).

- Institutional development and strengthening of EMBRAPA and other parts of the NARS, including reform and unification of management and operational systems (US$3.6 million, 4% of base cost).

- Impact assessment and special studies, including continuation of monitoring and evaluation adopted under the second research project and expanded socio-economic studies (US$3.2 million; 4% of base cost).

The total project cost was estimated at US$97.8 million including contingencies, with a Bank loan of US$47.0 million. The loan was designed to finance the foreign exchange costs of machinery, equipment, books, training and technical assistance, half the cost of civil works and a very small proportion of other costs. This design appears to have been a legacy from the Bank's Second Agricultural Research Project, in which foreign exchange controls were a major factor in project implementation. With the opening of the economy over the life of the third project, this design became less appropriate, especially in view of procurement arrangements for goods assuring domestic bidders a 15% preference in international tenders.

4. At the Government's request, a five-year disbursement period was agreed, rather that the six or eight years favored by the Bank. Because of import restrictions which at the time precluded international competitive bidding in accordance with Bank regulations, EMBRAPA was required to purchase with its own funds vehicles and computer equipment valued at a further US$9.1 million. Two financing changes were made later: with the liberalization of Brazil's markets the Bank was later able to participate in part of the financing of vehicles and computers; and as a result of a general review of the federal government's external loan portfolio, US$5.0 million was cut from the project loan. The loan was approved on October 24, 1989, became effective on April 27, 1990 and closed, after a 12-month delay, on June 30, 1996.

5. Project objectives were generally convergent with government policy and the Bank's country assistance strategy. National agricultural policy at the time of appraisal was dominated by concerns for food and commodity self-sufficiency and the evolution of agricultural exports. However, improvement in the technological base of small-farmer agriculture in more problematic areas - including greater sustainability of production systems in the Amazon and more stable systems for the impoverished and drought-prone Northeast Region - was also among government priorities. Subsequently, increasing concerns with environmental issues, particularly following the 1992 UN Conference on the Environment and Development in Rio de Janeiro, brought to even greater prominence the need for more sustainable technology for both regions. Agricultural improvements in the north and northeast, in support of ongoing Bank rural development, poverty alleviation and irrigation projects, were already an important element in the country's assistance strategy. To draw participants outside the public sector into the NARS, in the interests both of greater technical relevance of programs and their financial sustainability, had been an objective of the Bank's previous research projects. It was to become a very prominent government objective during implementation of the third project.

6. Given EMBRAPA's experience with implementation of past Bank-financed projects, as well as a satisfactory implementation record with IDB-financed research projects in the South and Southeast Regions, the project was justifiably considered as being within existing implementation capacity. It did, however, focus on the two regions in which it had so far proved most difficult to create well-staffed and stable research centers. The risks to timely project implementation which could arise from a repetition of previous shortfalls in counterpart funding of research were clearly identified. The risk that returns to research could be jeopardized by poor coordination between researchers and extension agents and inadequate feedback from farmers was also rightly flagged.

B. ACHIEVEMENT OF OBJECTIVES

7. The project's overall objectives were primarily institutional, but divided between two aims: the further development of agricultural research and technology dissemination capacity in public research centers; and broader evolution of the agricultural research system in the target regions. Each is discussed separately. In summary, the project either achieved these major objectives in the manner planned at appraisal or it contributed significantly to their achievement, albeit in less direct ways than were planned at appraisal. The project is also considered sustainable and likely to facilitate valuable future evolution and enhanced productivity of the national agricultural research system. Overall outcome is therefore rated as satisfactory.

Development of Research Capacity in the North and Northeast

8. The first general objective of the project was to strengthen EMBRAPA and the state agricultural research agencies to generate and disseminate technology which would contribute to sustained agricultural development in the Amazon and Northeast. A total of 91% of base cost was allocated to this objective. EMBRAPA's research capability was successfully strengthened in both of the target regions (particularly the Northeast) by the provision of infrastructure, equipment, vehicles, staff training (much of it postgraduate), consultancies,

technical assistance and improved access to information. Some support - particularly training - also went to state research corporations (Appendix C), but direct funding of their infrastructure and equipment was excluded from the project design prior to appraisal because it was precluded under the 1988 Constitution. Thus the project made only a small contribution to strengthening research capabilities in the states. The items financed in EMBRAPA centers closely mirrored those of the two previous projects in the series. They left the institutes better placed than before, physically and intellectually, to carry out a larger and more relevant research program for the North and Northeast. Items procured, at times after negotiated changes, generally matched institute needs. Technical assistance consultancies supported various key stages of program development or implementation. Trained staff generally returned to their original locations and applied the new knowledge or skills acquired. Outside training led to continuing links with centers of excellence in other countries while local universities have in some cases been able to upgrade their teaching standards by using more highly qualified researchers as lecturers. Training of technical support staff addressed another important constraint on the productivity of EMBRAPA scientists. Physical and financial objectives were mostly achieved or exceeded, and expenditure patterns were close to those estimated at appraisal (see Table 8A and Appendix C, Table 14). Despite these positive achievements there was, however, a tendency for the number of researchers at the more remote EMBRAPA centers in the two target regions to decline slightly, while numbers at the regional centers have increased (Appendix C, Table 17).

9. Whether or not, through these strengthened research capabilities, the project led to improved technologies being developed and disseminated cannot be assessed directly. The SAR lists research programs to be supported by project funds. However, the design process did not incorporate a systematic analysis of future program needs, resource gaps, and from this a derivation of component costs on the basis of specific technical targets. *De facto* therefore the project expanded overall institutional capacity for research rather than targeting specific needs for new technologies. Furthermore, a considerable time is needed - usually well beyond the six years of project disbursement - for a new technology to progress from initial experiments to becoming part of a production system in the farmer's field. In practice, project funding therefore ended up providing general support in part to ongoing EMBRAPA research and in part allowing new programs to be initiated.

10. What can be said is that project support allowed recipient research centers to press forward with or reinforce existing research lines and add to new programs, many of which had objectives which coincided with the technical areas listed in the SAR. Thus a number of EMBRAPA research products or achievements during the project period can be at least partially attributed to the project. These include, for instance, the selection and release of a range of new food and cash crops, fruit and vegetable varieties adapted to the north or northeast; resource mapping; collections of indigenous germplasm; improvements to irrigated production systems for high-value fruit and vegetable crops in the northeast as well as for livestock production in semi-arid areas; forage development for semi-arid areas; use of fungi and bacteria for biological control of a variety of insect pests; various innovations in post-harvest crop processing and storage; and important supporting studies in the fields of biotechnology, genetic manipulation and nitrogen fixation.

Although much applied research continued to be dominated by plant breeding, some progress was also made with increasing the proportion of systems work in the portfolio.

11. The project also exposed larger numbers of EMBRAPA researchers in the target regions to farmers and their problems. Targets for the promotion of new technologies through demonstrations, field days, media publications and talks were generally also achieved or exceeded (see Table 5). And state-level adaptive research corporations in the northeast, although for the most part excluded from the project at the design stage, did benefit from the training program and project-funded consultancies. Of the 303 scientists who were sent on academic (mostly Ph.D) courses, 46 were from state corporations.

Evolution of the NARS

12. The second general project objective was to increase the efficiency of regional sections of the research system by consolidating research planning and monitoring procedures within the various units and institutions under the coordination of EMBRAPA. Despite the stated importance given to this objective, it received only a small overall share of financing. Only a part of the 4% of costs allocated to institutional development was earmarked for preparation of an action plan to strengthen and restructure the system; only a part of the program of studies under the impact assessment component (a further 4% of base cost) could also be construed as supporting its overall evolution. During the project period there was nevertheless considerable change in both the NARS and in EMBRAPA's role. EMBRAPA designed and installed a new priority-setting and planning system intended to replace a previously supply-driven with a demand-led approach to technology dissemination and transfer. The new system involves greater participation of consumers and technology users outside the public sector in priority setting. It gives considerable further emphasis to a production systems approach. It is intended to facilitate more partnerships between government research organizations and bodies outside the public sector.

13. The impetus for these changes was provided mainly by the wave of reforms of the public sector in general which swept through the country. In contrast to the stated appraisal objective of pointing the way for change, project resources were in practice used in a supporting role, principally to finance a major consultant review and workshop on EMBRAPA's draft action plan for the future. However, this project contribution was perhaps more commensurate with the relatively limited funds actually allocated to this aim.[4]

14. Financing constraints of state governments in the northeast have so far prevented their research corporations and state extension services from responding very actively to EMBRAPA leadership. To only a limited extent was EMBRAPA, using project support, able to fill these unanticipated gaps. However, the demand-led system which has been set up and more recent measures to attract and administer grant funding appear sustainable and capable of drawing in states and other members of the NARS as more active partners in future. Meanwhile, the

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[4] Eventual expenditure under the institutional development component was in fact almost double the SAR estimate; but most of the increase was accounted for by hardware items.

technology diffusion component did, on a local basis at least, create some closer links with state extension and research services, the private sector, municipalities and farmer groups or individuals.

15. Among individual project components, only impact assessment and special studies (the smallest component in terms of cost) fell seriously short of stated objectives by whatever criteria "success" is defined. Socio-economic studies and assessments of the potential benefits of research mostly had little output relevant to their intended purposes. The project Mid-Term Review did not take place.

Financial Objectives

16. Total project expenditure was US$86.5 million. The project loan amount of US$47.0 million was equivalent to the total estimated foreign exchange cost. Following the reduction of US$5.0 million, which was agreed in December 1994, the remaining total loan amount of US$42.0 million was disbursed by end-1996. Foreign exchange costs appear to have been substantially overestimated at appraisal (see Table 8A). Although it is difficult to estimate exactly, it would appear that they actually amounted to only about US$30.0 million (including about US$4.0 million for computing equipment eventually purchased with loan funds). This exaggeration may reflect the concern of project designers to address real foreign exchange limitations which were a concern of previous projects, but which became less relevant with the liberalization of Brazil's economy. The distribution of expenditures between categories and components broadly mirrored the pattern set out in project design, although there was a tendency for funds to be concentrated in the larger centers (CNPAT, CENARGEN and EMBRAPA headquarters). For example, around 25% of technical assistance expenditure was concentrated at EMBRAPA headquarters in Brasilia.

Impact Assessment

17. No *ex ante* economic analysis was attempted for the project, and the lack of specific cost attributions to individual research programs precludes *ex post* cost:benefit calculations. Work done by research centers to assess incremental benefits from technologies generated and attribute them to project expenditures did not produce reliable results. Socio-economic studies (see Table 7) were curtailed through a lack of EMBRAPA staff resources, limited use of consultants, and generally a lack of focus on factors related to adoption of technologies by farmers in the North and Northeast. Hence there is an insufficient base for quantitative evaluation of research benefits over the project period.

C. THE IMPLEMENTATION RECORD

General

18. Project implementation was not greatly influenced by factors outside the control of the government. Perhaps the only event of major importance was the UN Conference on the Environment and Development in 1992, which sensitized public opinion to the importance of developing more sustainable production technologies, especially in fragile environments such as

the Brazilian Amazon. This may have contributed to a decision to alter the titles and the emphasis of programs in the northern Region to include specific mention of agroforestry. At a local level, failure of at least three building contractors led to a need to select others, with consequent delays and cost overruns on the works concerned. On the other hand, the late 1980s and early 1990s in Brazil were characterized by many changes under the control of the legislature or government embracing the national constitution, macro-economic and trade policies, and a re-definition of the role of the public sector and its institutions. Several of these impacted on the project. Linked with - and partly attributable to - these national changes, were reforms within EMBRAPA itself. The project thus came to be implemented in circumstances which could not have been fully foreseen when it was appraised. It is to the credit of the Borrower and lender that despite this turbulence the project still largely achieved its major objectives, albeit in a period closer to that preferred by the Bank than in the five years on which the government had insisted at appraisal.

Factors Subject to Government Control

19. A change in national administration shortly before loan effectiveness was followed by restrictions on the budget of the Federal Government. These severely curtailed counterpart funding. A number of federal parastatals in the agricultural sector were abolished, including the federal extension agency EMBRATER. With the disappearance of EMBRATER, EMBRAPA temporarily inherited some of its responsibilities including continued administration of the Bank's Second Extension Project. Government requirements for the preparation and approval of tender documents were changed.

Factors Subject to EMBRAPA's Control

20. The President of EMBRAPA changed almost immediately after loan effectiveness. This was followed by organizational changes which included the dissolution of the headquarters section which had substantial experience with managing previous Bank and other international projects. Shortly afterwards, perhaps spurred to action by the wave of reforms sweeping through the public sector, EMBRAPA began to develop its new demand-led planning system. The new system was implemented in 1994 and was substantially different from the previous system, which was developed during the two earlier Bank projects and was assumed in the SAR to continue during the third project. These factors may all have drawn institutional attention away from project implementation in the early years, although this cannot be said with certainty. A number of more specific internal factors also influenced early implementation, including the rigidity of EMBRAPA's financial control procedures at the time and the difficulty of covering a widely dispersed civil works program with a small engineering staff based in regional centers.

21. Under the combined impact of these factors, the first tender documents under the project were not approved until 1992, and at the end of that year disbursement was only 27% of the SAR projection. However, the flow of counterpart funds under the federal budget later improved substantially, so that by the time of project closure after a delay of 12 months, the amended loan disbursement target of US$42.0 million had been fully committed. The eventual total project

expenditure of US$86.5 million included counterpart funding of US$44.6 million, compared with the SAR figure, including the vehicles and computer equipment, of US$59.9 million.

Implementation Impact

22. About US$21.0 million of project funds were received by EMBRAPA centers in the northern region with the regional center, CPATU, receiving the largest share (US$7.8 million, incorporating US$2.7 million of civil works) (see Appendix C, Table 3). CPAA - the center for agro-forestry research in the western Amazon - at US$4.2 million (including US$1.0 million of civil works), was the other major beneficiary in the north. The northeast centers received a total of US$31.0 million, with the national center for tropical agro-industrial research receiving the largest share, at US$7.7 million. The remaining seven centers in the northeast each received between US$3.0 and US$4.4 million, including the regional center, CPATSA. The largest single recipient of project funds was the genetic resources and biotechnology center, CENARGEN, which was allocated US$10.3 million, including almost US$4.0 million of civil works. Centers providing strategic support received in total US$23.8 million. Project expenditure per scientist averaged about US$76,000 but ranging from up to US$145,000 for smaller centers down to under US$35,000 (Appendix C, Table 3).

D. SUSTAINABILITY

23. EMBRAPA is now a mature public research organization committed to fulfilling its mandated role in the two target regions as well as the role of leader of the Brazilian NARS. This is due to a combination of project support, impacts of two previous Bank as well as other externally funded research projects, and endogenous reforms within EMBRAPA which were convergent with the general aims of the third Bank project and supported by flexible use of project funds. EMBRAPA has in place the planning procedures, physical capacity and human resources needed to respond better to public demands for technology and to compete more actively in future for funding from the government and technology users themselves. It is well placed, also, to take the lead in forming new partnerships within the NARS in response to demand. The centers strengthened by the project in the North and Northeast Regions - especially the smaller and more distant ones - may require some further institutional support to make them as competitive as those elsewhere, but most have nevertheless progressed considerably.

24. Always provided that the federal government remains committed to maintaining the existing staff and infrastructure (i.e. the "standing capacity" of the institution) at their present levels, EMBRAPA can therefore be expected to sustain its contribution to the generation of agricultural technology through successful competition for future funding. This is favored by the fact that the government is about to embark on a fourth Bank supported research project, intended to provide competitive grants for new research programs plus institutional support to selected, weaker, *national* institutes. A new loan for such a project has recently been negotiated and approved by the Board on May 22, 1997.

25. The influence of EMBRAPA on the development of the cooperative agricultural research system in the target regions was restricted during the project, due partly to the inability of states to provide the expected financial support for their own research corporations (the northeast) and their extension services (both regions). However contacts with farmer groups under the technology transfer component, and in particular the stimulus which the project gave to some municipalities to take over public extension responsibilities from state governments as called for under the 1988 constitution, have provided at least localized precedents for more diversified partnerships in the NARS. Provided EMBRAPA succeeds - as expected - in maintaining its leadership of the NARS, these precedents supported by the project are likely to be replicated. Furthermore, it is expected that in future EMBRAPA centers will form more partnerships with the state research corporations of the northeast to compete for grants. By helping states to access new funding sources, EMBRAPA will thus help state research corporations to regain some of the ground lost due to restricted state budgets.

E. BANK PERFORMANCE

26. The Bank provided the Borrower with design assistance, beginning a year before closure of the second project, with a status review of agricultural and forestry research by two eminent consultants[5] and a proposal to the government for a major review of research policy to the end of the century. This was followed by an identification mission (1988) and a memorandum of understanding on the project concept which set the scene for local preparation work. EMBRAPA issued a preparation report early in 1989. The project which emerged was for the most part a continuation of the previous pattern, although major changes in the role of the public sector, including the closure of EMBRATER, the national extension corporation, were already taking place at the time. However these implications were reconciled with the project design to the satisfaction of the Bank and government, and the project was appraised in March/April 1989.

27. The majority of funding was presented by the appraisal team as supporting specific research projects: Working Papers accompanying the SAR dealt mainly with individual commodities or the resources of centers. However as stated earlier, *de facto* the project responded more to EMBRAPA's requests to expand its overall research capacity for the target regions, and had only a general link to the commodities, systems or background research topics which it sought to support. No monitoring indicators were specified at appraisal; a set was agreed only during the first supervision mission and these centered more on physical targets for implementation than outputs. It was assumed that most pre-existing O&M arrangements would be maintained under the third project, with the addition of regional research coordinators to oversee implementation in each region.

28. Given that the project as appraised was largely a repeat of earlier approaches, that EMBRAPA and the Bank had worked together for a dozen years and that the two previous projects had had satisfactory outcomes, this rather routine approach by the Bank to design and

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[5] Brazil: The Status of Agricultural and Forestry Research, Final Report by N. Borlaug and F. Zillinsky, August 22, 1986.

appraisal can be understood. Furthermore, Brazil was experiencing a macro-economic crisis and a series of massive adjustments which had prior claims on the Bank's attention and resources. At appraisal the major changes later made by EMBRAPA itself to its organization and *modus operandi,* at the national level, could not have reasonably been foreseen. However the combination of the approach to costing and the absence of suitable indicators precluded any sort of cost: benefit analysis for individual research outputs. And the appraisal team might have anticipated a subsequent failure of the attempt to use regional coordinators for research in the north and northeast. Their terms-of-reference, as drafted by EMBRAPA at the request of the Bank, cast them in a largely administrative role rather than making them responsible for the scientific quality and relevance. Furthermore they had no executive authority over allocation of funds and duplicated a function also performed at EMBRAPA headquarters. The concept was eventually abandoned as unworkable.

29. The Bank mounted only six formal supervision missions, with a crucial gap of two years from early 1992 when the Task Manager who had seen the project through from preparation was replaced. Thereafter routine supervision responsibility was transferred to the Bank's Recife office, where staff were, however, concurrently grappling with major implementation problems and reformulation of the Bank's portfolio of Northeast Rural Development Projects. The change resulted in an easier working relationship with the project coordinating team in EMBRAPA, speeding clearances and facilitating disbursement at a time when counterpart funding problems were diminishing. It was instrumental in allowing disbursement to be completed with an eventual delay of only 12 months, although at the expense of some weakening of formal financial monitoring and control from Washington. Relatively frequent contacts between Recife or Washington staff and EMBRAPA headquarters or centers, taking advantage of proximity while on other Bank duties, filled some of the gaps in formal supervision.

30. The Mid-Term Review planned for March 1992 was postponed because tendering delays and slow disbursement made it premature. When supervision was resumed in 1994, a Mid-Term Review was no longer considered appropriate since major changes in research priority-setting and coordination which were generally convergent with Bank thinking on the public funding of research had already been made by EMBRAPA at national level; and by then disbursement had picked up impressively and the project was scheduled to close within a year. At the same stage the Bank Recife Office proposed testing a competitive grants system which would have piloted what became the main component of the planned successor project. Despite preparatory work in the Recife office, this idea was not taken forward.

31. The Bank's inability, when faced with the calls from the rest of its Brazil portfolio, to find sufficient resources for more organized supervision of the research project is the main reason why supervision performance is rated overall as unsatisfactory, even though the staff concerned did their best possible in the circumstances. But by giving low priority to supervision during a period of rapid institutional change, the Bank probably missed opportunities to improve the outcome particularly of the smaller project components, which were included in the project mainly in response to Bank policy and suggestions, or to the lessons of the first two projects. More useful arrangements for technical monitoring and supervision of research in the topics which the project was intended to support could have been put in place. Firmer backing from Washington of Recife's suggestions to pilot some form of

competitive research funding could have generated useful experience and training for the design of the fourth research project. Resources allocated to closer technical supervision of institutional issues and socio-economic research could have improved the relevance and standard of socio-economic studies and sharpened impact evaluation, which were the weakest areas of project implementation.

32. As it was, Bank supervision resources usually did not allow staff to go far beyond responding to day-to-day borrower requests or approving minor adjustments. One of the consequences was a reduction in the catalytic role which the Bank was originally expected to play in reshaping the cooperative agricultural research system in the Northeast and EMBRAPA itself. However, it must be recognized that the Bank flexibility also supported and reinforced national-level reforms of internal origin which represented a timely and desirable maturation of the EMBRAPA system. And because of a higher degree of client ownership, these endogenous reforms can be regarded as preferable to changes involving only reaction to pressure by the Bank.

F. BORROWER PERFORMANCE

33. Overall, the Borrower's performance was satisfactory. The government maintained its commitment to agricultural research throughout the disbursement period, despite severe budgetary restrictions and major associated policy and structural changes affecting the role of the public sector. When national-level restrictions were somewhat relaxed, it was quick to restore the flow of counterpart funds to the project. EMBRAPA, as the implementing agency, and the government complied with loan requirements for the preparation of annual workplans, annual and final reports, and submission of audited accounts, etc. (See Table 10). The major project expenditure and physical objectives were achieved.

34. There were, however, implementation shortcomings especially in early project years. For instance EMBRAPA delayed submitting audited accounts for 1990 which placed the government temporarily in breach of the Loan Agreement, and had difficulties in meeting simultaneously all the demands by centers for support with their civil works programs - understandable in view of some of the distances involved. But the potentially negative effect of breaking up EMBRAPA's implementation coordination team inherited from the previous project was offset in 1992 by the appointment of satisfactory substitutes. During the project period EMBRAPA furthermore devised and put into place the major and beneficial national reforms to its research planning system. While initiated largely outside and going beyond the project framework, EMBRAPA drew effectively on project support to facilitate these changes. EMBRAPA contracted out to an international agency the management of international consultants' contracts; shortly afterwards it also contracted out the management of national consultant's contracts, and ultimately - in an effort to speed disbursement - the management of training arrangements. This greatly facilitated recruitment and administration, although monitoring and reporting of the consultancy program did not reach standards which might reasonably have been expected from the international agency under the terms of its contract. EMBRAPA also requested Bank permission to use project funds to recruit long-term consultants to assist the corporation with project management. Two consultants were engaged, with terms of reference requiring them *inter alia* to oversee monitoring

and evaluation of the project's research programs. However, both appear to have quickly been assigned to other duties.

35. The Borrower was somewhat less successful in dealing with technical control of the project. When the plan to install regional coordinators of research was abandoned, this responsibility fell back on the center. The EMBRAPA Board and headquarters units designated in the SAR - as for the two previous projects - as having ultimate technical control over the research program, were responsible for the corporation's national research portfolio, of which the project financed only a part. They had some early difficulty in ensuring that resources were used in strict compliance with project objectives. When the headquarters project coordinating team was strengthened in 1992, efforts still tended to center on the management of disbursements and procurement. Oversight to ensure conformity of research programs with declared technical objectives and to monitor technical achievements remained a secondary priority. In 1993, when EMBRAPA's demand-led system of research priority setting and planning superseded the system assumed at appraisal, its research portfolio was simultaneously compressed from 66 programs and over 4,000 projects to 16 programs and about 450 projects. Most individual research lines tagged under the original system as benefiting from capacity created by the Third Research Project then became merged with other lines not supported by the project, making technical control over the use of project funds for the generation of specific technologies virtually impossible.

G. ASSESSMENT OF OUTCOME

36. As was common at the time, no internal economic rate of return (IERR) was calculated for the project at appraisal. The lack of means to tie project expenditures to the evolution of specific technologies during implementation precluded any *ex post* quantification of economic impact. Further, given the design of the project and the changes to the national system being made by EMBRAPA, it would have been extremely demanding on analytical skills and staff time to have done any meaningful analysis of this type. The relatively simpler task of estimating financial cost and benefits from a selection of technologies at the user level was poorly carried out and yielded little useful information.

37. Overall, however, the project is rated as satisfactory, reflecting the achievement of its major development objectives, flexible support to the Borrower and its likely sustainability.

H. FUTURE OPERATIONS

38. Annual plans for the continuation of ongoing research programs which were recipients of project funds have already been made. A declining share of loan funds in operating costs incorporated into the project design has resulted in all but 4% of these operating costs already being absorbed into EMBRAPA's regular budget. Future operation of the regional and supporting research centers funded by the project is expected to be based on successful competition for grants, often - in line with the new shape of the NARS which is emerging - in partnership with Universities, NGOs, private companies or others outside the EMBRAPA system. The new arrangements are to be supported by the Bank under a fourth agricultural research project, recently negotiated; competitive grants are expected to be supplemented by

further training, studies, etc. under the institutional development component of the same project.

I. KEY LESSONS LEARNED

(i) Because the Borrower maintained a commitment to research despite a series of overarching national adjustments and reforms which withdrew the public sector from other areas of agricultural support, the project was able to reach its major financial and physical objectives. Bank flexibility in adjusting to reform was an important contributor to these achievements.

(ii) Initiatives for institutional reform of publicly-funded agricultural research and for changes in its relationship with other participants in the national agricultural research system arose largely independently, from within the implementing institution, rather than - as envisaged at appraisal - being directly catalyzed by Bank support. The reforms were, however, convergent with Bank thinking; and because they were largely endogenous probably went further and have generated greater local commitment and potential benefits that the project designers could have hoped.

(iii) In the face of other demands for its assistance, the Bank gave low priority to project supervision. In particular, supervision was interrupted at a critical stage of project implementation. This brought a risk that institutional reforms could have drifted into directions inconsistent with project objectives. That they did not, shows the importance of the prior unanimity of vision and familiarity with world views on what constitutes an appropriate evolution of the public role in agricultural research, which had been built up in the case of this project through dialogue with the Bank and through EMBRAPA's other external contacts, over a longer term.

(iv) Close supervision is particularly important for successful outcomes of project components which are included primarily to meet Bank requirements, and which are not as well understood by the Borrower or perceived as having the same priority - in the case of this project, socio-economic studies, monitoring and evaluation.

(v) Attempts to overcome the above difficulties with neglected components through consultants hired by the Borrower were not effective, showing the importance of supervising consultants just as closely as project implementing agencies if they are to be used to solve such implementation problems.

(vi) Regionalization, or decentralization of technical control of research to the institute level, is only effective if financial control is also decentralized.

(vii) The approach to project costing and an initial lack of monitoring indicators precluded meaningful cost:benefit analysis of research outputs. If *ex-post*

evaluation of agricultural research is planned, the monitoring system needs to be designed from the outset to record expenditures for each research line to be analyzed, which must remain distinct from any other line. Even if these conditions are met, skilled and dedicated analysts - preferably external - are likely to be needed to obtain meaningful results. They may be too costly for use except on a sample basis.

(viii) The project confirmed the value of long-term continuity of Bank support for the establishment and subsequent maturation of national agricultural research systems.

2. PART II: STATISTICAL TABLES

Table 1: Summary of Assessments

A. Achievement of objectives	Substantial (✓)	Partial (✓)	Negligible (✓)	Not Applicable (✓)
Macro policies	☐	☐	☐	☑
Sector policies	☐	☐	☐	☑
Financial objectives	☐	☐	☐	☑
Institutional development	☑	☐	☐	☐
Physical objectives	☑	☐	☐	☐
Poverty reduction	☐	☐	☐	☑
Gender issues	☐	☐	☐	☑
Other social objectives	☐	☐	☐	☑
Environmental objectives	☐	☐	☑	☐
Public sector management	☐	☑	☐	☐
Private sector development	☐	☐	☑	☐
Other (specify)	☐	☐	☐	☐

B. Project sustainability	Likely	Unlikely	Uncertain
	☑	☐	☐

C. Bank performance	Highly satisfactory	Satisfactory	Deficient
Identification	☐	☑	☐
Preparation assistance	☐	☑	☐
Appraisal	☐	☑	☐
Supervision	☐	☐	☑ [6]

D. Borrower performance	Highly satisfactory	Satisfactory	Deficient
Preparation	☐	☑	☐
Implementation	☐	☑	☐
Covenant compliance	☐	☑	☐
Operation (if applicable)	☐	☑	☐

E. Assessment of outcome	Highly satisfactory	Satisfactory	Unsatisfactory	Highly unsatisfactory
	☐	☑	☐	☐

[6] Rating refers primarily to allocation of Bank resources: see text.

Table 2: Related Bank Loans/Credits

Loan/credit title	Purpose	Year of approval	Status
Preceding operations			
1. Agricultural Research II (2016-BR)	Strengthening EMBRAPA's research capacity through training, infrastructure, equipment and operating costs	1981	Completed 1987
Following operations			
1. Agricultural Technology Development (Ln. 4169-BR)	Support for diversification and decentralization of national agricultural research system, including introduction of competitive grants	1997	Implementation expected to start early FY98
Linked contemporary operations			
1. Agricultural Extension II (2679-BR)	Support for national technical assistance and rural extension service (SIBRATER), through provision of vehicles, equipment, infrastructure, training and studies	1986	Closed 1995
2. Northeast Rural Development Projects (2524-BR, 2761-BR, 2523-BR, 2763-BR, 2718-BR, 2762-BR, 2861-BR, 2863-BR, 2860-BR, 2862-BR)	10 State projects providing support to rural communities and small-scale producers, including some support to on-farm adaptive research	1986-87	Completed. Now being succeeded by NE Rural Poverty Alleviation Projects
3. Northeast Irrigation I (Ln. 3170-BR)	Irrigation development of 51,000 ha and institutional strengthening through farmers' organisations and improving performance of public agencies	1990	On-going. Due to close June 1997
4. Rondonia and Mato Grosso Natural Resources Management (Ln. 3444-BR, Ln. 3492-BR)	Support for natural resources management in bordering Amazon region	1992	On-going

Table 3: Project Timetable

Steps in project cycle	Date planned	Date actual/ latest estimate
Identification (Executive Project Summary)	-	3/16-21/88
Preparation	-	9/19-29/88
Appraisal	-	3/27 - 4/20/89
Negotiations	-	8/28/89 - 9/1/89
Letter of development policy (if applicable)	N.A.	N.A.
Board presentation	-	10/24/89
Signing	-	1/10/90
Effectiveness	-	4/27/90
First disbursement	-	7/18/90
Midterm review (if applicable)	3/31/92	-
Second (and third) tranche release (if applicable)	N.A.	N.A.
Project completion	9/1/95	12/31/95
Loan closing	6/30/95	2/7/96

Table 4: Loan/Credit Disbursements: Cumulative Estimated and Actual
(US$ millions)

	1990	1991	1992	1993	1994	1995	1996
Appraisal Estimate	7.3	17.0	30.9	41.4	46.3	47.0	
Actual	2.4	4.9	8 4	15.4	23.0	36 0	42.0[1/]
Actual % of Estimate	33%	29%	27%	37%	50%	77%	89%[1/]
Date of final disbursement	December 10, 1996						

[1/] US$ 5.0 million canceled from the loan on December 21, 1994.

Table 5: Key Indicators for Project Implementation

Key implementation indicators[1/]	Unit	Estimated	Actual[2/]	% (of SAR)
I. Generation of Technology				
Research Projects	No.	1000	1386	139
Civil works (new)	M^2	22126	18904	86
Civil works (refurbishment)	US$	273,000	1,859,070	680
Other civil works	US$	388,000	1,106,400	285
Furniture and equipment	US$	11,211,000	6,089,730	54
Animals	US$	930,00	235,850	25
Books and periodicals	US$	3,071,000	1,869,960	61
In-country training	No	714	1995	279
Overseas training	No.	310	142	46
National Consultants	Months	144	85	69
Foreign Consultants	Months	197	97	49
II. Research Support Programs				
Research projects	No.	163	538	318
Civil works (new)	M^2	11252	7298	65
Civil works (refurbishment)	US$	315,000	1,054,270	335
Other civil works	US$	538,000	57000	10
Furniture and equipment	US$	8,879,000	5,350,800	60
In-country training	No.	251	200	80
Overseas training	No	141	96	68
National consultants	Months	428	76	18
Foreign consultants	Months	128	94	73
III. Technology Transfer				
Observation plots	No.	2,134	343	16
Demonstration plots	No	2,769	706	25
Production systems	No.	242	49	20
Training courses for farmers/others	No.	439	1007	229
Furniture and equipment	US$	856,000	2,838,000	331
Animals	US$	55,000		
IV. Institutional Development				
Diagnostic studies	No.	27	10	37
National training (EMBRAPA)	No	115	49	42
Overseas training (EMBRAPA)	No.	12	48	450
National training (State companies)	No.	371	53	14
Overseas training (State companies)	No.	71	27	38
V. Project Impact/Special Studies				
Studies commenced	No.	26	25	96
Studies completed	No	26	19	73

[1/] As established during first supervision mission.
[2/] Indicators as at 6/30/96.
Source: EMBRAPA, DEC.

Table 6: Key Indicators for Project Operation

Key operating indicators in SAR/President's Report	Estimated	Actual
None	Not Applicable	

Table 7: Studies Included in Project

Study	Purpose as defined at appraisal/redefined	Status	Impact of study
1. Diagnostic studies of 8 state research companies.	As a basis for restructuring and strengthening national research network.	4 companies given orientation following diagnostic studies	Superseded by events. EMBRAPA's state liaison section (SSE) is to embark on new diagnostic studies.
2. Diagnostic studies of EMBRAPA decentralized units.	As a basis for restructuring and strengthening natural research network	Not found.	Subsequently, a detailed critical review of one center (CNPGL) has led to rationalization of research program.
3. Review of all agricultural research in Brazil.	Redefinition of research priorities.	Review of EMBRAPA's research program conducted 1990, completed in preliminary form May 1992.	One of the bases on which EMBRAPA's Second Master Plan, including revised planning system, was developed.
4. Mid -Term Review.	Assessment of management systems and effectiveness of research-extension linkages.	Not conducted. A workshop was held to review EMBRAPA's future strategy and Second Master Plan.	-
5. Project Completion Report	Summary of project's performance and evaluation of lessons learned.	Completed 1997	Availability of comprehensive information on project implementation
6. Socio-economic zoning of the Amazon.	-	Discontinued 1993	Provided background for many papers and articles on Amazon development and was forerunner of Brazilian component of current IFPRI study of Amazon farming systems
7. Baseline farmer survey and follow-up.	-	A series of surveys by a number of centers to establish socioeconomic characteristics of farmer research clients.	Greater general understanding by study participants of farm/farmer status and farming practices. In one or two centers, progress towards categorization of farm clients of research with a view to orientation of research programs.
8. Numerous studies on policy, trade, development trends and agricultural phenomena of local significance related to research work.	-	Completion and publication by individuals or groups of researchers.	Wider availability of information and further discussion of aspects relating to economic and agricultural development in the North and Northeast.

Table 8A: Project Costs

	Appraisal Estimate (US$M)			Actual/latest Estimate (US$M)		
	Local costs	Foreign costs	Total	Local costs	Foreign costs	Total
Item						
1. Civil Works	7.66	17.08	24.74	19.97	1.00[2]	20.97
2. Furniture, Equipment & Books	17.90	13.92	31.82	15.92	15.11	31.03
3. Technical Assistance	4.91	5.52	10.43	1.92	2.85	4.77
4. Training	6.71	10.43	17.14	4.49	9.75	14.24
5. Operating Costs	13.69	-	13.69	13.54	2.00[2]	15.54
TOTAL	50 87[1/]	46.95[1/]	97.82	55.84	30.71	86.55

Sources: Appraisal - SWP B 17 June 1989
Actual - EMBRAPA. BIRD III Relatorio Final

[1/] SAR Annex 4 (b)
[2/] Mission estimate.

Table 8B: Project Financing

	Appraisal Estimate (US$M)			Actual/latest Estimate (US$M)		
Source	Local costs	Foreign costs	Total	Local costs	Foreign costs	Total
IBRD/IDA	-	47.0	47.0	11.3	30.7	42.0
Cofinancing institutions			-			-
Other external sources			-			-
Domestic contribution[1]	50.8	-	50.8	44.5	-	44 5
TOTAL	50 8	47.0	97.8	55.8	30.7	86.5

[1/] Appraisal estimate excludes US$ 9.1 million to be spent on vehicles and computing equipment. Actual figures include US$ 5.1 million for these items.

Table 9: Economic Costs and Benefits

No IERR was calculated at appraisal.

Table 10: Status of Legal Covenants

Agreement	Section	Covenant type	Present status	Original fulfillment date	Revised fulfillment date	Description of covenant	Comments
LA PA	3.03 2.03	13	C			Furnish, as part of PAT, evidence of ownership or long-term user rights, insurance, etc.	
LA PA	4.01 (a)	1	C			Maintain project accounts	
LA PA	4.01 (b) (i)+(ii)	1	CD			Audit accounts and submit reports to Bank	Delays and shortcomings in audits project especially 1990. Audits for 1996 initiated 3/97
LA	4.01 (b) (iii)	1	C			Monthly certified statements (CESA/FESA)	
LA	4.02	4	CD			Counterpart funding	Shortfalls and cuts in early years; ultimately satisfactory
LA PA	6.01 (b) 2.04 (a)	11	C			Contractual arrangements between EMBRAPA and participating state research agencies	
LA	6.01 (d)	3	C			Subsidiary Agreements between Borrower and EMBRAPA	
LA PA	6.01 (f) 2.05 (c)	10	C			Assign and maintain minimum number of staff (20) for transfer component technology	
PA	2.02	5	C			Procurement procedures	
PA	2.06	5	C			Create and maintain position of Project Coordinator in accordance with agreed terms of reference	

Agreement	Section	Covenant type	Present status	Original fulfillment date	Revised fulfillment date	Description of covenant	Comments
PA	2.07	5	CP			Create and maintain positions of Regional Research Coordinators	Regional coordinators appointed but found to be unworkable within EMBRAPA management context and without control over funding
PA	2.08 (a)	9	CD			Submit draft consolidated PAT and budget for review and comment by November 30 each year	Delays, often relating to reorganization within EMBRAPA, agreed with Bank
PA	2.09 (a) (ii)	9	C			Prepare and send for review semi-annual progress reports with contents and dates as specified	
PA	2.09 (a) (iii)	9	C			Cause participating entities to prepare and submit to EMBRAPA semi-annual progress reports	
PA	2.09 (c)	9	CP			Special studies submitted for review and comment as soon as practicable	Program of studies initially submitted, but later program was curtailed
PA	2.09 (b)	9	NC	31 March 92		Mid-term review and implementation of recommendations	Neither Bank nor EMBRAPA conducted Mid-Term review. By agreement, project funds used instead for workshop to review II Plano Diretor
PA	2.10	4	NC			Purchase of vehicle and computer equipment in timely manner	Purchases not initially made by EMBRAPA. Loan amended 3/2/93 allocating US$ 4 m for financing of vehicles and computers

Table 11: Compliance with Operational Manual Statements

No infringements identified

Table 12: Bank Resources: Staff Inputs

Stage of project cycle	Planned		Revised		Actual	
	Weeks	US$	Weeks	US$	Weeks	US$
Preparation to appraisal	90		103		61	
Appraisal					8	
Negotiations through Board approval					-	
Supervision					70	
Completion					9	
TOTAL					148	

Table 13: Bank Resources: Missions

Stage of project cycle	Month/ year	Number of persons	Days in field	Specialized staff skills represented	Performance rating		Types of problems
					Implementation status	Development objectives	
Through appraisal	3/88	3	5	Engineer Agriculturalists	-	-	-
	9/88	5	10	Agriculturalists Economist Architect			
	4/89	3	24	Agriculturalists Architect			
Appraisal through Board approval	-	-	-	-	-	-	-
Supervision	5/90	2	5	Agriculturalists	2	1	Counterpart funding, procurement
	11/90	2	12	Agriculturalists	2	1	Counterpart funding, Project Management
	7/91	3	18	Agriculturalists	2	1	Counterpart funding, Project Management
	5/92	2	13[7]	Agriculturalists	2	1	Counterpart funding, Project Management
	6/94	2	11	Agriculturalists	S	S	Counterpart funding, Project Management, Training delay
	2/95	2	5	Agriculturalists	S	S	Training delay
Completion	2/97	2	19	Agriculturalist Agric. Economist	-	-	-

[7] Joint supervision with Second Agricultural Extension Project (2679-BR)

APPENDIX A

AIDE MEMOIRE

Introduction

1 This is the aide memoire of a mission of the FAO/World Bank Cooperative Program consisting of S.D. Hocombe, Senior Adviser, Mission Leader and Ms F.J. Maundrell, Consultant Economist, which visited Brazil from February 12-28, 1997 to prepare the Implementation Completion Report (ICR) of the Third Agricultural Research Project supported by the World Bank (BIRD III). The aide memoire is written in English since the Bank requires it to be annexed to the ICR.

2 The mission worked closely with staff who had been associated with the implementation of BIRD III at the Brasilia headquarters of the implementing agency, EMBRAPA. It visited the agricultural research centers for the humid tropics (CPATU) and semi-arid zone (CPATSA) as well as the national genetic resources and biotechnology center (CENARGEN), which together benefited from approximately 25% of project expenditures. The mission's program was ably organized by Dra Ana Maria Goncalves who had been responsible for coordination of BIRD III from April 1992 until project closure in mid-1996. The mission would like to thank her and all others who gave it their attention and cooperation, despite often urgent calls on their time from other duties.

3 This aide memoire has been written before the mission has had access to project files in the World Bank. It summarizes main findings as they appear at the time of drafting, but these should not be regarded as final. Some changes may be expected in the ICR itself.

Statement and Evaluation of BIRD III Objectives

4 The project was a successor to two previous Bank projects. It sought to strengthen EMBRAPA's and the state research agencies' capacities to generate and disseminate technology which would contribute to sustained agricultural development in two distinct agro-ecological regions - the "legal Amazon" and the semi arid Northeast - both of which had received only modest support under previous Bank research loans. It had five components: development of new and improved technology for crop, livestock and forestry production within existing research centers in the selected regions; support to other centers providing national backstopping research; technology transfer - including the development of new systems and partnerships; institutional strengthening and development; and impact assessment and special studies. Project cost was estimated at US$97.8 million including contingencies, with a Bank loan of US$47 million. EMBRAPA was additionally to acquire vehicles and computer equipment with Government funds to a value of US$9.1 million. The loan became effective in April 1990 with a target completion date of June 1995.

5 The project as designed was a logical extension of previous Bank support for EMBRAPA, seeking to further develop the capacity of the institution while focusing on achieving a better regional balance of research programs, and improving both the dissemination of technology and the assessment of the impact of research. The regions chosen, being both ecologically fragile and/or foci of rural poverty, were priority targets under current Bank strategies for country assistance. Given EMBRAPA's experience with the implementation of past Bank - as well as IDB - projects, the project was within existing implementation capacity, although it did focus on regions where it had been most difficult to create well-staffed and stable research centers.

6 The project was, designed at a time when the agricultural sector was already losing profitability under reforms to Brazil's agricultural support systems. Its focus on generation of more efficient, sustainable technologies, with increased emphasis on their economic evaluation, meant that the project was in principle well placed to assist the sector in responding to these new financial challenges. However, the project was quickly overtaken by a further series of events which led to it being implemented in significantly different circumstances from those in which it was designed. A change in government administration shortly before loan effectiveness resulted in further cutbacks in federal support for agriculture. Federal government spending cuts severely curtailed the release of counterpart funding committed to the project, greatly slowing disbursements in the early 1990s. At the same time changes in the leadership of EMBRAPA were followed by organizational changes which included the dissolution of the section which had substantial experience of managing Bank and other international projects. Also, in 1990, with the extinction of the federal extension agency, EMBRATER, EMBRAPA was charged with greater responsibilities for technology dissemination and with taking over the administration of the Bank's Second Extension Project. During implementation, a new research planning system was evolved. This substituted the farmer-back-to-farmer systems used earlier - and incorporated into the design of BIRD III - with a consumer-back-to-consumer system intended to give greater weight in research plans to the post-harvest chain, markets, agriculture-related industries and the like. An appraisal target was for the project to review the national research system and develop an action plan for restructuring and developing it. In fact, change and reform in EMBRAPA were initiated from outside the project and, partially, even from outside EMBRAPA itself. The project adapted successfully in that resources earmarked for institutional development were used to support change: but it did not, as originally envisaged, instigate major changes. Finally, a review of the government's external loan portfolio at the end of 1994 resulted in a cut of US$5 million in Bank funding.

7 A leading project objective in the Staff Appraisal Report (SAR) was to strengthen the State research agencies (principally in the Northeast). However, during negotiations, the government opposed the use of project funds to support research programs in such agencies arguing that sufficient funds were already reaching State governments for this purpose by other means. Project support to state research agencies was therefore limited to management studies, training and purchase of books and publications. Some state research agencies have

not enjoyed strong support from their governments over the period of the project and have remained weak.

Achievement of Project Objectives

8 BIRD III was generally successful in achieving its main objectives, despite the changes in circumstances. The project achieved its amended loan disbursement target of US$42 million and a commensurate total project expenditure of US$86.5 million (including US$9.8 million on vehicles and computer equipment) with a one year extension, closing on June 30, 1996. Actual project expenditures were distributed among disbursement categories very much as planned, as the Table below illustrates.

Category	SAR (Base Costs)	Actual	SAR	Actual
	US$ million		% of total costs	
Civil Works	19.6	21.0	24	24
Materials and Equipment	26.7	30.8	33	36
Technical Assistance	9.1	4.8	11	6
Training	15.0	14.2	18	16
Operating Costs	11.7	15.5	14	18
TOTAL	82.1	86.5	100	100

Counterpart funding amounted to US$ 44.6 million compared with the overall total contribution expected in the SAR (including vehicles and computer equipment) of US$ 59.9 million.

9 On the technical front, the project gave support to a wide range of research programs, including those relevant to improved incomes for small farmers, more sustainable natural resource management and the conservation and exploitation of biodiversity. New programs on production systems, resource management and biological pest control were introduced. Capacities for technology dissemination of all the research centers in the Amazon and the Northeast were greatly strengthened: researchers were more exposed to farmer problems; new technologies were promoted by field days and demonstrations as well as mass media; some new extension partnerships were formed with NGOs, municipalities, farmer groups and the private sector. Extensive post-graduate training was given to staff of both participating EMBRAPA centers and state research agencies. Most have returned to appropriate jobs in their employing institutions having enhanced not only their own professional capacity but also having formed valuable new national or international contacts. In some cases, local universities have been able to upgrade the level of courses they are able to offer through lecturing arrangements with these more highly qualified researchers. Training of technical support staff

has also boosted the productive capacity of researchers. National and international consultancies, coordinated by IICA, provided valuable support in critical technical or institutional topics, although the smaller centers in the North were unable to take their full share of the consultancies on offer.

10 Several changes were made to the project by agreement with the Bank during implementation. The project's schedule of works was amended and, following the lifting of the Brazilian embargo on imports of computer equipment in 1992, the Bank authorized the use of loan funds in the purchase of both vehicles and computing equipment. Because of slow disbursement and institutional changes already afoot in EMBRAPA as a whole, the Mid-Term review scheduled for early 1992 was postponed. Instead, the project supported a workshop which conducted an external evaluation of EMBRAPA. The Bank later intended to carry out its own mid-term review in late 1994, but appears to have abandoned the plan. This was presumably because by the end of 1994, US$ 5 million of the loan (under the "unallocated" category) was canceled and most other resources were by then already committed.

11 There were a number of project implementation difficulties. Disbursement was at first very slow: by end of 1992 (well over 2 years into the project) only 18% of the total loan had been disbursed (27% of planned disbursement at that stage). In addition to delays in the civil works program and in tenders for machinery and equipment, cost overruns were incurred on at least three of the major building contracts, when the original contractors collapsed and had to be replaced. A plan to coordinate regional research programs via an Amazon coordinator in CPATU and a Northeast coordinator in CPATSA proved to be not well adjusted to EMBRAPA s research management system of the time and was dropped. The EMBRAPA Board and technical units in Brasilia, designated in the SAR as having ultimate technical control over the research program - as for previous Bank projects - initially had difficulty in maintaining BIRD III objectives, to the extent that Bank supervision missions found it necessary to warn against potential changes in the project design or redistribution of project resources outside the Amazon and Northeast. There was some technical strengthening of the project coordination team in 1992, but efforts still tended to focus on management of disbursement in the different loan categories rather than on achieving technical objectives of the project components. Work on evaluating the impact of project research programs has generally not produced reliable results. EMBRAPA's own socio-economic staff resources were limited and few major special studies were contracted out to consultants. Overall, the socio-economic studies appear to have had little impact on approaches to technology generation or implementation of other project components.

Main Factors Affecting the Project Outcome

12 Principal factors identified by the mission as adversely affecting project outcome can be summarized as:

- budget cuts by the Federal Government in early project years;

- successive reorganizations of sections and departments charged with project management and disbandment of experienced teams;

- rigidity of EMBRAPA's internal financial control of the project in early years;

- changes in both Government and Bank requirements relating to preparation and approval of bid documents (the first of which were only finally approved in 1992);

- the failure of the initially-proposed system of regional technical coordination and lack of an alternative system fully dedicated to the oversight of project research programs;

- financial failure of building contractors leading to time and cost overruns.

13 The main factors identified as contributing to the ultimate success of the project following its early problems were:

- the institution by the Federal Government of a system for advancing project counterpart funds (around the beginning of 1991);

- the dedication of project management to identifying and resolving project implementation problems of the participating centers from 1992 onwards;

- the commitment of EMBRAPA management to improve project implementation and disbursement and its strengthening of the project management team from 1993 onwards;

- the Bank's general flexibility in addressing requirements for reallocation of funds, including permission for loan funds to be spent on vehicles and computing equipment;

- the establishment of standard bid documents for civil works in mid-1994.

Project Sustainability

14 A major aim of organizational and operational changes introduced by EMBRAPA during the project period was to make its research system more responsive to user demands for technology and less supply-driven. The project supported these changes, as well as equipping research units in the Amazon and Northeast and upgrading staff skills so that they will be able to respond better to demand in the future. They are thus better placed to compete effectively under the grant funding mechanisms which EMBRAPA will introduce in the near future, especially if also provided with some continuity of institutional support: both are envisaged under a succeeding phase of Bank funding. For these reasons the attainments of BIRD III are rated as sustainable.

Bank and Borrower Performance

15 Bank performance cannot be fully assessed until the mission has reviewed relevant Bank files. Initial impressions from the five aides memoire of supervision missions available in Brasilia are that the Bank was generally flexible and supportive. However, there appears to have been a gap of two years in field supervision between mid-1992 and mid-1994, apparently due to the departure of the Task Manager who had seen the project through from preparation. This was a critical period of change in EMBRAPA, raising the question of whether the Bank missed opportunities at that time: for instance to review and re-focus research programs, evaluation and studies; or to agree improved mechanisms for technical coordination.

16 The borrower, despite the restrictions on the government budget, has showed a continued commitment to agricultural research. Overall, EMBRAPA's administration of the project was satisfactory. During the disbursement period EMBRAPA initiated a still ongoing program of reorganization and reform intended to adapt and equip the institution for a new demand-responsive research approach, better matched to emerging policies on the role of the public sector as well as to the changing needs of agricultural producers and processors. Identified shortcomings in project administration by the Borrower mainly occurred during the early years and were: delays in submitting audited accounts for 1990; and some difficulties in meeting demands for engineering support to civil works in outlying centers, understandable because of their distances from headquarters or the seat of regional engineers.

Project Outcome

17 On the basis of information at present to hand, the mission rates the overall project outcome as satisfactory.

Borrower's Completion Report

18 EMBRAPA has prepared a final project report which documents the implementation of the project in some detail and has proved extremely helpful to the mission. The mission has provided the ex-project coordinator with guidelines on the preparation of a borrower's ICR (the requirement for which was instituted after loan effectiveness of BIRD III) and has invited EMBRAPA to prepare its own summary project assessment for attachment to the Bank's ICR.

Future Operation

19 Future operation of the centers in the Amazon and Northeast supported by the project is expected to be based on successful competition (often in partnership with Universities, NGOs, private companies or others outside the EMBRAPA system) for grants under the new arrangements to be supported by the Bank under its fourth agricultural research project. These resources are expected to be supplemented by further training, studies etc. under the institutional development component of the same project. Given the capacity-building nature of BIRD III, that EMBRAPA prepares annual plans for the continuation of its

research programs and is currently negotiating with the Bank for a follow-on project, the mission sees no need for a separate Operational Plan for continuation of BIRD III activities.

Main Lessons Learned

20 The main lessons learned from BIRD III are that:

- given determined Borrower commitment and Bank flexibility, a project can achieve its major financial and physical objectives despite difficult circumstances;
- however, more intensive technical supervision is needed to ensure that specific component objectives (e.g. effective project impact assessment) are also achieved;
- it is necessary, if decentralized control of research is to be effective, to link it to decentralized control of research funds.

The project also confirms two generic lessons from Bank-financed research projects:

- the value of long-term continuity of Bank support for the establishment and subsequent maturation of national agricultural research systems; and
- the benefits of Bank flexibility in adapting project implementation in response to new and well-justified initiatives for institutional change, provided these are consistent with previously agreed development and assistance strategies as well as general project objectives.

APPENDIX B

Key Dates in Project Formulation and Implementation

1986

13/6/86	Initiating Project Brief as a result of review mission of BIRD II (5-21/5/86). Bank IEPS and PID. Proposed a major review of Brazil's research policy to the end of the century.
29/8/86	Paper on The Status of Agricultural and Forestry Research by Borlaug and Zillinsky.

1987

5-6/87	Final supervision mission of BIRD II.
30/6/87	BIRD II completed on time.
31/12/87	BIRD II loan closed. Virtually completely disbursed.

1988	*EMBRAPA's First Master Plan (I Plano Diretor 1988-92) published* under Presidency of Ormuz Freitas Rivaldo. Orientation towards increasing food self-sufficiency - particularly of low income population; developing (non-degrading) technologies for conquest of new agricultural frontiers, especially in the Amazon and Center West; boosting production of the Pantanal and semi-arid tropics; and increasing EMBRAPA's own capacity for generating "tecnologia de ponta".
3/88	**Bank Identification Mission.** 3 members, 5 days. Signed Memorandum of Understanding with EMBRAPA. At this stage N, NE and CO (incl. Pantanal) were included.
29/4/88	Bank Executive Project Summary.
6/88	Protocolo de Intencoes meeting at CPATSA with representatives from the Bank, SUDENE, EMBRAPA. It was agreed that CPATSA would continue to coordinate PAPP (research on farmers' fields) and provide advice to State research agencies. New project/EMBRAPA to concentrate on on-station work. The initial proposal by EMBRAPA for BIRD III was being reformulated and should be ready 30/9/88. EMBRAPA handed over preliminary version of final evaluation report of BIRD II. CPATSA provided methodology for Testes de Ajustes de Tecnologia.
19-29/9/88	**Bank Preappraisal Mission.** 5 members, 10 days. Signed Memorandum of Understanding with EMBRAPA. Because the Government had not officially requested the project, the mission was designated a "technical mission". Later called a "review". MOU establishes that (direct) support to state research companies should be eliminated from project objectives and establishes conditions for arrival of Bank Appraisal Mission. Following this mission 16 Staff Working Papers and preliminary cost estimates are produced.
5/10/88	New Constitution came into effect.
10/88	Visit of Bank Division Chief to Brazil. Discussions on effect of "Operacao Desmonte" (provisions for decentralization of state budgets).

1989

15/1/89	Decision taken to abolish EMBRATER.
1/89	New proposals by EMBRAPA for the project (in 2 volumes) sent to Bank.
31/1/89	EMBRAPA sends note on state funding to Bank.
28/2/89	Bank discusses White Paper SAR.

7/3/89	EMBRAPA presents a Position Paper on the state research companies to the Bank.
17/3/89	Bank's Final Executive Project Summary. TOR prepared for Appraisal mission.
27/3/89	**Bank Appraisal Mission.** 3 members, 24 days. MOU of 20/4/89 detailing proposed project "O projeto financiara programas especificos de pesquisa."
11/4/89	Further Protocolo de Intencoes meeting with SUDENE, EMBRAPA/SEP to discuss interaction with PAPP. SUDENE would negotiate with the States the conditions in which PAPP would support the strengthening of the state research companies.
26/5/89	New President of EMBRAPA: Carlos Magno Campos da Rocha.
21/7/89	EMBRAPA reappoints Project Coordinator of BIRD II (Luciano Fernandes, SEA) as PC of BIRD III. Regional Coordinators also appointed for North and Northeast.
28/8/89	**Negotiations** start in Washington.
1/9/89	Negotiations conclude with only two significant changes: increase in deposits in local and foreign Special Accounts and introduction of a requirement for a Subsidiary Agreement between the Government and EMBRAPA as an additional condition of effectiveness. Requirement for counterpart funding is set at US$4.0 million, within an overall budget provision for the project of US$10.0 million in 1990. Bank agrees to omit from legal agreements a detailed listing of vehicles to be provided by EMBRAPA.
17/10/89	Bank essentially approves agreements with state research companies.
24/10/89	**Bank Board Approval.** Exceptionally for Brazil, and as a result of previous Government (COFIEX) urging, a 5 year project period is agreed.
9/11/89	Final Bank version of BIRD II Project Completion Report.
1990	
10/1/90	**Signature of Loan and Project Agreements.**
4/90	Agreement by Bank to extend the deadline for loan effectiveness to allow alteration of the Brazilian Central Bank's Project Registration Certificate in order for civil works to be financed out of the (local) Special Account.
3/90	New Federal President: Collor.
27/4/90	**Loan Effective.**
16/5/90	Contract with IICA for recruitment/management of foreign consultants.
21/5/90	**First Supervision Mission.** 2 members, 5 days. Establishment of key indicators for project.
18/5/90	New President of EMBRAPA: Murilo Xavier Flores.
2/7/90	Project Coordinator submits proposals for socio-economic studies to Bank.
18/7/90	First Deposit to Special Account.
19/9/90	***Statement on EMBRAPA's medium term strategy by its President.*** Over the next 5 years, EMBRAPA's program would be oriented around development of technologies for basic farm commodities, raw materials, farming and the environment, farm development and farm information services. EMBRAPA was undertaking a global review of Brazil's agricultural research with a view to formulating directives and strategy to guide EMBRAPA into the next century.
19/11/90	**Second Supervision Mission.** 2 members, 12 days. Expected restructuring of EMBRAPA to be completed by first quarter of 1991.
1991	
2/4/91	Changes in EMBRAPA Centers in North: UEPAEs become CPAFs, UEPAE Belem merged with CPATU.
21/6/91	Final version of OED's Project Performance Audit Report on BIRD II with recommendations for EMBRAPA on technology diffusion systems and strengthening farming systems approach.

27/6/91	New Project Coordinator named: Cezar Roberto de Souza Mirandela (DOF).
8/7/91	**Third Supervision Mission.** 3 members, 18 days. Civil works bidding documents reviewed and changes to civil works program agreed including construction of Herbarium at CPATU.
22/7/91	Bank follows up supervision mission with letter inviting EMBRAPA to look for ways to have EMBRAPA's decentralized units and the state research companies in the project area benefit more directly from TA funds available under the project.
2/12/91	Secretaria de Programas Especiais (SPE) created, directly under President of EMBRAPA, to oversee international projects.
20/12/91	Widening of IICA's contract to include management of national consultants.
1992	
31/3/92	Mid-Term Review due.
4/92	Audit for 1990 received. Bank approves first bidding documents for procurement of goods (equipment etc.).
24/4/92	Bank informed that Dr Joao Carlos Monteiro de Carvalho, Head of SPE is ex officio PC of BIRD III but that functions would be spread amongst technical staff of SPE.
4/5/92	**Fourth Supervision Mission.** 2 members, 13 days. Repeats need for Regional Coordinators. SPE assigns overall responsibility for project management to Ana Maria Goncalves and suggests delay in tendering for equipment because of reorganization within EMBRAPA.
5/92	Preliminary version of diagnostic study on EMBRAPA's research projects.
1992	***Preliminary version of EMBRAPA's Second Master Plan (II Plano Diretor)*** proposing new research planning system - Sistema EMBRAPA de Planejamento (SEP) - within a framework of 16 priority research domains.
10/6/92	Bank approves standard LCB documents for small works.
22/6/92	Workshop on Second Master Plan for EMBRAPA with panel of external advisers, financed by the project.
mid 92	Change of Bank Division Chief.
8/92	Change of Task Manager to Recife Office.
29/9/92	Posts of Regional Coordinators reinstated and incumbents named in CPATU and CPATSA.
10/92	Withdrawal by Government of market restrictions on computers/vehicles.
17/12/92	Clearance by Bank of award of first ICB (lab equipment and machinery), following delay by Washington.
1993	
28/4/93	First clearance of major civil works contract by Bank. (CENARGEN). Awarded to lowest bidder at approx. US$1.6 million. Rapidly followed (18/5/93) by approval of 7 more contracts to a total of approx. US$1.9m
3/2/93	Agreement by Bank to amend loan agreement to include US$4.0 million financing for computers and vehicles.
3/93	SPE disbanded. Creation of DEC.
7/5/93	Agreement by Government for computers/vehicles to be purchased through BIRD III loan.
11/8/93	EMBRAPA inquires of the Bank what it is going to do about the Mid-Term Review.
29/9/93	EMBRAPA submits a revised schedule of civil works, which is promptly approved by the Bank.
28/12/93	Award of ICB for computers approved by the Bank approx. one month after opening of bids.

1994	***EMBRAPA's research programs for 1994 planned under new planning system - SEP.***
9/3/94	Internal Bank proposal for Pilot Plan presented to Division Chief with suggestion that it be floated in Mid-term Review intended for September/October 1994.
30/5/94	**Fifth Supervision Mission. 2 members, 11 days. EMBRAPA agreed to undertake a review, with the Bank, of the project scope to adjust it to the new SNPA.**
22/6/94	Revised standard bidding documents (to comply with changes in federal law) are approved by the Bank for LCBs and ICBs.
1/7/94	New currency/Plano Real introduced.
12/7/94	EMBRAPA notifies the Bank that the building contracts at CENARGEN and the Herbarium at CPATU have been suspended because of failure of contractors with US$385,000 and US$149,000 having been paid at that time. Tenders are being repeated.
8/94	Change of Bank Division Chief.
10/94	EMBRAPA presents proposal for competitive grants fund to Task Manager (LA1ER) during his familiarization mission as "member of new management team for three projects" including BIRD III.
17/11/94	Bank's clearance of replacement contract for CENARGEN (R$2.87 million)
20/12/94	Bank clearance of (new) contract for CNPAT buildings (R$4.5 million fixed sum). Rival bidder pursues protest in court.
21/12/94	Government's general portfolio review results in cut of US$5.0 million in loan amount. Approved by Bank in loan amendment 11/1/95. Amortization amounts amended.
1995	
6/1/95	Extension of IICA contract to 30/6/95.
6/2/95	**Sixth Supervision Mission. 2 members, 5 days. Agreed to delay study to evaluate the impact of project-financed research until preparation of the project's completion report.**
15/3/95	Ministry of Agriculture commences loan repayment.
16/5/95	New President of EMBRAPA: Dr Alberto Portugal.
6/6/95	Loan extended to 30/6/96.
mid 95	Change of Bank Division Chief.
26/8/95	Further extension of IICA contract, also including management of training program (in order to speed disbursement) and reduction of management fee from 10% to 8%.
1996	
16/7/96	Extension of IICA contract to 30/12/96.
10/12/96	Final Bank disbursement.
10/12/96	Extension of IICA contract to 30/6/97.
7/2/97	Loan closed.

Appendix C

Supplementary Project Data

Table 14: Cost Breakdown by Category and Component

Category	Technology Generation	Research Support	Technology Transfer	International Development	Project Impact	TOTAL	Percentage	
			(US$ million)				Actual	SAR
Civil Works	**13.59**	**6.85**	**0.30**	**0.10**	**0.14**	**20.97**	***24%***	***24%***
Machinery/Other Goods	**18.35**	**9.10**	**0.15**	**3.40**	**0.01**	**31.03**	***36%***	***33%***
Machinery & equipment	2.50	0.36	0.01			**2.86**		
Furniture and tools	7.31	6.40	0.07	0.17	0.00	**13.95**		
Livestock	0.24	0.12	0.00			**0.37**		
Books and journals	1.91	1.33		0.79		**4.02**		
Vehicles	3.57	0.53	0.03	0.02		**4.15**		
Computing equipment	2.82	0.36	0.05	2.42	0.00	**5.66**		
Technical Assistance	**1.40**	**1.73**	**0.20**	**1.07**	**0.38**	**4.77**	***6%***	***11%***
Training	**7.27**	**3.19**	**0.50**	**3.23**	**0.04**	**14.24**	***16%***	***18%***
Operating Costs	**10.20**	**4.43**	**0.41**	**0.46**	**0.04**	**15.54**	***18%***	***14%***
TOTAL	**50.81**	**25.29**	**1.56**	**8.27**	**0.60**	**86.55**	***100%***	***100%***
Actual (%)	**59**	**29**	**2**	**10**	**1**	**100**		
SAR (%)	**55**	**32**	**4**	**5**	**4**	**100**		

Table 15: Variations in Project Expenditures by Center and Region (US$ 000)

	Civil Works	Goods	Consultancies	Training	Op. costs	TOTAL
North	**-1096**	**-105**	**-1046**	**-942**	**735**	**-2454**
CPATU	587	-863	-384	-928	163	**-1425**
CPAA	-879	-218	-143	-140	225	**-1155**
CPAF-AC	298	633	-185	185	35	**966**
CPAF-AP	-48	-31	-167	17	214	**-15**
CPAF-RO	70	199	-157	-71	-50	**-9**
CPAF-RR	-1124	175	-10	-5	148	**-816**
Northeast	**1127**	**1970**	**-949**	**-386**	**1789**	**3551**
CPATSA	-697	76	-235	-208	193	**-871**
CPAMN	-600	91	-75	15	283	**-286**
CNPA	-712	264	58	152	155	**-83**
CNPC	203	807	-270	130	206	**1076**
CNPAT	3350	150	2	-146	599	**3955**
CNPATC	-355	-126	-230	-288	-50	**-1049**
CNPMF	90	220	-160	-37	111	**224**
CNPGL	-152	488	-39	-4	292	**585**
Other	**1311**	**2444**	**-2335**	**590**	**1305**	**3315**
CENARGEN	1859	218	0	633	529	**3239**
CTAA	-467	35	107	141	223	**39**
CNPMA	515	-928	-78	-509	129	**-871**
CNPAB	93	-48	-406	-239	56	**-544**
CNPS	-1204	-233	-200	249	-31	**-1419**
CNPF	-24	161	48	35	82	**302**
SEDE	240	3317	-979	2845	372	**5795**
SPI	299	-78	-827	-2565	-55	**-3226**
TOTAL	**1342**	**4309**	**-4330**	**-738**	**3829**	**4412**

[1] Base costs are used for comparison given that:

(a) following the US$5 million cut in loan amount in December 1994, base costs give a closer basis for comparison of SAR values with actuals (total SAR base costs: US$82.1 million; total actual costs: US$86.5 million)

(b) no detailed breakdown of total costs including contingencies is provided in the SAR

Table 16: Project Expenditures per Researcher by Center

	Staff		Expenditure on Civil Works		Expenditure on Goods		Total Expenditure	
	Researchers	TOTAL	US$ 000	US$/Res	US$ 000	US$/Res	US$ 000	US$/Res
CPAA a)	56	300	1,009	18,018	1,496	26,714	4,200	75,000
CPAF-AC	30	124	489	16,300	1,129	37,633	2,400	80,000
CPAF-AP	16	73	308	19,250	636	39,750	1,809	113,063
CPAF-RO	30	161	648	21,600	844	28,133	2,488	82,933
CPAF-RR	16	83	501	31,313	1,052	65,750	2,323	145,188
CPATU b)	136	578	2,649	19,478	2,121	15,596	7,836	57,618
Subtotal North	**284**	**1,319**	**5,604**	**19,732**	**7,278**	**25,627**	**21,056**	**74,141**
CNPA	39	204	588	15,077	1,166	29,897	3,438	88,154
CNPC	27	148	665	24,630	1,024	37,926	4,142	153,407
CNPCa/CNPAT	54	161	4,905	90,833	1,181	21,870	7,740	143,333
CNPCo/CPATC	37	194	390	10,541	1,165	31,486	2,360	63,784
CNPGL d)	64	384	183	2,859	680	10,625	2,743	42,859
CNPMF	59	237	431	7,305	1,144	19,390	3,052	51,729
CPAMN c)	42	293	447	10,643	1,789	42,595	4,353	103,643
CPATSA	79	409	357	4,519	1,301	16,468	3,227	40,848
Subtotal NE	**401**	**2,030**	**7,966**	**19,865**	**9,450**	**23,566**	**31,055**	**77,444**
CENARGEN	114	275	3,894	34,158	3,364	29,509	10,314	90,474
CNPBS/CNPAB	32	139	243	7,594	821	25,656	1,780	55,625
CNPDA/CNPMA	60	141	1,580	26,333	1,477	24,617	5,079	84,650
SNLCS/CNPS	58	132	318	5,483	776	13,379	2,016	34,759
CTAA	48	138	785	16,354	1,987	41,396	4,598	95,792
Subtotal Other	**312**	**825**	**6,820**	**21,859**	**8,425**	**27,003**	**23,787**	**76,240**
TOTAL	**997**	**4,174**	**20,390**	**20,451**	**25,153**	**25,229**	**75,898**	**76,126**

a) Includes ex-UEPAE para
b) Includes ex-UEPAE Amazonas
c) Includes ex-CNPAI (now UEP)
d) Total Staff. The two out-stations in the NE were closed in mid-1990s.

Table 17: Changes in Staff in EMBRAPA Centers (1989-1996) and Training

	1996						Difference 1996-1989					Training: National		Training: Overseas	
	PhD	MSc	BSc	Researchers	Other	TOTAL	PhD	MSc	BSc	Researchers	TOTAL	PhD	MSc	PhD/PD	MSc
CPAA a)	7	39	10	56	244	300	0	1	-8	-7	-33	5	16	1	1
CPAF-AC	2	19	9	30	94	124	-6	9	8	11	15	1	4	2	1
CPAF-AP	1	7	8	16	57	73	1	2	-10	-7	14	1	4	1	2
CPAF-RO	3	20	7	30	131	161	3	4	0	7	105	1	8	1	2
CPAF-RR	0	14	2	16	67	83	0	-3	-9	-12	-59	1	3		
CPATU b)	36	85	15	136	442	578	25	13	-22	16	-41	5	11	8	1
Subtotal North	**49**	**184**	**51**	**284**	**1035**	**1319**	**23**	**26**	**-41**	**8**	**1**	**14**	**46**	**13**	**7**
CNPA	13	23	3	39	165	204	6	-1	-6	-1	29	2	6	6	1
CNPC	9	14	4	27	121	148	5	-1	-2	2	6	1	3	9	3
CNPCa/CNPAT	17	36	1	54	107	161	10	19	-1	28	113	2		1	
CNPCo/CPATC	8	28	1	37	157	194	6	4	-1	9	46	2	1	2	
CNPGL d)	38	24	2	64	320	384	10	-11	-6	-7	-24		3	6	
CNPMF	17	40	2	59	178	237	17	-8	-6	3	-20	4	2	5	
CPAMN c)	8	31	3	42	251	293	2	-6	-7	-11	28	5	11	7	
CPATSA	14	59	6	79	330	409	4	19	4	27	17	11	12	3	
Subtotal NE	**124**	**255**	**22**	**401**	**1629**	**2030**	**60**	**15**	**-25**	**50**	**195**	**27**	**38**	**39**	**4**
CENARGEN	55	49	10	114	161	275	39	26	-1	64	145	2	1	3	3
CNPBS/CNPAB	22	7	3	32	107	139	12	0	2	14	73	6		1	
CNPF	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	1		2	1
CNPDA/CNPMA	37	22	1	60	81	141	21	-7	-2	12	66	1		8	
SNLCS/CNPS	12	37	9	58	74	132	0	-7	-3	-10	-46		8	1	1
CTAA	16	29	3	48	90	138	4	11	-10	5	43	4	1	5	
SEDE	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	3	8	9	1
							0	0	0	0	0				
Subtotal Other	**142**	**144**	**26**	**312**	**513**	**825**	**76**	**23**	**-14**	**85**	**281**	**17**	**18**	**29**	**6**
TOTAL	**315**	**583**	**99**	**997**	**3177**	**4174**	**159**	**64**	**-80**	**143**	**477**	**58**	**102**	**81**	**17**
											State Agencies	**9**	**18**	**17**	**1**

a) Includes ex- UEPAE Para
b) Includes ex- UEPAE Amazonas
c) Includes ex- CNPAI (now UEP)
d) Total staff. The two out-stations in the NE were closed in mid 1990s. HQ in MG.

Table 18: Consultancies

	National Consultants		International Consultants		TOTAL	
	Number	Months	Number	Months	Actual Months	SAR
CPAA	5	7	2	3	10	22
CPAFs	2	6	2	1	7	102
CPATU	17	27	13	23	50	59
Subtotal North	**24**	**40**	**17**	**27**	**67**	**183**
CNPA	1	1	2	25	26	16
CNPC	1	4	2	17	21	37
CNPCa	7	51			51	22
CNPCo			2	3	3	27
CNPGL			6	14	14	17
CNPMF	5	23	7	3	26	25
CPAMN	4	22	2	7	29	36
CPATSA	2	4	14	14	18	36
Subtotal Northeast	**20**	**105**	**35**	**83**	**188**	**216**
CENARGEN	3	16	45	40	56	58
CNPBS	1	8	15	15	23	86
CNPF	1	12	3	0.5	12.5	0
CNPMA	9	89	22	27	116	97
CNPS	2	11	2	12	23	35
CTAA	5	29	12	41	70	44
SEDE	33	132	24	70	202	215
SPI	3	13.5			13.5	
Subtotal Other	**57**	**310.5**	**123**	**205.5**	**516**	**535**
TOTAL	**101**	**455.5**	**175**	**315.5**	**771**	**934**

of which:		
long term (12 months +)	**98**	**99**
medium term (3-<12 months)	300	91
short term (<3 months)	57.5	125.5
SAR TOTAL	**574**	**360**
of which:		
long term	**60**	**24**

Appendix D

Borrower's Comments
(transcript from Electronic Mail from EMBRAPA to Ms. Constance Bernard dated May 21, 1997)

Evaluation Summary

Although we agree that project funding may not be directly linked to individual research projects they could certainly be linked to programs. Programs supported were those described in the SAR. We note that similar statements, i.e., lack of linkage between funding and projects, achievements, etc., are made throughout the documents and could, perhaps, be rephrased.

We disagree with the statement that cooperation with state agencies was disappointing. Training was the main activity to financed by the project for the states and this was implemented satisfactorily. Therefore, there seems to be little reason for disappointments.

Part I

Via strengthened research capabilities financed by the loan the project led to the development of improved technologies which were and are being disseminated and can be assessed directly. We disagree with the statement that they cannot be assessed. The question here is perhaps the lack of time - and in some cases technical capacity - regular ICR missions have to make the necessary evaluations/assessments.

It seems to be incorrect to mention that research objectives simply coincided with the technical areas listed in the SAR. For research units in northern Brazil, most of the research lines and programs implemented were those previously negotiated with the World Bank as priorities which were, therefore implemented. Again, to state that achievements can be loosely attributed to the project does not seem to reflect the reality, in our opinion. EMBRAPA's report on project implementation details achievements resulting from project implementation.

The statements on concentration of expenditure should be reviewed. As an example, according to our figures (Annex 10 and table 4) it is not correct to state that 40% of expenditure on computing equipment was concentrated at headquarters. It was, in fact, 16.7%.

On the technical control of the project we would like to stress that EMBRAPA uses system-wide procedures for the control of research projects. Since this, as well as other past and future loans, represent an important and significant - but small - fraction of the total budget, technical control procedures are adopted for all research projects, independent of the financier. The priority setting and planning system established in 1993

which superseded the one in place at appraisal greatly improved EMBRAPA's technical assessment, monitoring and control of research projects.

Key Lessons Learned

We disagree that project components which are included primarily to meet Bank requirements should be closely supervised, as stated. We think they should simply not be included! All components, major and minor, were well understood by the Borrower and did receive priority in their implementation. Some, however, were more difficult to implement than others due to several factors, but they were and should not be considered neglected components. Their results may not be as satisfactory as the ones obtained in the implementation of other components. It seems naive to suggest that close supervision of consultants is the key point to be addressed when overcoming limited effectiveness during implementation of certain components; much more complex situations need different approaches to problem solving.

The comment on cost/benefit analyses of research outputs (here and in the main text) differs from national as well as, I understand, some of the international thinking on the topic as well - it is too simplistic. Internal discussion in Brazil, international seminars and World Bank discussions (I understand at ESDAR and other sites) indicate that analyses of research outputs are extremely complex due to several factors including adoption lag, spill overs, etc. Therefore, improved project costing and indicators, assessed just after project completion do not seem to be key elements which preclude meaningful analyses.

Part II: Statistical Tables, Table 1 Summary of Assessments

Considering the objectives states in the SAR and the results obtained, we do not agree that environmental objectives and private sector development should be rated as negligible. Several results which positively impact on the environment were attained as detailed in our report.

Finally, reading the document as a whole and comparing to technology generation projects financed by the World Bank here and elsewhere we have the impression that overall performance is perhaps a bit more than satisfactory. We, as Borrowers, are certainly proud of our achievements in this project and would certainly like to share this pride - and all outcomes - with the Bank.

IMAGING

Report No.: 16776
Type: ICR