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IMPLEMENTATION COMPLETION AND RESULTS REPORT  
(IDA-30920 IDA-3092A IFAD-04350)

ON A  
CREDIT  
IN THE AMOUNT OF US\$60.0 MILLION  
TO THE  
FEDERAL DEMOCRATIC REPUBLIC OF ETHIOPIA  
FOR AN  
AGRICULTURAL RESEARCH AND TRAINING PROJECT

December 20, 2007

Sustainable Development Department  
Agriculture and Rural Development  
Africa Region

**CURRENCY EQUIVALENTS**  
(Exchange Rate Effective November 29, 2007)

Currency Unit  
Birr 1.00 = US\$ 0.11  
US\$1.00 = Birr 9.0405

**FISCAL YEAR**  
July 8 – July 7

**ABBREVIATIONS AND ACRONYMS**

ARF	Agricultural Research Fund
ARFMC	Agricultural Research Fund Management Committee
ARP	Agricultural Research Project
ARTP	Agricultural Research and Training Project
AUA	Alemaya University of Agriculture
CGIAR	Consultative Group on International Agricultural Research
DCA	Development Credit Agreement
EARB	Ethiopian Agricultural Research Board
EARO	Ethiopian Agricultural Research Organization
EIAR	Ethiopia Institute of Agricultural Research
FREAC	Federal Research-Extension Advisory Council
FRC	Federal Research Center
FRG	Farmer Research Group
GoE	Government of Ethiopia
HU	Haramaya University (formerly AUA)
IAR	Institute of Agricultural Research
IARC	International Agricultural Research Center
ICR	Implementation Completion and Results Report
IDA	International Development Agency
IFAD	International Fund for Agricultural Development
ISR	Implementation Status Report
MEDAC	Ministry of Economic Development and Cooperation
MoARD	Ministry of Agriculture and Rural Development
MoFED	Ministry of Finance and Economic Development
MTR	Mid-Term Review
M&E	Monitoring & Evaluation
NARS	National Agricultural Research System
NSTP	National Science and Technology Policy
PASDEP	Plan for Accelerated and Sustained Development to End Poverty 2005-2010
PCU	Project Coordination Unit
RARI	Regional Agricultural Research Institute
REAC	Research-Extension Advisory Council
RC	Research Center
TVET	Technical and Vocational Education and Training
SDPRP	Sustainable Development and Poverty Reduction Program

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**ETHIOPIA**  
**AGRICULTURAL RESEARCH AND TRAINING PROJECT**  
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<b>A. Basic Information</b>			
Country:	Ethiopia	Project Name:	ET: AG. RESEARCH & TRAINING
Project ID:	P000733	L/C/TF Number(s):	IDA-30920,IDA-3092A,IFAD-04350
ICR Date:	12/22/2007	ICR Type:	Core ICR
Lending Instrument:	SIL	Borrower:	GOE
Original Total Commitment:	XDR 44.5M	Disbursed Amount:	XDR 44.4M
<b>Environmental Category: C</b>			
<b>Implementing Agencies:</b> Ethiopian Institute of Agricultural Research			
<b>Cofinanciers and Other External Partners:</b>			

<b>B. Key Dates</b>				
Process	Date	Process	Original Date	Revised / Actual Date(s)
Concept Review:	03/25/1997	Effectiveness:	02/04/1999	02/04/1999
Appraisal:	09/22/1997	Restructuring(s):		11/10/2003
Approval:	06/09/1998	Mid-term Review:		07/27/2002
		Closing:	03/31/2005	06/30/2007

<b>C. Ratings Summary</b>	
<b>C.1 Performance Rating by ICR</b>	
Outcomes:	Moderately Satisfactory
Risk to Development Outcome:	Moderate
Bank Performance:	Moderately Unsatisfactory
Borrower Performance:	Moderately Satisfactory

<b>C.2 Detailed Ratings of Bank and Borrower Performance (by ICR)</b>			
Bank	Ratings	Borrower	Ratings
Quality at Entry:	Moderately Unsatisfactory	Government:	Moderately Satisfactory
Quality of Supervision:	Moderately Unsatisfactory	Implementing Agency/Agencies:	Moderately Satisfactory
<b>Overall Bank Performance:</b>	Moderately Unsatisfactory	<b>Overall Borrower Performance:</b>	Moderately Satisfactory

<b>C.3 Quality at Entry and Implementation Performance Indicators</b>			
<b>Implementation Performance</b>	<b>Indicators</b>	<b>QAG Assessments (if any)</b>	<b>Rating</b>
Potential Problem Project at any time (Yes/No):	No	Quality at Entry (QEA):	None
Problem Project at any time (Yes/No):	No	Quality of Supervision (QSA):	Satisfactory
DO rating before Closing/Inactive status:	Satisfactory		

<b>D. Sector and Theme Codes</b>		
	<b>Original</b>	<b>Actual</b>
<b>Sector Code (as % of total Bank financing)</b>		
Agricultural extension and research	37	37
Central government administration	63	63
<b>Theme Code (Primary/Secondary)</b>		
Decentralization	Secondary	Secondary
Other rural development	Primary	Primary
Rural policies and institutions	Primary	Primary
Rural services and infrastructure	Primary	Primary

<b>E. Bank Staff</b>		
<b>Positions</b>	<b>At ICR</b>	<b>At Approval</b>
Vice President:	Obiageli Katryn Ezekwesili	Callisto E. Madavo
Country Director:	Kenichi Ohashi	Oey Astra Meesook
Sector Manager:	Karen Mcconnell Brooks	Joseph Baah-Dwomoh
Project Team Leader:	David J. Nielson	Amar J. S. Sodhi
ICR Team Leader:	Malathi S. Jayawickrama	
ICR Primary Author:		

## **F. Results Framework Analysis**

### **Project Development Objectives (from Project Appraisal Document)**

The development objective of the project is: "to support modernization and enhancement of the efficiency and effectiveness of Ethiopian agricultural research system and related agricultural higher education programs in the generation of ecologically sound agricultural technology and human capacity development while making the system more responsive to farmer's technology needs and priorities".

Toward accomplishing the new DO, the project will assist in (i) making the newly created apex national organization for research, viz. the Ethiopian Agricultural Research Organization (EARO) fully functional with appropriate working procedures and systems; (ii) building participatory approaches in a decentralized agricultural research system; (iii) establishing a management information system (MIS) and networking of information systems; (iv) fostering effective linkages between research, extension and farmers and between research centers and centers of excellence, domestically and internationally; (v) rehabilitating and strengthening the existing research infrastructure and extending it to hitherto uncovered and harsh agro-ecological areas characterized by extreme poverty; (vi) building human resource capacity for agricultural research through technical assistance and training; (vii) strengthening the Alemaya University (AU); and (viii) opening up the research system to new research actors through the launching of the Agricultural Research Fund (a competitive grant scheme for contracting out some research activities).

**Revised Project Development Objectives (as approved by original approving authority)**

The development objective of the project is: "to support modernization and enhancement of the efficiency and effectiveness of Ethiopian agricultural research system and related agricultural higher education programs in the generation of ecologically sound agricultural technology and human capacity development while making the system more responsive to farmer#s technology needs and priorities".

**(a) PDO Indicator(s)**

Indicator	Baseline Value	Original Target Values (from approval documents)	Formally Revised Target Values	Actual Value Achieved at Completion or Target Years
<b>Indicator 1 :</b>	1.1 Accelerated generation, identification, testing, release and transfer to the extension services of improved technologies in crop, livestock and tree production, and natural resource management.			
Value quantitative or Qualitative)	0	EARO to provide data for the last five years on the number of technologies released and transferred to extension in crop, livestock and tree production, and natural resource management.		A total of 393 crop and forage technologies, 25 farm implements, 38 tree species, 18 soil and water conservation/manag ement techniques and 86 livestock production technologies were released. In addition, technology importation from abroad resulted in
Date achieved	02/01/1999	06/30/2007		12/31/2006
Comments				

(incl. % achievement)				
<b>Indicator 2 :</b>	1.2 Client-centered, demand driven collaborative process for identifying, prioritizing, implementing and evaluating research programs established and managed at various levels.			
Value quantitative or Qualitative)	0	All centers and research programs display the indicated characteristics.		The Federal REAC has been revived and held a well-attended stakeholder meeting. A management/executive committee has been established with 11 members and chaired by the State Minister, MoARD. The first meeting was held in October 2006. A REAC coordination
Date achieved	02/01/1999	06/30/2007		12/31/2006
Comments (incl. % achievement)				
<b>Indicator 3 :</b>	1.3 Human resource capacity in technology development and transfer substantially improved.			
Value quantitative or Qualitative)	0	EARO long-term training = 401 research and support staff 109 Ph.D, 291 M.SC and 1 B.Sc.; AU overseas degrees for teaching staff = 50 (48 Ph.D, and 2 M.SC); and 119 Short-term training.		All in all, (i.e. at EIAR and AU), about 465 researchers and academic staff (160 Ph.D., 301 M.SC and 1 B.Sc.???) have been trained through ARTP.
Date achieved	03/01/1999	06/30/2007		12/31/2006
Comments (incl. % achievement)				



**(b) Intermediate Outcome Indicator(s)**

Indicator	Baseline Value	Original Target Values (from approval documents)	Formally Revised Target Values	Actual Value Achieved at Completion or Target Years
<b>Indicator 1 :</b>	2.1 EARO as autonomous apex organization established to guide and coordinate overall national research system, staffed and operational.			
Value (quantitative or Qualitative)	0	EARO has improved its linkages with other stakeholders in the research system, is effectively coordinating the NARS and has signed Memoranda of Understanding (MoU) with RARIs covering all programs.		EARO's name has been changed to the Ethiopia Institute of Agricultural Research (EIAR). EIAR's organizational structure is being reviewed by MoARD on the basis of a Business Process Re-engineering (BPR) process.
Date achieved	03/01/1999	06/30/2007		12/31/2006
Comments (incl. % achievement)				
<b>Indicator 2 :</b>	2.2 ARTP coordination unit for donor assisted projects established and operational.			
Value (quantitative or Qualitative)	0	ARTP Unit established and operational.		ARTP Unit established and operational.
Date achieved	03/01/1999	06/30/2007		12/31/2006
Comments (incl. % achievement)				
<b>Indicator 3 :</b>	2.3 Consolidated annual ARTP work plan, procurement plan and training plan prepared by EARO three months prior to the beginning of each fiscal year and cleared with IDA.			
Value (quantitative or Qualitative)	0	These items are still being prepared and submitted regularly.		These items are still being prepared and submitted regularly.
Date achieved	03/01/1999	06/30/2007		12/31/2006
Comments (incl. % achievement)				
<b>Indicator 4 :</b>	2.4 Fully integrated information technology system, including hardware/software			

	platforms, Internet and database access, deployed in EARO headquarters, AU and all centers by December 2003.			
Value (quantitative or Qualitative)	0	EARO would: (a) complete installation of LAN and WAN in all remaining RCs by June 30, 2007; and, (b) ensure that LAN and WAN are installed in all 6 news RCs before project closing (IFAD, 12/31/2007).		LAN has been established at EARO HQ and 22 Research Centers. Equipment procurement for the six new RCs is underway and LAN establishment will follow construction completion. AT EIAR Headquarters and RCs arrangements are being made to use terrestrial bro
Date achieved	03/01/1999	06/30/2007		12/31/2006
Comments (incl. % achievement)				
<b>Indicator 5 :</b>	2.5 Performance based system for annual funding and review of approved research programs established at federal and regional research centers.			
Value (quantitative or Qualitative)	0	EARO has implemented a performance-based system of funding and review of the approved research programs together with RARIs .		EARO has implemented a performance-based system of funding and review of the approved research programs together with RARIs.
Date achieved	03/01/1999	06/30/2007		12/31/2006
Comments (incl. % achievement)				
<b>Indicator 6 :</b>	2.6 ARF Management committee and secretariat established.			
Value (quantitative or Qualitative)	0	Committee and secretariat established and fully operational. Final stakeholder workshop and lessons learned to be completed.		Committee and secretariat established and fully operational. Final stakeholder workshop and lessons learned to be completed .
Date achieved	03/01/1999	06/30/2007		12/31/2006
Comments				

(incl. % achievement)				
<b>Indicator 7 :</b>	2.7 Number of research programs funded and completed under ARF.			
Value (quantitative or Qualitative)	0	All ARF-funded projects completed by the ARTP closing date and final workshop organized. Proceedings and lesson learned will be reported.		Two ARF Competitive Grant calls have been made. 88 proposals were submitted for the 1st call and 66 proposals for the 2nd call.
Date achieved	03/01/1999	06/30/2007		12/31/2006
Comments (incl. % achievement)				
<b>Indicator 8 :</b>	2.8 Six new research centers constructed, equipped, staffed and operational by December 2005.			
Value (quantitative or Qualitative)	0	Six new RCs fully operational.	6	Six new RCs fully operational.
Date achieved	03/01/1999	12/31/2006	06/30/2007	12/31/2006
Comments (incl. % achievement)				
<b>Indicator 9 :</b>	2.9 Research-extension-farmer coordination mechanism established at the federal, regional and research center level for getting farmer feedback on research priority needs.			
Value (quantitative or Qualitative)	0	EIAR was review the research-extension-farmer linkages at various levels and make recommendations to institutionalize and to ensure their sustainability beyond the project period		EIAR was review the research-extension-farmer linkages at various levels and make recommendations to institutionalize and t o ensure their sustainability beyond the project period
Date achieved	03/01/1999	12/31/2006		12/31/2006
Comments (incl. % achievement)				
<b>Indicator 10 :</b>	2.10 Build additional office, laboratory, library, class room, and computer center facilities at AU to improve the educational infrastructure.			
Value (quantitative or Qualitative)	0	All construction of planned buildings and facilities		All construction of planned buildings and facilities

		completed.		completed.
Date achieved	03/01/1999	12/31/2006		12/31/2006
Comments (incl. % achievement)				

### G. Ratings of Project Performance in ISRs

No.	Date ISR Archived	DO	IP	Actual Disbursements (USD millions)
1	06/26/1998	Satisfactory	Satisfactory	0.00
2	02/11/1999	Satisfactory	Satisfactory	0.00
3	12/06/1999	Satisfactory	Satisfactory	1.84
4	02/10/2000	Highly Satisfactory	Satisfactory	2.21
5	09/12/2000	Highly Satisfactory	Satisfactory	7.29
6	09/12/2000	Highly Satisfactory	Satisfactory	7.29
7	12/11/2000	Highly Satisfactory	Satisfactory	10.95
8	05/18/2001	Highly Satisfactory	Satisfactory	14.04
9	12/21/2001	Highly Satisfactory	Satisfactory	17.81
10	12/21/2001	Highly Satisfactory	Satisfactory	17.81
11	12/27/2001	Highly Satisfactory	Satisfactory	17.81
12	05/01/2002	Highly Satisfactory	Satisfactory	20.43
13	11/01/2002	Satisfactory	Satisfactory	25.41
14	12/14/2002	Satisfactory	Satisfactory	27.00
15	05/30/2003	Satisfactory	Satisfactory	32.82
16	09/10/2003	Satisfactory	Satisfactory	35.83
17	03/03/2004	Satisfactory	Satisfactory	41.30
18	10/08/2004	Satisfactory	Satisfactory	46.51
19	05/13/2005	Satisfactory	Satisfactory	50.25
20	12/05/2005	Satisfactory	Satisfactory	54.20
21	06/28/2006	Satisfactory	Satisfactory	57.26
22	12/22/2006	Satisfactory	Moderately Satisfactory	58.48
23	06/27/2007	Satisfactory	Moderately Satisfactory	60.06

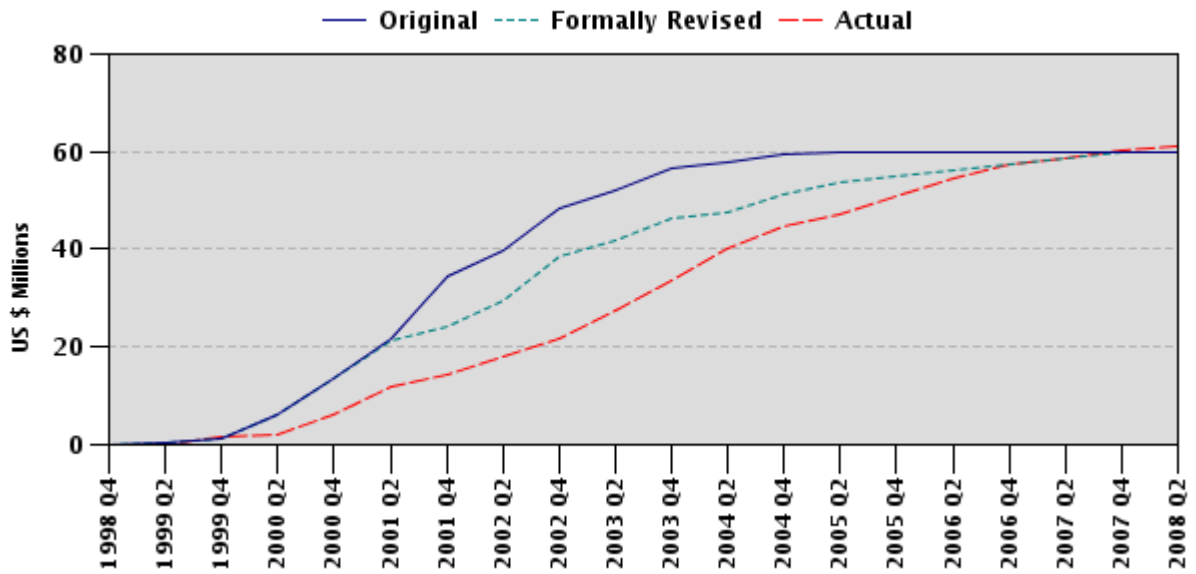
### H. Restructuring (if any)

Restructuring Date(s)	Board Approved PDO Change	ISR Ratings at Restructuring		Amount Disbursed at Restructuring in USD millions	Reason for Restructuring & Key Changes Made
		DO	IP		
11/10/2003	Y	S	S	37.14	

If PDO and/or Key Outcome Targets were formally revised (approved by the original approving body) enter ratings below:

	Outcome Ratings
Against Original PDO/Targets	Moderately Satisfactory
Against Formally Revised PDO/Targets	Moderately Satisfactory
Overall (weighted) rating	Moderately Satisfactory

### I. Disbursement Profile



## 1. PROJECT CONTEXT, DEVELOPMENT OBJECTIVES AND DESIGN

### 1.1 Context at Appraisal

1. **Ethiopia, with a per capita GDP of US\$100, was one of the poorest countries in the world when its civil war ended in May 1991.** During 1981-91, annual GDP growth had averaged 1.7 percent while population growth averaged 3.0 percent. Agriculture had grown at an average annual rate of only 0.9 percent and per capita food grain production had fallen from about 200 kg in 1981 to 150 kg in 1991. In 1992, the new Government embarked on structural reforms and programs to directly address food security and poverty. Noteworthy reforms in agriculture were the liberalization of rural product and factor markets and the opening up of fertilizer imports and domestic marketing. The economy responded positively to the reforms, and finally, after three decades of declining living standards, Ethiopia made progress in increasing growth and reducing poverty during 1991/92 to 1997/98.<sup>1</sup>

2. **Agriculture's stagnation in the 1970s and 1980s was primarily due to devastating droughts, pest infestations, significant land degradation, poor infrastructure, civil strife and an un conducive policy environment.** Despite its poor performance, however, agriculture remained the cornerstone of the economy and was expected to provide the basis for future industrial growth. In the early-1990s, agriculture-related activities generated 60 percent of commodity export earnings, provided 70 percent of the raw material requirements for Ethiopia's large and medium-sized agro-industries, and employed 80 percent of the population.<sup>2</sup> Crop production was estimated to contribute about 60 percent of total agricultural output, followed by livestock (30 percent) and fisheries, forestry and other sub-sectors (10 percent). In 1991, Ethiopia had six million smallholder farms, with farm size averaging 0.8 hectares of arable land (compared to 1.5 ha in 1979/80). Seventy two percent of all farms were 1.0 ha or less. Most farmers operated largely traditional, low input/low output, rain-fed production systems using technologies that could neither meet food demand nor sustainably utilize natural resources.

3. **Ethiopia's potential for expanding agricultural output depended to a large extent on improving agricultural research systems and generating relevant technologies for various agro-ecological zones, more effective extension services and an enhanced policy environment.** The National Science and Technology Policy (NSTP, 1993) and the Agricultural Research Policy and Strategy of 1993 were designed to guide agricultural research. At the time, the research system consisted of the Institute of Agricultural Research (IAR), comprising several national and regional research centers (RCs) and higher learning institutions. The relationship among research, extension and other organizations, however, was weak and the shortage of scientists and functional laboratories further hampered the research system's capacity to identify, develop and adapt improved and relevant technologies.

4. **ARTP's design sought to improve the agricultural research system, including research management, education, training and research-extension-farmer linkages, to ensure a steady flow of new technologies to farmers.** The project planned to build on achievements of the previous Bank-funded Agricultural Research Project (ARP, Credit 1521-ET) completed in 1994, which had focused mainly on building research infrastructure (a significant part of which had been destroyed in the latter years of the civil war) and providing limited training opportunities. Several other IDA projects were addressing some of the main challenges that faced Ethiopia's agriculture sector: the National Fertilizer Sector Project (Credit No. 27400, FY95); and the Seed Systems Development Project (Credit No. 27410, FY95). In addition, the Roads Sector Project (Credit No. 30320, FY98) enhanced access to markets for the rural population. The Ethiopia CAS FY98-2000 had identified agricultural research and training as a

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<sup>1</sup> ARTP Inception Report, Africa II Division, Programme Management Department, IFAD, August 1997.

<sup>2</sup> ARTP Project Information Document, World Bank, August 18, 1997.

vital area for support (CAS, August 1997, Report No. 17009-ET). Bank assistance was justified by its extensive experience in promoting cost-effective and relevant agricultural research systems in over 40 countries since 1980. Bank support was also to help in securing coordination with other donors and harmonizing various approaches to developing an agricultural research system and the needed technical assistance. No critical macro issues were identified at appraisal, as Ethiopia had satisfactorily implemented structural reforms from 1994-96. However, it is important to understand the circumstances of Ethiopia's political economy at the time of ARTP's design and appraisal. On the one hand, there was great optimism about positive changes taking place but, at the same time, significant residual elements of a highly controlled and centrally directed economy. These countervailing trends remained throughout the life of the project in degrees that varied over time.

## 1.2 Original Project Development Objectives (PDO) and Key Indicators

5. The PDO was "to increase the Borrower's agricultural production and yields, and incomes of farmers, through improved agricultural research to assist in achieving sustained generation and enhancement of ecologically sound technology for crop and livestock production systems and natural resource management in Ethiopia" (ARTP Development Credit Agreement (DCA), August 7, 1998).<sup>3</sup>

6. **Key Performance Indicators (KPIs):**<sup>4</sup> (i) increase in production and yield in crops and livestock; (ii) increase in the number of small farmers using new technology; (iii) autonomous apex organization (EARO) established to guide and coordinate overall national research system, staffed and operational; and (iv) number of new research initiatives based on collaborative processes started annually.

## 1.3 Revised PDO and Key Indicators, and reasons/justification

7. Revised PDO: "to support modernization and enhancement of the efficiency and effectiveness of Ethiopian agricultural research system and related agricultural higher education programs in the generation of ecologically sound agricultural technology and human capacity development, while making the system more responsive to farmers' technology needs and priorities".

8. **The PDO was revised at the Mid-Term Review (MTR) in May/July 2002 to more closely align the focus of the PDO with the scope of the original project.** ARTP's original PDO was consistent with the project's purpose and expected outcomes. However, the PDO, as originally worded, focused on a very broad set of outcomes that depended on many factors beyond the scope of the project's influence. In particular, the agricultural research activities being upgraded through ARTP were a necessary but not a sufficient condition to achieve increases in agricultural production and yields expressed in the original PDO. Also, the ARTP-facilitated acceleration of research outputs was in most cases not likely to have significant and broad impact on farm productivity within the relatively short project implementation period. The PDO was clarified in order that the project might be fairly evaluated against the actual *controllable* output of its investments and activities, i.e. that it might be evaluated according to its success in bringing about the modernization and enhancement of the Ethiopian agricultural research system and related agricultural higher education programs, including improved

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<sup>3</sup> The PDO is different in the DCA, the text of ARTP's Project Appraisal Document (PAD), and the PAD Project Design Summary (Annex 1). Since the DCA's PDO is more specific in terms of outcomes, this ICR evaluates project performance against the PDO in the DCA.

<sup>4</sup> The KPIs listed in the PAD Results Framework, and in subsequent Implementation Status Reports (ISRs) differ. As the DCA has no performance indicators, this ICR considers the KPIs listed in the PAD. However, the ICR also looks at 'incomes of farmers' as an additional KPI since it is specified in the DCA's development objective.

responsiveness to clients. The revision was not in response to problems in ARTP's performance, nor a plan to alter the nature or scope of the project's activities. The Board approved the revised PDO on a no-objection basis on October 20, 2003 (see Sections 1.6 and 1.7).

#### **1.4 Main Beneficiaries**

9. ARTP's main beneficiaries comprised male and female small farmers, mostly with holdings of less than two hectares, who constituted about 90 percent of the farming population. Women farm workers were expected to benefit from improved post-harvest and other farm operations handled by women. The project also sought to raise the participation of women in the overall agricultural research effort through higher recruitment of women scientists and support staff. All researchers/scientists and technical and administrative staff trained under the project were expected to benefit.

#### **1.5 Original Components**

10. **Agricultural Research Management** (US\$8.1 million) sought to strengthen the management and operational capacities of the Ethiopian Agricultural Research Organization (EARO) by: (i) making EARO functional with adequate staff and physical budget, and by establishing appropriate procedures and systems for better direction and coordination of research efforts; (ii) developing and introducing a decentralized system for prioritization of agricultural research, in consultation with stakeholders and male and female beneficiaries, and according to acceptable economic criteria; (iii) improving the effectiveness of research by strengthening research-extension-farmer linkages; (iv) improving the exchange of research information by strengthening the agricultural research data base, information and documentation system; (v) strengthening links with international research organizations; (vi) ensuring timely and adequate budgetary support to approved programs; (vii) introducing and maintaining an incentive structure for research staff; (viii) addressing gender issues; (ix) providing EARO with budget for consultant support and management training; (x) improving EARO infrastructure and equipment; and (xi) establishing and operating a competitive Agricultural Research Fund (ARF).

11. **Strengthening of the Agricultural Research System** (US\$25.6 million) aimed to rehabilitate, modernize and expand the existing agricultural research system in order to increase and improve its capacities to engage in agricultural research activities by: (i) strengthening the network of existing RCs through rehabilitation, provision of equipment including biotechnology research, and improving social facilities; (ii) providing new research facilities and associated infrastructure in less favorable and previously unserved agro-ecological environments; and (iii) providing incremental operating and maintenance costs at RCs.

12. **Human Resource Development** (US\$26.3 million) was to strengthen the human resource base of Ethiopia's agricultural research and education institutions through providing opportunities for higher education and training, both at local Universities and abroad. It included: (i) facilitating the availability of higher quality and increased numbers of research personnel, both male and female, in needed disciplines, through strengthening of Alemaya University of Agriculture's (AUA) teaching facilities and associated infrastructure, improving the skills of academic staff and recruiting international academics to substitute for local teaching staff on training abroad; and (ii) improving skills of research staff through formal long-term overseas training (Ph.Ds and M.Sc.s), and providing local training (M.Sc.s) and other specialized training programs.

#### **1.6 Revised Components**

13. The project's components were not revised significantly; however, at the MTR new activities were included under Components (i) and (ii) to reflect changes in circumstances during project implementation.



Since ARTP's design, regional governments had begun to take on lead responsibility for local research activities (originally included in the national-level EARO mandate) through the establishment of Regional Agricultural Research Institutes (RARIs). This signified a desirable decentralization of research. Accordingly, the following activities were added to ARTP: (i) under Component 1 (Agricultural Research Management), *designing and preparing proposals for future activities of EARO and/or RARIs*; and (ii) under Component 2 (Agricultural Research System), *providing start-up facilities to newly-established RARIs through provision of vehicles, office equipment and furniture*. The Board approved the amended DCA on a no-objection basis on October 20, 2003.

## 1.7 Other significant changes

14. **Changes in Project Design.** The PDO, project outputs and monitorable indicators were reviewed and revised as part of the MTR, prompted by the need to enhance performance monitoring (Section 1.3) and also by institutional changes (Section 1.6). The revised project output included *the establishment of a decentralized incentive-based national agricultural research system*. The new KPIs were: (i) *strengthened capacity of the regional agricultural research systems*; and, (ii) *enhanced linkages among regional research systems, and between regional research systems and EARO*.

15. **Reallocation of Funds.** Prior to the MTR, it had become evident that project costs were higher than planned in some areas (i.e. civil works, goods for new RCs), and lower than estimated in others (i.e. consultancy services and operating costs). In particular, project costs of the six new RCs had been underestimated. The IFAD Loan (US\$13.1m) had originally provided for financing the construction of and equipment for these centers (US\$15.6m), with matching GoE funds (US\$2.5m). However, based on pre-investment feasibility studies and engineering designs, the revised cost estimates for the six RCs amounted to US\$23.9m, indicating a financing gap of US\$8.3m. The gap was partly met from a reallocation of IFAD Loan funds from other expenditure items, in particular from funds originally planned to finance Research-Extension-Linkage activities (US\$3.7m) and the ARF (US\$1.3m). GoE also increased its contribution to this sub-component from US\$2.5m to US\$5.7m (including approximately US\$3.1m for local duties and taxes). GoE requested using any subsequent savings from the IFAD Loan to minimize the overall financial burden of ARTP on GoE. Correspondingly, IDA took on the responsibility for financing Research-Extension Linkage activities and the ARF.<sup>5</sup> To support decentralization efforts, the Bank also allocated US\$0.75m under Category 2 to a new expenditure item, *to equip the coordination offices of the newly-established RARIs*.<sup>6</sup>

16. **Amendments to the DCA.** The DCA was amended on March 19, 2003 and on October 20, 2003. The MTR made several recommendations to facilitate successful implementation of ARTP. These were: (i) reallocation across expenditure categories to adjust Credit allocations to updated cost estimates of project investments and activities; (ii) increase in the upper limits for the project's Special Accounts to facilitate disbursement where lack of sufficient funds in the Special Account had become a bottleneck; (iii) clarification in the focus of the PDO to harmonize the scope of the PDO with the project's original (and unchanged) set of investments and activities (Section 1.3); (iv) adjustment in the project description, to include decentralized research activities as eligible expenditures under ARTP (Section 1.6); (v) adjustments in financing arrangements to harmonize IDA and IFAD financial commitments with the new allocations or Credit proceeds across expenditure categories (see (i) above); and (vi) revision in procurement methods to facilitate procurement of goods by adding more agile procedures than were

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<sup>5</sup> ARTP had provided US\$1.5m for establishing and operating a competitive ARF under Component 1. Funding was to come from the IFAD Loan (US\$1.3million) and GoE (US\$0.2m). This responsibility was shifted to IDA.

<sup>6</sup> See MTR Aide Memoire, July 2002, for Project Design Summary, Schedule changes, and cost reallocations.

originally available. Items (i) and (ii) did not need Board approval and were effected in the first amendment to the DCA on March 19, 2003. Recommendations (iii) – (vi) required Board approval (and had not been included in the earlier amendment, as it would have delayed processing). These items were approved, on a no-objection basis, in the second amendment to the DCA.

## **2. KEY FACTORS AFFECTING IMPLEMENTATION AND OUTCOMES**

### **2.1 Project Preparation, Design and Quality at Entry**

17. **GoE was very committed to improving agricultural research and held a good track record of funding the Ethiopian Agricultural Research System (EARS).**<sup>7</sup> GoE's background work towards ARTP facilitated the Bank's Preparation Mission in identifying various issues and making recommendations on ARTP's design and content. By the time of the Appraisal Mission in April-May 1997, GoE had prepared detailed project reports on: a Review of the Agricultural Research System and Recommended Future Direction (July 1996); the proposed Agricultural Research and Training Project (second draft, September 1996); and the National Agricultural Research Program Project Implementation Manual (November 1996).

18. **The Bank made available US\$525,000 through a PHRD Grant for project preparation and appraisal. These resources and the extended period in advance of actual project launch permitted good preparation, especially in Human Resource Development (HRD) and procurement aspects.** Preparatory work in HRD included: a review of Ethiopia's human resources planning in agricultural education and recommendations on coping with future needs of the research and extension systems; an analysis of the attrition problem and the development of an effective HRD strategy; and a training needs assessment. During negotiations, the Bank and GoE discussed opportunities for EARO to establish long-term institutional relationships and collaboration arrangements with reputable foreign agricultural universities to strengthen the effectiveness of the HRD program in general and the training program in particular. These contributed to designing an outstanding training program, which successfully trained a large number of researchers (Annex 2).

19. **ARTP's project design incorporated several lessons from ARP and from previous Bank operations.** The ARP ICR had indicated: (i) the need to prepare a well-designed and detailed training plan with clearly articulated training needs and priorities during appraisal; and (ii) the need to give financial authority to institutions, i.e. the RCs, to manage their resources and to establish an adequate financial recording, reporting and accounting system for efficient functioning of all institutions. Although RCs were granted financial and technical authority to some extent, support continued to be channeled through EIAR and became an important issue in terms of moving towards the project's intended outcomes (Sections 2.2 and 6). An Operations Evaluation Department (OED) review of several Bangladesh agricultural research and extension projects (Credits 0828-BD, 1215-BD and 1455-BD) had indicated limited achievements as a result of the Government's reluctance to depart from traditional civil service norms to create greater incentives for research (ARTP PAD, p. 10). ARTP identified this as a major risk, and the Bank required GoE to set up a separate salary and incentive structure for scientists and technicians as a condition for Board presentation.<sup>8</sup> GoE revised the salary scale, although Government has not maintained an adequate incentive system throughout ARTP implementation (see Section 5.2). Bangladesh's project implementing agency had not achieved effective coordinating and planning capacity

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<sup>7</sup> ARTP PAD, p. 10.

<sup>8</sup> The DCA specified that EARO was to adopt a HRD plan that provided incentives to retain qualified staff by March 1999.

due to lack of authority. Although GoE, via an official proclamation granted EARO full powers to organize and manage the research program with direct accountability to the Prime Minister, this decision was reversed during implementation (Section 2.2).

20. **ARTP's PAD identified several risks** posed by: (i) delays in EARO getting fully established and taking charge of the research system; and (ii) inadequate autonomy of the research system, leading to delays and discontinuities. The Bank and IFAD saw the establishment of an autonomous EARO, although not a specific "condition" for appraisal, as an essential prerequisite for ARTP's success. GoE was aware of and responsive to this concern and ensured that the new EARO was "up and running" with its Board of stakeholders and management team in place well before ARTP negotiations. To mitigate the second risk, during Appraisal, the teams agreed on specific powers and delegation of authority to be granted to EARO and the RCs, with several actions to be undertaken prior to Board presentation or Credit effectiveness. These included signing of a Memorandum of Understanding (MOU) with Regional Centers/regional Governments, AUA and MOA to improve inter-institutional accountability.

21. **The project design failed to safeguard against one critical risk: reversal of the structure of EARO and its Board (representing all stakeholders) and the possible impact on successful implementation.** Bank and IFAD support to agricultural research was founded on the establishment of EARO (ARTP PAD, 1998, Section 4). However, the DCA had no reference to the crucial role that the new institution would play in "making the system more responsive to farmers' needs and priorities" nor did the DCA require continued existence of "an apex organization that represents all stakeholders" for successful implementation.<sup>9</sup> (See Section 2.2 for details on how this affected achievements.)

22. **ARTP was flawed in its institutional assessment. The project documents provided a relatively disappointing set of lessons learned (not drawing more heavily on lessons learned in Africa) on the main institutional issues** that one might have expected to have been addressed and incorporated into project design. These include subsidiarity issues as related to farmer input and the demand aspects of research, and also the political economy context at appraisal (Section 1.1)

23. **The project's poorly specified Results Framework, including the vague PDOs, KPIs and the weak M&E system were major design flaws.** As mentioned in Sections 1.2 and 1.3, the PDOs in the DCA, the PAD text and PAD Results Framework differed and changes in outcomes were not attributable to the project (discussed further in Section 3.2—M&E). Bank management flagged this issue on several occasions during the Project Concept Document (PCD) stage, as, "*the need to spend more time with the client on the performance indicators to make them appropriate, measurable, and with baseline and target figures*" (Office Memorandum on ARTP, March 21, 1997).<sup>10</sup> Although the DCA required an annual beneficiary assessment and an assessment of the role of the private sector in agricultural research, there were no formal assessments. In the PAD's Project Design Summary, monitoring and supervision was to be done mostly through Supervision Reports and EARO Semi-Annual Reports; there were no baselines specified. A well-designed set of KPIs should have been set out at preparation to guide any surveys conducted under ARTP and M&E to be conducted under the project.

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<sup>9</sup> The Memorandum of February 24, 1997 observes ARTP's unrealistic expectation, that EARO--an institution that is almost fully funded by the GoE budget--would be made "fully autonomous".

<sup>10</sup> A Memorandum of February 24, 1997 flags several key design issues: (i) the shortcomings in the project's Results Framework in specifying the interrelationships between the objectives and the performance indicators; and (ii) the vague component description and the failure to specify how results will be achieved and measured.

## 2.2 Implementation

24. Overall, ARTP has achieved progress in most major project activities and contributed to strengthening the capacity of Ethiopia's agricultural research system, although there were significant delays in project implementation, especially in the area of civil works discussed below.

### Favorable Factors in project implementation:

- The ARTP-induced close collaboration between AUA as the lead training institute spearheading the HRD program and EARO, and the involvement of a highly effective project team at AUA greatly contributed to the successes of the project-supported training programs.
- At MTR, the inclusion of a new sub-component to reinforce RARI management was an important addition to the project and contributed to further RARI development.
- The MTR, in addition to attempting to resolve the routine kind of issues (civil works, procurement delays and M&E issues), also sought to address emerging concerns about the relationships between EARO (which by that time had been re-constituted as EIAR with an "Advisory Council" instead of a stakeholder Board) and the newly emerging RARIs, which had gained rapidly in capacity and ambition. These attempts, however, were not fully successful (see Sections 3.2)

### Unfavorable Factors that negatively affected ARTP's ultimate impacts:

- Delays in civil works and the uneven quality of construction. The difficulties of establishing full-fledged RCs in remote areas without relevant local construction capacity were underestimated. The rapid escalation of overall costs and a lack of cement caused by a country-wide building boom resulted in delays of up to 3-4 years before actual construction started. The Biotechnology Research Institute at Holeta was delayed in part due to difficulties in receiving a World Bank no objection (Eleventh Review Mission Aide Memoire, November/December 2006, p. 13). ARTP was extended twice, and IFAD financing for the six new RCs was also extended to allow for completion of activities under implementation. Two RCs, however, remain incomplete. In the case of the Jinka RC, a rigidly applied Bank procurement process resulted in the hiring of contractors with a poor record in similar projects in Ethiopia, causing further delays.
- Bank Supervision Missions did not include any persons with civil engineering expertise. Had this been done early-on during project implementation, it is likely that some of the problems encountered later in terms of quality of works (such as inadequate sewage disposal systems in staff housing, poor RC library construction, leakages in walls and roofs) could have been prevented.
- The lack of an institutional framework for agricultural research that would adequately define the respective roles and responsibilities of the federal and emergent RARIs (according to principles of subsidiarity) hindered the development of the demand side of Ethiopia's agricultural research system. As a result, the system remains less responsive to the needs of its clients than should be the case. Also related to this, some duplication persists with regard to federal and regional research stations in terms of locations and mandates – a more developed framework dealing with subsidiarity would have helped to address this.
- The lack of an apex institution for agricultural research with independence from EIAR and other research providers led to the control of EIAR over the entire NARS and to underdevelopment of the potential of the RARIs and other service providers. GoE's decision to abolish the EARO Board and rename EARO as EIAR, with the Institute being guided by an Advisory Council was an attempt to address some of the issues mentioned above. This was an opportunity missed in the sense that it did not create an independent apex body and also did not solve the issue of

divergence between EIAR on the one hand and the RARIs on the other. Thus, there remains a concern with regard to the “apex institution establishment” (See Nov/Dec. 2006 Aide Memoire p. 2).

- The Bank and IFAD support was provided under the umbrella of a single ARTP. However, at no time during project implementation was there any actual IFAD-financed input into field supervision, nor did there seem to be any formal agreement on how project supervision and implementation assistance would be provided. The end result of this situation was likely a level, frequency and intensity of supervision below what would have been ideally required for a project as complex and broad as ARTP. For example, although the Bank was expected to supervise the construction of the Jinka Research Center, there were no resources for supervision after the Bank’s ARTP project closed on June 30, 2007 and IFAD extended their component (construction of the six RCs) to December 31, 2007. The Jinka RC is only 34 percent complete.

### 2.3 Monitoring and Evaluation (M&E) Design, Implementation and Utilization

25. **Design. The M&E design was poor, and the Results Framework had several weaknesses:** objectives were defined in broad, non-operational terms; there was lack of congruence between project components, activities and the PDO, and the KPIs were not well-linked to the project objectives. Overall, there was no M&E system set up to gather systematic data to monitor progress towards the outcomes. The revision of the PDO did not make objective monitoring of project outcomes any easier. Management flagged deficiencies in the M&E system during project preparation (Section 2.1). Senior Management continued to flag this issue in several Implementation Status Reports (ISRs), for example:

*“The team will need to make sure that M&E activities, including the impact assessments of the research system, are carried out in a timely and efficient manner...”<sup>11</sup>*

26. **M&E Implementation and Utilization. The project failed to establish and implement an operational M&E system,** and thus did not ensure the necessary data collection, validation, analysis and dissemination, in particular, with regard to projected increases in production and yield, and project outreach, and in the numbers of small farmers using new technologies. The ‘satisfactory’ implementation performance ratings on M&E reported in ISRs are therefore unrealistic.<sup>12</sup> The shortcomings of the M&E system are documented in the beneficiary perception survey: about 60 percent of the respondents report design and implementation problems of M&E, ranking it the third biggest problem of ARTP.<sup>13</sup> Troubleshooting, for example, through a larger qualitative beneficiary impact assessment, either through training and simplification of the reporting format, or by the use of proxy indicators was not attempted. These factors adversely affected the ability to evaluate and learn from ARTP’s experience.

27. **On the positive side, EIAR and IFAD conducted a number of “case studies” on research impact using a variety of methodologies.** Most of the available evidence comes from selected RCs and small surveys, where findings can be attributed to a certain degree directly to the project interventions in the vicinity of these RCs (see Appendix 3--Economic and Financial Analysis).

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<sup>11</sup> Country Director’s comments, ISR, April 28, 2005. Also see ISRs from May 1, 2002, March 3, 2004 and May 13, 2005.

<sup>12</sup> M&E is downgraded to ‘Marginally Satisfactory’ only in the final ISR of June 27, 2007.

<sup>13</sup> Ethiopia draft Government ICR, p. 58.

## 2.4 Safeguard and Fiduciary Compliance

28. Overall, the project presented no significant safeguard or fiduciary compliance issues. ARTP was classified as environmental category C. This was justified based on several reasons, including: farmers in Ethiopia being the main custodians of its natural resources; generating ecologically sound and yield enhancing agricultural technologies was intended to relieve pressure on marginal and degraded lands; and participatory on-farm and farming systems research were to help improve water and soil management. The project was envisaged to contribute to an overall positive impact on the environment.

29. Overall, financial management arrangements continued to be satisfactory. However, the internal audit for FY2005/06 was not completed.<sup>14</sup> There were some issues with salaries of civil service employees at the PMU being paid from proceeds of the credit. According to the ARTP DCA, only contractual staff salaries were to be paid from the Credit proceeds. The final two ARTP Missions (in December 2005 and Nov/Dec 2006) had urged EIAR to take measures to correct this situation, and to refund to the Bank salaries paid to civil service staff but at project closure, this issue remained unresolved. Regional and Federal RCs also failed to account for their advances on time (and a total of US\$1.4m was outstanding as at December 2006.<sup>15</sup> There were some procurement delays, but no serious procurement issues.

## 2.5 Post-completion Operation/Next Phase

30. GoE is expected to ensure adequate budgetary support for normal operations of EIAR and AUA, and for maintaining ARTP-funded improvements in facilities, equipment and human resource capacity. The Bank's Rural Capacity Building Project (RCBP, US\$54m, Report 35457-ET), which became effective in FY07, will carry forward the agenda that was launched under ARTP. The RCBP supports GoE's efforts in: strengthening the agricultural technology system; making it more responsive to clients' needs; and enhancing the capacity of producers to select economically viable technologies and practices. It supports programs and activities geared toward the following: (i) modernized Technical and Vocational Education and Training (TVET) colleges that are more responsive to the changing needs of a demand-driven and market-driven agricultural sector; (ii) piloting new initiatives in the agricultural advisory services system to introduce demand-driven and participatory mechanisms; and (iii) a strengthened agricultural research system with improved institutional and human capacity to generate and disseminate client-demanded and market-oriented technologies.

# 3. ASSESSMENT OF OUTCOMES

## 3.1 Relevance of Objectives, Design and Implementation

31. **The project's objectives remain relevant. This holds true for the need to modernize the agricultural research system, improve agricultural education programs and staffing, and, in particular, enhance the responsiveness to farmers' technology needs.** According to official data, annual agricultural growth over the last three years averaged 10 percent, but there is no doubt that the sector continues to face significant structural challenges due to a lack of institutional capacity and limited technological adaptation and adoption by farmers in all major regions. Ethiopia's Plan for Accelerated and Sustained Development to End Poverty, 2005-2010 (PASDEP), which builds on GoE's Sustainable Development and Poverty Reduction Program (SDPRP, July 2002), emphasizes broad-based growth,

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<sup>14</sup> Final Aide Memoire, Nov/Dec. 2006, p. 19.

<sup>15</sup> Ibid, p. 20.

private sector development in agriculture and alleviation of food insecurity. Technological intensification is a key part of PASDEP and the Bank's Interim CAS. Investment in agricultural research is a long-term need.

32. **In the future context, the nature of appropriate support will differ from that of ARTP** for the following reasons: (a) the design was successful in setting up and accomplishing the physical aspects (training, civil works etc.), however, the future emphasis will need to be placed on the institutional structure for sustainable improvements in the overall agricultural research system; (b) greater scope for non-state actors will be desirable.<sup>16</sup> Through the ARF, the project has taken the first steps toward increasing the involvement of non-state actors in research activities.

### 3.2 Achievement of Project Development Objectives

33. Section 1.2 lists the project's original PDOs and KPIs, and Section 1.3 gives the revised PDO. **As research evidence suggests, there is great *potential* for yield improvements in Ethiopia as a result of increased seed and fertilizer adoption (Annex 3). However, it is difficult to directly attribute the observed improvements in adoption rates, yields and incomes to ARTP activities**, especially at this stage, due to several factors such as: (i) observing/measuring the outcomes of investments in better agricultural training, research facilities, research, and technology is a long-term process. For example, it can take up to a decade to develop, test and multiply seeds, and disseminate improved tef seed varieties to farmers, and observe reliable yield increases. Also, several improved seed varieties released to farmers during ARTP's implementation were developed prior to this project;<sup>17</sup> (ii) adoption rates depend on many factors including the availability and effectiveness of agricultural advisory services, the education level and experience of farmers, availability of credit, seeds, fertilizer and water, and need to be carefully interpreted (Feleke et. al, 2005; Zegene et al, 2001a; Zegene et. al, 2001b; Hailemariam, 2007; Legese et. al, 2006); and finally, (iii) multiple factors affect yields and incomes<sup>18</sup>.

34. **The poor results framework makes it a further challenge to link outputs to the achievement of PDOs/outcomes** (as discussed in Sections 2.1 and 2.3). This ICR considers evidence from various documents, ICR team field interviews, and selected field-level research observations in an attempt to compensate for gaps in M&E and to link outcomes to project interventions and outputs. The following discussion presents: (a) evidence on outcomes related to the original PDO and KPIs--technology generation and adoption, research-extension linkages, yields and farmer income, and the establishment of an autonomous apex organization to guide overall research; and (b) evidence related to the revised PDO and KPIs--modernization and enhancement of the research system and education programs (see Annex 2 for details on Outputs by Component).

#### (a) Outcomes related to the original Project Development Objectives

35. **Technology generation and adoption. It is likely that ARTP contributed to the number and type of released crop varieties.** Evidence on adoption rates however need to be carefully evaluated. Over 2000-05, the crop varieties released were about 2 to 5 fold the numbers released in the previous decades (see Table 1, Annex 2). However, the available evidence can only report association not

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<sup>16</sup> Byerlee, D. et al. 2007, "Policies to Promote Cereal Intensification in Ethiopia", International Food Policy Research Institute (IFPRI), *Discussion Paper 707*. Washington DC.

<sup>17</sup> Evidence from ICR team interviews with researchers at Debre Zeit, the oldest and one of the best equipped RCs.

<sup>18</sup> Interestingly, adoption rates were observed to be higher for non participants in ARTP-supported on-farm verification trials than for participating farmers around the Debre Zeit RC, possibly due to spillover effects and/or overlapping interventions in the project area (Hailemariam, 2007—see Annex 3).

causality. While the results may not be directly attributed to ARTP, the project's contributions to building human and physical capacity, and providing laboratory supplies and operating expenses are believed to have made a significant difference in research achievements. During the last five years, EIAR has released a total of 393 crop and forage technologies, 25 technologies in farm implement use, 38 tree species, 18 soil and water conservation practices and 86 livestock production technologies. In addition, "technology importation" from abroad resulted in the release of 2 varieties of haricot beans, 1 durum wheat, 2 malt barley, and seven multi-purpose trees.<sup>19</sup> Moreover, ARTP has made it possible for some farmers to gain better access to agricultural technology and information by participating in Research/Extension Advisory Councils (REACs) and Farmer Research Groups (FRGs) (See outcome reported below on research-extension-farmer linkage mechanisms). Farmer adoption rates are discussed further in Annex 3.

**36. ARTP has contributed to initiating and strengthening Biotechnology research.** The National Agricultural Biotechnology Strategy was prepared and the National Biotechnology Laboratory was built at the Holletta RC (with significant delays), and provides facilities for genotyping and sequencing, protein analysis, tissue culture research, animal reproductive biology for embryo transfer and bioinformatics. Agricultural biotechnology research has been initiated at different RCs that have developed mass propagation practices for several crops and their elite varieties and provided information to private investors on tissue culture. Several high value crops are now under research for optimizing micro-propagation protocol and some are about to finish and show promising results. Current R&D activities include partnerships with NGOs, cooperatives, regional offices involving plantations for the generation of 10 million seedlings of pineapple, 0.215 million seedlings of banana 0.2 million seedlings of potato and 0.05 million seedlings of coffee. At present, EIAR RCs are conducting a total of 18 activities on plant biotechnology, 6 activities on microbial biotechnology and 2 activities on animal biotechnology.

**37. Research-extension-farmer linkage mechanisms. ARTP has helped to establish FRGs, which have contributed to greater farmer participation in priority setting and likely improved technology transfer.** EIAR established Research-Extension Advisory Councils at Federal, Regional and RC level as a strategy to strengthen research-extension-farmer linkages and enhance the process of technology transfer. Establishment of FRGs to enhance on-farm research and technology dissemination, adaptation and scaling up has been an important area of project impact. A total of 159 FRGs have been established around 7 federal RCs and 8 regional RCs, with participation of a total of 2831 farmers (Annex 2 Table 2). Although the registered progress and the impact are limited to the near proximity of the centers, piloting FRGs at the various research centers is promising.

**38. Yield and Production Increases: Pilot empirical studies indicate that adopters of new technologies obtained higher yields than non-adopters.** The impact of ARTP on farmer's yields has been analyzed in pilot empirical studies for chickpeas (Hailemariam et al., 2007) and for faba beans at the Debre Zeit RC (Legese et al., 2006).<sup>20</sup> Since the launching of the chickpea research program, associated with ARTP and international collaboration, especially with the International Agricultural Research Center (IARC) of the Consultative Group on International Agricultural Research (CGIAR), the program has released twelve improved chickpea varieties both from domestic and foreign materials. Chickpea technologies were subsequently disseminated via regular extension activities provided to FRGs.

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<sup>19</sup> ARTP Project Implementation Performance Report, November 2006, Addis Ababa.

<sup>20</sup> Legese, Getachew and Hailemariam T. 2007. "Adoption and Impact of IFAD Funded Technology Transfer Activities: A Report on Improved Chickpea Technologies." May 2007; and Legese, G. and Alemu, T. "Adoption and Impact of IFAD Funded Technology Transfer Activities: A Report on Improved Faba Bean Technologies, August 2006.



39. **The main findings from the two studies indicate a statistically significant difference in yields between adopters (1.8 tons/ha) and non-adopters (1.1 tons/ha) of the improved seeds.** The estimated rate of return (farmer level) to improved varieties of chickpea seeds, implicitly derived from an agricultural production function, is about 49 percent. Similarly, a statistically significant difference was found in yields between adopters and non-adopters of improved faba bean varieties; the yield was 0.5 tons/ha for non-adopters and 1.8 tones/ha for adopters. A production function estimate suggests a high rate of return (at farmer's level) equivalent to about 72 percent. This research also suggests the presence of significant externalities as spillover effects reach households that are not participating in the FRGs.

40. **At the country level, there is conflicting evidence on cereal yield increases.** According to data from Ethiopia's Central Statistical Authority and the Government ICR, productivity of major crops may have increased slightly over the past decade (Government ICR, November 2007, p. 9). However, data from the World Bank's Rural Development Review 2007, which looks at the original and verified source data based on crop cutting estimates, indicate that overall yields in Ethiopia have been almost stagnant over the period 1989-2004 in tef, maize, sorghum, barley and wheat (Figure 1). Current efforts are underway to see if this finding holds true for the period 2004-06. The interpretation of the data, however, is important—would yields have fallen without Research and Development (R&D), and are aggregate yields being curbed by bringing less fertile lands into production? These aspects need to be further explored.

41. **On the other hand, there is strong evidence that improved agricultural technologies in Ethiopia will have a *potentially* high impact on agricultural yields.** Findings from Byerlee et al. (2007) suggest that crop packages combining fertilizers, improved seeds and better management practices can significantly raise productivity for wheat, maize, and tef in moisture reliable areas (see Appendix 5).

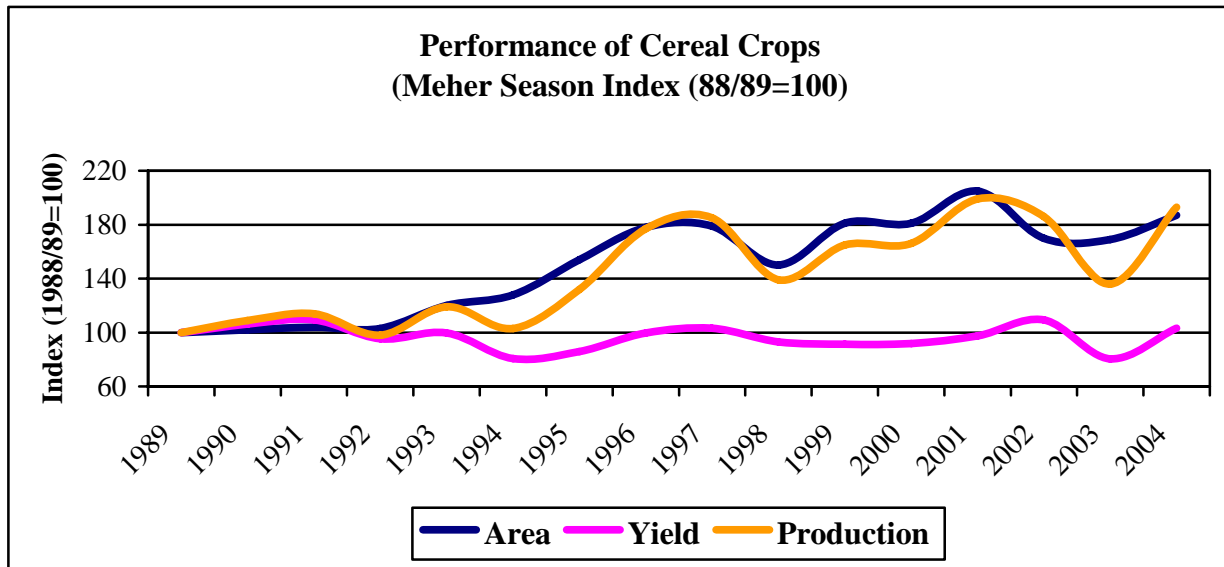
42. Official production statistics in the Government ICR show yield and productivity for major crops in Ethiopia (Government ICR, p. 9). However, these cannot be attributed directly to ARTP because of the many factors that affect yield and productivity and the lagged impact of the project-supported activities. Similarly, the increase in the number of small farmers using new technology reported in the Government ICR cannot be solely attributed to ARTP as extension services under Ministry of Agriculture and Rural Development (MoARD) do not fall under this project<sup>21</sup>.

43. ***Household Income. Adopters of chickpea varieties tend to have a higher household income than non adopters, though the difference is not statistically significant (Hailemariam et al., 2007). Adopters of Faba beans do not exhibit significantly higher incomes than non-adopters (Legese et al., 2006).*** These studies call for a careful interpretation, as measurement of household income is prone to measurement errors and significant uncertainties in Ethiopia. The studies also use simple methodologies that may not be able to detect differences in the presence of sample selection bias. Therefore, while income differences are likely due to greater production and other benefits, more careful analysis is needed. Abate (2006) reports evidence mainly from higher value crops suggesting the potential for larger household incomes due to technology adoption, though the evidence cannot be directly attributed to ARTP.

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<sup>21</sup> The total number of farmers participating in extension at the national level is reported to have increased from 32,000 in 1999 to 5.4 million in 2006.

**Figure 1: Performance of Major Cereal Crops, 1989-2004**



44. **Establishment of an autonomous apex organization to guide and coordinate the overall national agricultural research system. It is unclear if ARTP achieved this objective.** ICR team field interviews obtained mixed responses with regard to this issue. Several persons responded that the new Advisory Council of EIAR fails to adequately represent all stakeholders, including the RARIs, as the Heads of RARIs (who were members of the EARO Board) are not on the Advisory Council. As noted in the Final Review Mission Aide Memoire of Nov. /Dec. 2006:

*“Although in the mission’s view, good progress has been made concerning most of the KPIs that relate directly to the PDO, there is concern with regard to ARTP fully achieving KPI 1.1 “autonomous apex organization established to guide and coordinate overall national research system, staffed and operational”. Just before the ARTP MTR in 2002, GoE abolished the (then EARO) Board of stakeholders and re-organized EARO as an entity within the Ministry of Agriculture and Rural Development (MoARD). EARO in 2005 was re-named as “EIAR” the Ethiopia Institute of Agricultural Research. EIAR is currently guided by an “Advisory Council” of senior research and development (R&D) specialists. Memoranda of Understanding (MoAs) have recently been signed between EIAR and the respective RARIs concerning the responsibilities of the respective institutions in implementing “national” research programs. However, there still seems to be a lack of coordination of research programs between the federal RCs (EIAR) and the RARI RCs, and between the different RARIs, which in some cases serve similar agro-ecological zones; this likely results in unnecessary duplication and inefficiency. The current mission therefore re-iterates the opinion of earlier ARTP Review Missions that the present configuration of the Ethiopia agricultural research system does not yet encompass the characteristics internationally recognized as necessary over the long term to successfully support a dynamic agricultural sector. The mission is of the view that among the steps ultimately required in order to achieve such a system would be establishment of an autonomous national Apex Board for the entire Ethiopia NARS (EIAR, RARIs, Universities, private sector etc.) that is recognized by all stakeholders and in which they participate as decision makers on research priorities and resource allocation.”*

## **(b) Outcomes related to the revised Project Development Objectives**

45. The revised PDO focuses on outputs rather than outcomes, i.e. modernizing and enhancing the research system and higher education programs. This assessment is based on available internal and external evaluations and the mission's findings on intermediate outcomes toward the achievement of the development objectives. Annex 2 gives details of outputs by component.

46. ***Training and Capacity Building.*** **In addition to building staff capacity of EIAR RCs, ARTP significantly strengthened human capacity of the regional agricultural research systems; there was also a substantial provision for short-term staff training.** At appraisal, many perceived the amount allocated to improving the skills of research staff, including at AUA (about 21 percent of the overall project costs or US\$19m out of a total of US\$90.6m) as unrealistically low. The project, however, helped to train 465 research staff and 50 teaching staff at MSc and PhD level abroad (with an estimated attrition rate of only 5 percent). Actual data for local short-term local training is not available but it is estimated that about 4,000 employees have benefited from ARTP. New teaching facilities have been opened and Ph.D. training programs initiated, permitting further local training. Overall, the results of the project-supported training programs are considered as highly successful.

47. ***Civil Works.*** **Civil works, rehabilitation and re-equipping of the agricultural research system strengthened the RCs.** In the planning and launching phase, ARTP did not fully address the requirements of some RCs that were not part of the NARS. ARTP also extended the national research network and created capability in previously unaddressed agro-ecologies and established six entirely new RCs. Although construction of two of these six RCs is not yet complete, research activities have already been started at all of the centers. Based on the information contained in several project supervision mission reports and beneficiary assessments, concerns remained about the quality of civil works constructed at several RCs.

48. ***Research Coordination.***<sup>22</sup> **The project contributed to strengthening capacity of the RARIs. Enhanced linkages among regional research systems and EARO have not been fully achieved** mainly due to deteriorating relationships between EARO/EIAR and the RARIs, which became competitive attitude for mandate areas, physical facilities and staff resources. Coordination between the NARS entities has not been satisfactory. Efficient utilization of Management Information Systems and functional electronic connectivity between RCs was not fully achieved. EARO/EIAR was also slow in creating and operationalizing the competitive ARF. Its management committee and priority setting procedures are believed to be dominated by EARO/EIAR, undermining beneficiary confidence in the grant awards being solely based on the merits of the submitted R&D proposals.

49. **At the subordinate level the following picture emerges.** The RCs (federal and regional) performed their ARTP implementation responsibilities well. However, a major problem was insufficient involvement of the center management and scientific staff in the civil works design phase resulting in some cases in a less than optimum work environment. AUA was the key implementing agency of the ambitious and complex human resources development plan supported by ARTP and performed this function in a highly satisfactory manner. The RARIs as independent regional institutions successfully managed their ARTP support. Regional RCs have also started to generate research-extension-farmer linkage mechanisms around the centers, though the number of beneficiaries is still small.

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<sup>22</sup> As mentioned in Section 1.7, ARTP added new project outputs and KPIs during restructuring at the MTR.

### **(c) Expected achievement of the project objectives**

50. The significantly increased human capacity base and improved infrastructure created under ARTP, and the Government's continued firm commitment to increasing agricultural productivity, are likely to ensure further realization of the project's development outcome. While the empirical evidence on impacts of ARTP is limited there is sufficient evidence that continued adoption of agricultural technologies should in the future contribute substantially to yield increases in Ethiopia, and, by extension, to farm incomes.

### **3.3 Efficiency**

51. The project did not collect any comprehensive quantitative information on yields. Thus, the ICR could not carry out an economic, financial or efficiency analysis. Furthermore, the project's main outcomes depend on many factors outside ARTP and overall changes could not have been reasonably attributed to the project.

52. The ICR team conducted a review of the available research evidence. While not equivalent to a standard economic or financial analysis, the review in Annex 3 provides insights into the potential impact of improved agricultural technology in Ethiopia. Research generally indicates that Ethiopian farmers operate with substantial inefficiency, and that the adoption of seed and fertilizer technologies has the potential to more than double cereal yields while being profitable at the farm level. At the national level, an analysis of the adoption and impact of maize technologies for 1986-2000 suggests an economic rate of return (ERR) in the order of 29 percent. However, this type of analysis somewhat suffers from the lack of reliable data and exclusion of administration and overhead costs.

### **3.4 Justification of Overall Outcome Rating**

**Rating:** Marginally Satisfactory

53. The ICR team could not directly measure the achievements of the PDOs, given the unspecific Results Framework, and the largely absent M&E system during project design and implementation.

54. Overall, given the status of the Ethiopia NARS during the late 1990s and the severe constraints of the system particularly in terms of available well-trained human resources and also with regard to physical facilities for agricultural research, the project was relevant and continues to be relevant; it achieved its intended (revised) PDOs, in particular by training significant numbers of research and technical staff, and by providing infrastructure and the necessary equipment. Due to the lack of adequate M&E it is not possible to draw firm conclusions concerning ARTP impacts on the original PDOs--yields and production of major commodities, and farmer incomes. A few selected studies, however, show growth in farmer yields.

55. The Government's continued commitment to increasing agricultural productivity is likely to ensure further realization of the project's development outcome. Although there is some uncertainty on farmer's yields and effective technology adoption, the overall project outcome is rated as marginally satisfactory. This rating reflects the substantial relevance of the project, achievement of the main project outcomes weighted by disbursements (human capacity, infrastructure, and to a lesser degree institutional coordination), and the expected future achievements of the project.<sup>23</sup>

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<sup>23</sup> Disbursements were 35 percent and 65 percent against the original and revised PDOs respectively.

### **3.5 Overarching Themes, Other Outcomes and Impacts**

#### **(a) Poverty Impacts, Gender Aspects, and Social Development**

56. A gender focal point was established under the Research-Extension-Farmer Linkage Department (REFLD) to integrate gender issues into every aspect of the research endeavors i.e. research design; implementation, and M&E processes. ARTP allocated support for recurrent budgets to facilitate research analysis on gender issues. A major factor in the achievements of the unit in recent years has been the increase in the budget allocated to the unit, which had previously operated with minimal financing. In the past year the unit held 10 training events on gender analysis for over 237 participants from EIAR management, and federal and regional RCs. The unit also coordinated the development of case studies and baseline data collection through surveys at eleven RCs to identify gender disaggregated research priorities. A workshop presenting survey results was held and the findings are expected to be collected in a proceedings and a summary report.

57. The Tenth Supervision Mission in 2006 recommended the unit make an inventory of case studies on how research outcomes have addressed issues faced by women. An initial assessment was undertaken and identified several research outputs that could be considered gender-responsive in increasing household food security, reducing household drudgery and mitigating HIV/AIDs and poverty. No formal inventory was produced but the assessment provided an input into training activities and a more substantive report, including case studies, will instead be produced based on the results of the surveys. The report is expected to be finalized in 2007. The unit also plans to continue to implement survey findings in developing research proposals and undertake similar surveys at the regional level. While there has been excellent progress in identifying gender issues and initiating a gender-focused research program, there is a need to further institutionalize the collection of gender disaggregated data and the enhancement of gender focus of research operations.

#### **(b) Institutional Change/Strengthening**

58. ARTP has made significant contributions toward infrastructure development and capacity building for the Ethiopia National Agricultural Research System (NARS). In addition to the successful establishment of new RCs in six of Ethiopia's more marginal agro-ecological zones, ARTP has made good progress in rehabilitating and upgrading of existing laboratory and field facilities at EIAR Headquarters and RCs, RARI RCs, and at AAU. There has also been substantial impact of the human resource development (HRD) program. A total of 354 MScs, 160 PhDs (of which about 50 at AAU), approximately 200 short-term trainees who participated in overseas training programs and several thousand short-term trainees who benefited from local training programs, were successfully supported through ARTP.

59. Significant progress was made in improving the coordination of the NARS. In order to make research more client-oriented and demand-driven there has been an intensive effort to develop institutional mechanisms for closer research-extension-farmer/client linkages and collaboration in order to establish more effective working relationships with farmers and agri-businesses in setting research priorities, working on collaborative on-farm research and in assessing the relevance and impact of research results. ARTP facilitated the establishment of a competitive national "Agricultural Research Fund"; two rounds of "Calls" have been successfully completed. ARTP has also enabled research institutes to accelerate identification and development of a wide range of agricultural technologies and know-how adapted to the different agro-ecologies.<sup>24</sup>

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<sup>24</sup> For details, reference is made to a 2003 paper on Technology Generation and Adoption by Dr. Legesse Dadi, PPM&E EARO and to the Aide-Memoire of the "Tenth ARTP Review Mission" of December 2005.

60. However, the task of effectively preparing the Ethiopia NARS for its wide-ranging mandate is far from completed. Lessons learned under ARTP clearly indicate that although a good basis has been created for accelerated technology generation, dissemination and adoption, to achieve and sustain this will require continued and intensified support. There is an urgent need to further reinforce research institutions and make arrangements for closer coordination, greater client participation in setting research priorities, implementation and funding, pluralism in service provision and much more intensive farmer-extension-research linkages and collaboration. Building complementary capacity in the extension system and private agribusiness will be critical to scaling-up the localized successes achieved under ARTP especially in marginal and remote areas. Finally, building on ARTP support, it is important for Ethiopia to enhance its capacity in new frontier areas of research such as biotechnology in order to capitalize on opportunities for international collaboration in addressing important productivity constraints. All of these areas that need further attention will be addressed under the Rural Capacity Building Project (RCBP).

**(c) Other Unintended Outcomes and Impacts (positive or negative)**

None

**3.6 Summary of Findings of Beneficiary Survey and/or Stakeholder Workshops**

61. The survey carried out in 2007, assessed research staff's opinions on ARTP (Annex 5). The majority of the respondents believe that ARTP contributed positively to the strengthening of the NARS. The contribution of ARTP is rated as "significant". Some respondents reported that ARTP may have not fully addressed the need for research strategy development in some regions. There is a general consensus that the agricultural research system is moving towards a demand-driven and client-centered approach. According to participants, ARTP may not have enhanced international collaboration. Financial management, human resource management, farm management and transport management are rated critically. About half of the respondents find that civil works increased the efficiency of their research work. Very few respondents perceived that civil works built at their center are fully operational though the response rates are very low. Additional laboratory equipment and chemicals provided by ARTP improved research activities but a large number of respondents expressed the view that no sustained support is provided for the operation and maintenance of laboratory equipment.

62. IT services are reported to be fragile or non-operational and the level of satisfaction of respondents is moderate. There is evidence that ARTP provided operating costs for extension-farmer linkages and related activities. Such ARTP support is reported to have helped adoption of technologies in close vicinity of RCs. More than 75 percent of the respondents rate the contribution to human resource development as 'very good' or 'good.' The majority of respondents (83 percent) believe that there may be an increased number of released technologies in the near future due to ARTP interventions. The majority of respondents (82 percent) also believe that support rendered by ARTP leads to increased production, productivity and improved natural resource protection around the RCs. Gender mainstreaming in research remains an area of concern.

**4. ASSESSMENT OF RISK TO DEVELOPMENT OUTCOME**

**Rating:** Moderate

63. Risk that the development outcomes of the project will not be maintained is rated moderate, based on the considerations below:

- GoE remains committed to maintaining a strong agricultural research system and provides for it in the budget;

- GoE is investing in an expanded system of extension and outreach to enhance adoption of improved varieties, thus increasing demand for research;
- Research staff incentives to stay in the research systems are diminishing due to the uncompetitive salary structure of the public sector. EIAR’s revised organizational structure and personnel policy, including providing adequate salaries and performance incentives for research staff have been submitted to GoE and are presently under consideration. Some of the RARIs report difficulty in retaining their most qualified staff. Although ‘hardship allowances’ have been granted to staff at some RCs (in Oromiya, Tigray, and part of the Somali and Southern Regions), many research staff working at remote locations under extremely difficult conditions do not receive any extra compensation. The Final ARTP Supervision Aide Memoire reports that in general staff levels are below capacity, with the RCs in Somali (Jijiga and a sub-center in Gode) operating at about 60 percent of its expected staff level, Sekota operating at an estimated 40 percent of capacity and others operating at less than 20 percent (in part due to unfinished civil works). The provision of hardship allowances is considered vital to retain qualified and experienced researchers at difficult locations, to ensure effectiveness and sustainability of the concerned research programs, and ultimately to sustain ARTP’s achievements;
- Maintenance of civil works, laboratory equipments and the likelihood of overall sustainability of investments into buildings and assets present a mixed picture;
- The lack of development of an operational M&E system prevents management and financial planning of Ethiopia’s research and training system; and
- The extent to which the GoE intends to relinquish central control over the agricultural technology system is not yet clear.

## **5. ASSESSMENT OF BANK AND BORROWER PERFORMANCE**

### **5.1 Bank Performance**

#### **(a) Bank Performance in Ensuring Quality at Entry**

**Rating:** Moderately Unsatisfactory

64. The Bank team worked closely with the client to develop a highly relevant project to address some of the key constraints to the efficiency of Ethiopia’s NARS. The Bank team also used its convening power to mobilize IFAD support to collaborate in agricultural research expansion through the financing of six new RCs. The Bank should have performed significantly better in the formulation of the PDOs, the Results Framework, and the selection of related KPIs. Lack of clear articulation of measurable indicators and specific proposals to implement an effective M&E system was a significant weakness that hindered supervision success. The institutional assessment on which the project was based overestimated the strength of the system at the outset, and the project was accordingly overambitious in the expected pace of change.

#### **(b) Quality of Supervision**

**Rating:** Moderately Unsatisfactory

65. The Bank’s supervision performance was mixed. On the one hand, the Bank played a critical role in supervising the project and providing assistance to implementation. The Bank undertook regular supervision missions, which were perceived as relevant by the client. The composition of the Task Team remained stable (with two TTLs and one lead consultant over the entire project cycle). The Bank team also provided detailed action plans in Aide Memoires at the end of each supervision mission. However, the Bank did not do well at following up on actual implementation of the Action Plans/contents in Aide Memoires. The Bank also did not perform satisfactorily in several other areas: (i) project ratings for development objectives (DOs) and implementation progress (IP) were unrealistic, and there is a

disconnect between the write ups in the Aide Memoires (referring to serious delays affecting implementation and outcomes) and the satisfactory ratings for both achievement of DOs and IP in the Implementation Status Reports (ISRs).<sup>25</sup>

66. The team continued to extend the project to accommodate delays but did not downgrade it to unsatisfactory. An unsatisfactory rating might have prompted more attention and follow up to problem areas. The Bank also delayed in responding to the client on several occasions, including taking seven months to amend the DCA (Letter from Government to TTL dated February 20, 2003), on providing ‘no objections’, and (on one occasion) advising against modifying a procurement procedure, which made it impossible for EIAR to reject a likely unreliable contractor from being awarded a large contract for the construction of Jinka Research Center; this contract subsequently ended up with severe implementation problems. Supervision teams did not include construction engineers to supervise civil works.

### **(c) Justification of Rating for Overall Bank Performance**

Rating: Moderately Unsatisfactory

This rating is due to Bank performance being rated Moderately Unsatisfactory on both Quality at Entry and Supervision.

## **5.2 Borrower Performance**

### **(a) Government Performance**

Rating: Moderately Satisfactory

67. Throughout ARTP’s early implementation period, GoE maintained its commitment to the NARS, (initially represented by EARO, later by the EIAR) in terms of providing sustained essential recurrent operating cost support and a satisfactory level of staff incentives. During the later years of ARTP, there were however problems in maintaining an adequate incentive environment for scientists and other staff. The Supervision Missions repeatedly flagged three serious problem areas, where, if Government had engaged itself more pro-actively, ARTP’s impacts and outcomes would likely have been significantly improved. These problem areas concerned the need to:

- tackle the slowly deteriorating relationships between EARO/EIAR and the RARIs;
- maintain EARO/EIAR as a semi-autonomous stakeholder-driven and controlled Federal Research Organization. The GoE decision to abolish the EARO Board midway through ARTP and replace it by a high-level Advisory Body, and to have EIAR linked to the MoARD made researchers subject to the civil service pay scales; and
- ensure the establishment of satisfactory internal EARO/EIAR M&E systems to provide Government, donors and stakeholders with objective quantified evidence of the outcomes and impacts of research conducted through the NARS.

### **(b) Implementing Agencies Performance**

Rating: Moderately Satisfactory

68. There were three organizations involved in implementing ARTP. Although EARO/EIAR was responsible for overall project implementation and submitted consolidated reports directly to the Bank, IFAD and the Government concerning project progress, the responsibility for actual implementation of ARTP-supported activities was with three agencies, namely EARO/EIAR, RCs, including specialized Institutes, and AUA. After the MTR, the RARIs also were assigned implementation responsibility.

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<sup>25</sup> Tenth Review Mission Aide Memoire, December 2005, p. 3. Also see Aide Memoires from previous years.



69. EARO/EIAR established the Project Coordination Office before project effectiveness, maintained the PCU well-staffed and resourced throughout project implementation and provided adequate backstopping and guidance to implementation through close involvement of the office of the EARO/EIAR Director-General and through regular project Progress Reviews by the Board/Advisory Council. Feedback of the results of Board/Advisory Council reviews was not provided to Bank supervision missions during project implementation.

70. EARO/EIAR was slow in addressing serious procurement issues, especially concerning a lack of linkage between civil works construction and the simultaneous purchase of equipment (many RC facilities remain under-utilized) and the shortage of cement for civil works construction. The latter problem--exogenous to ARTP, was a major cause of delays in RC construction and the need for repeated extensions of the project implementation period. Also, EARO/EIAR was slow in creating and operationalizing the competitive ARF. Once established, the ARF Management Committee (ARFMC) and priority setting procedures were unduly dominated by EARO/EIAR.<sup>26</sup> This undermined beneficiary confidence that the grant awards were based on the merits of submitted project proposals. Finally, EARO/EIAR fell seriously short in establishing and operating a NARS M&E system and especially in its responsibility to ensure the necessary data collection, validation, analysis and dissemination, in particular with regard to the KPIs related to projected increases in production and yield in crops and livestock, and in the numbers of small farmers using new technology.

71. RCs, both at Federal and at Regional level, generally performed their ARTP implementation responsibilities well. However, there were some major problems, including insufficient involvement of the Center management and scientific staff in the civil works design phase and in procurement planning, and a frequent lack of communication with the ARTP PCU. The envisaged establishment of a “bottom-up” approach towards organizing R&D priorities and defining the research agenda through intensive stakeholder and beneficiary consultations was only partially achieved, and its sustainability remains in doubt.

72. AUA performed its function well, as the key implementing agency of the very ambitious and complex HRD plan supported by ARTP. Over 500 scientists (including those at AUA) received training at the M.Sc. and Ph.D. levels, and almost all returned to their positions in the Ethiopia NARS. The program to replace AUA staff with consultants to allow the former to go on post-degree study leaves was well-managed. However, similar to the EARO/EIAR RCs, AUA experienced a frequent mismatch between the schedules for civil works and the procurement of equipment and furnishings to make new buildings functional.

73. The RARIs as independent regional institutions also managed their ARTP support well. In addition to assistance for HRD, after the ARTP MTR the RARIs received limited financing under the project for establishing their Headquarters facilities and transport. Especially after the Government’s abolishment of the EARO Board (where the RARI DGs were represented), the question of a fair division of available training financing became an often-contentious issue.

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<sup>26</sup> The issue of the composition of the ARFMC requiring a better balance between representatives of EIAR and other stakeholders was raised during several ARTP Review Missions but was never addressed (see Ninth and Tenth ARTP Review Mission Aide Memoires of September 2004 and December 2005 respectively).

### (c) Justification of rating for Overall Borrower Performance

Rating: Moderately Satisfactory

74. Based on the moderately satisfactory ratings under 5.2 (a) and 5.2 (b), overall Borrower performance is rated as moderately satisfactory.

## 6. LESSONS LEARNED

- **Using “South-south” collaboration in human resource development can be very relevant, effective and efficient.** ARTP was one of the first Bank-supported projects in SSA to use this type of collaboration between Agricultural Universities (Alemaya and Universities of high standing in South Africa, India, Thailand, the Philippines, etc.) to train a large number of researchers in a cost-effective manner; almost all of the post-graduate trainees returned to their sponsoring institutions in Ethiopia.
- **The relationship between the federal system and regional agricultural research systems needs to be carefully worked out and nurtured.** During ARTP’s implementation, several regional governments established and developed their own agricultural research systems and stations. The appropriate division of responsibility between the federal system and the regional systems and the appropriate support (fiscal and technical) for the regional programs from the federal level became an important issue. Also, the expansion of agricultural faculties at several universities signaled the emergence of new capacity outside of EIAR and AUA to undertake agricultural research and related training activities. However, the fact that all federal support for agricultural research is channeled through EIAR itself is not conducive to the possibility of making objective decisions on possible channeling of federal fiscal resources to these other public providers of agricultural research and teaching services. For this reason, establishing an Apex organization at the federal level would be desirable as it could provide an “honest broker” function to channel federal resources to the best qualified of several possible service providers.
- **Well-designed Competitive Grants can successfully mobilize additional national capacity and resources. However, such a mechanism should be prepared up-front to avoid delays in implementation and be managed by an independent entity limiting possible conflicts of interest.** The experience in using competitive grants fostered a group of very interesting research proposals and projects implemented by the universities, the private sector and EIAR Institutes. This modality for supporting research has several advantages confirmed by ARTP’s experience--it promotes pluralism in research and makes it possible to identify and support ideas and researchers that might not otherwise find funding. However, establishing and implementing a new competitive grant program is far from trivial and takes time to launch effectively. ARTP was fortunate to have been able to benefit from the services of a consultant particularly experienced in this area. Yet the launch of grants took longer than expected. Intensive preparation of such a mechanism is recommended up-front to avoid delays in implementation. The Grant program was managed by EIAR itself. This had the obvious drawback of potential conflict of interest (i.e. applicants might think EIAR to be more inclined to support proposals from EIAR scientists than those coming from other institutions). Although the extent of the problem was not apparent, it seems clear that this arrangement was not desirable as a permanent structure. However, once established in this configuration, the oversight function proved difficult to change.
- **A functional strategy can successfully strengthen Research-Extension-Farmer linkages in a demand-driven manner, but there is a need to find modalities to make this happen on a larger scale and sustainable in the long term.** One component of ARTP supported research work on farmers’ fields involving FRGs. Under this program, farmers with their extension agents worked with researchers from EIAR’s RCs to identify, plan, and carry out research projects relevant to the

farmers' needs. This program was very successful. However, it was limited to a small scale-- essentially a relatively small number of farmer groups located near research stations. This experience helped to confirm the value of closely linking farmers with researchers in a different and more demand-driven way, but also highlighted the need to find ways to promote this on a larger scale and to make it sustainable. This is a topic taken up in the design of the follow-on project (RCBP) in which the budget for these activities was shifted from EIAR to the extension program.

- **Project Legal Agreements need to refer not only to the status at Project appraisal but also to the continued existence of the pre-conditions for successful implementation, even if already put in place during project preparation.** During preparation and appraisal of ARTP, the Government's decision to establish EARO as an autonomous, national apex organization accountable to the Prime Minister to build up the NARS research capacity consistent with the development needs of Ethiopia, was considered by all involved as a condition and cornerstone for World Bank (and IFAD) support to agricultural R&D (see ARTP PAD, Section 4). The EARO establishment was formalized through the National Parliament's Proclamation No. 79/1997. In terms of "Project oversight" (policy guidance) the Ethiopia Agricultural Research Board (EARB) was assigned to guide, direct and supervise EARO (ARTP PAD Section 4) and also the ARTP (see DCA). However, nowhere in the Project Legal Agreements is there a reference to the role the new EARO was to play in "making the system more responsive to farmers' needs and priorities". When the Government abolished the EARO Board and then re-constituted EARO as a Department of the Ministry of Agriculture, the Bank had no legally grounded basis to object.
- **In case of jointly financed projects, it is critical to ensure that there are concrete agreements between the financing partners with regard to supervision responsibilities and the sharing of costs thereof.** The World Bank and IFAD financed ARTP jointly. During implementation the responsibility for financing different project components (e.g. the ARF) was sometimes re-assigned between the two financiers. However, there were essentially two "sub-projects" namely, the IFAD-financed "remote RCs", and the WB-financed "remainder of ARTP", with each component having its own supervision and back-stopping requirements. At no time during ARTP implementation was there any provision of resources for project supervision from IFAD, nor was there any specific ARTP supervision-related agreement between IFAD and the Bank. This caused in practice a shortage of supervision resources and a mismatch in timing, since the IFAD project remained active after the IDA portion had closed.

## **7. COMMENTS ON ISSUES RAISED BY BORROWER/IMPLEMENTING AGENCIES/PARTNERS**

### **(a) Borrower/implementing agencies**

Draft (incomplete) Borrower ICR received on November 26, 2007 is summarized in Annex 7.

### **(b) Cofinanciers**

No comments available from Cofinanciers.

### **(c) Other partners and stakeholders**

None

**ANNEX 1. PROJECT COSTS AND FINANCING**

**(a) Project Cost by Component (in USD Million equivalent)**

Components	Appraisal Estimate (USD millions)	Actual/Latest Estimate (USD millions)	Percentage of Appraisal
AGRICULTURE RESEARCH MANAGEMENT	13.3	13.3	100%
STRENGTHENING OF AGRICULTURE RESEARCH SYSTEM	38.1	38.1	100%
HUMAN RESOURCES DEVELOPMENT	22.3	22.3	100%
<b>Total Baseline Cost</b>	73.7	73.7	100%
Physical Contingencies	10.5	10.5	100%
Price Contingencies	6.4	6.4	100%
<b>Total Project Costs</b>	90.6	90.6	100%
Project Preparation Fund			
Front-end fee IBRD			
<b>Total Financing Required</b>	90.6	90.6	100%

**(b) Financing**

Source of Funds	Type of Cofinancing	Appraisal Estimate (USD millions)	Actual/Latest Estimate (USD millions)	Percentage of Appraisal
Borrower		12.40	12.40	100%
International Development Association (IDA)		60.00	60.00	100%
International Fund for Agriculture Development		18.20	18.20	100%

## ANNEX 2. OUTPUTS BY COMPONENT

### Component 1: Agricultural Research Management

1. Towards accelerated generation, identification, testing, release and transfer to the extension services of improved technologies in crop, livestock and tree production, and natural resource management:

**ARTP has contributed to developing new technologies and strengthening research-extension-farmer linkages as shown in Tables 1 and 2.** The crop varieties released over 2000-05 were about 2 to 5 fold the amounts released in the previous decades. *However, the available evidence can only report association, not causality.* While the results may not be directly attributed to ARTP, the project's contributions to building human and physical capacity, and providing laboratory supplies and operating expenses are believed to have made a significant difference in research achievements. EIAR has also transferred modern management practices in crop, animal sciences, and natural resource management, including 25 techniques in farm implement use and 18 soil and water conservation practices.<sup>27</sup> Moreover, ARTP has made it possible for some farmers to gain better access to agricultural technology and information by participating in REACs, FRGs. Several impact studies are currently ongoing.

**Table 1: Released Crop Varieties in Ethiopia, 1970-2005**

Crop	1970-1979	1980-1989	1990-1999	2000-2005	Total
Cereals	15	23	56	101	195
Pulses	11	11	30	42	94
Oil crops	6	9	8	15	38
Roots and Tubers	0	4	12	26	42
Vegetables	0	0	3	14	17
Fruits	0	0	0	6	6
Spices	0	0	0	1	1
Fiber crops	4	5	4	0	13
Stimulant	0	12	5	3	20
Forage crops	3	5	1	0	9
Total	39	69	119	208	435

Source: Government ICR, November 2007.

2. Client-centered, demand driven collaborative process for identifying, prioritizing, implementing and evaluating research programs established and managed at various levels.

**Research-Extension-Farmer Linkages: ARTP financed the establishment and operating costs of Research-Extension Advisory Councils at the Federal, Regional and Research Center level.** The Councils served as a mechanism to ensure effective research-extension-farmer linkages and the process of technology transfer, especially at grassroots level. In the REACs there is a wide range of participation and/or representation by small-scale farmers, farmer's cooperatives, commercial farmers, agro-industries, exporters, NGOs and government organizations. At the Federal level there was (supposed to be) a single council the Federal Research-Extension Advisory Council or FREAC<sup>28</sup>; regional councils are established

<sup>27</sup> ARTP Project Implementation Performance Report, November 2006, Addis Ababa.

<sup>28</sup> FREAC was formally established only during the last year of ARTP implementation

in all the 9 regions;<sup>29</sup> and the Zonal councils are established at all Federal Research Centers (Debre Zeit, Jimma, Holetta, Kulumsa, Melkasa, Werer, Sebeta (Animal Health and Fisheries), Forestry, National Soils, Ambo Plant Protection, and Pawe) as well as at the Regional Research Centers in Oromiya (Sinana, Bako, Adami Tulu), Amhara (Adet, Sirinka and Sheno), Awassa and Areka RCs. The establishment of Farmer Research Groups (FRGs) to enhance on-farm research and technology dissemination, adaptation and scaling-up has been an important area of impact. A total of 159 FRGs have been established, with the participation of about 2800 farmers, including many women (Table 2).

**EIAR has developed linkages with 43 International Foundations and Institutions and Universities.** The ARTP Coordination Office headed by the Project Director is actively engaged in managing the project-supported activities; however, recently there has been more staff turnover. An office was also opened at Haramaya University (the re-named AUA) to follow up the day to day project activities of ARTP at the University. During the last year of ARTP implementation, the unit has encountered high staff turnover and in order to address this EIAR has been delegating government staff to the coordination unit.

**Table 2: Estimated Number of Farmer Research Groups and Participating Farmers**

Agricultural Research Center		Number of FRGs established	Number of farmers participating in the FRGs
Federal	Debre Zeit	16	300
	Holleta	7	127
	Melkassa	17	280
	Werer	3	41
	Jimma	4	84
	Kulumsa	5	90
	Pawe	2	30
Regional	Areka	12	360
	Awassa	5	25
	Sinanna	23	276
	Bako	28	150
	Adami Tulu	7	229
	Sirinka	3	30
	Adet	28	840
	Debre Birhan	6	24
	Total	159	2831

Source: Government ICR, November 2007.

**The project also funded capacity building activities aimed at strengthening research-extension-farmer linkages.** These included long-term training for 4 PhD and 11 MSc studies and physical resource development (vehicles, office equipment and financing of operational expenses) of the research extension linkages divisions.

3. Autonomous apex organization established to guide and coordinate the overall national research system, staffed and operational.

<sup>29</sup> Amhara Regional State, Oromiya Regional State, Southern Nations, Nationalities and Peoples Regional State, Tigray Regional State, Gambella Regional State, Benishangul Gumuz Regional State, Somali Regional State and Afar Regional State.

EARO was established in June 1997 prior to project approval. GoE also made sure that the new EARO was “up and running” with its Board of stakeholders and management team in place well before ARTP negotiations. The Bank and GoE teams agreed on specific powers and delegation of authority to be granted to EARO and the RCs, with several actions to be undertaken prior to World Bank Board presentation and credit effectiveness. However, some of these actions have since been reversed, and the autonomy of the research system remains a concern. Just before the ARTP MTR in 2002, GoE abolished the (then EARO) Board of stakeholders and re-organized EARO as an entity within the Ministry of Agriculture and Rural Development (MoARD). EARO in 2005 was re-named as “EIAR” the Ethiopia Institute of Agricultural Research. EIAR is currently guided by an “Advisory Council” of senior research and development (R&D) specialists and the RARI Heads are not represented on this Advisory Council. Memoranda of Understanding (MoUs) have recently been signed between EIAR and the respective RARIs concerning the responsibilities of the respective institutions in implementing “national” research programs. However, there still seems to be a lack of coordination of research programs between the federal RCs (EIAR) and the RARI RCs, and between the different RARIs which in some cases serve similar agro-ecological zones; this likely results in unnecessary duplication and inefficiency. The final ARTP Mission (Nov/Dec 2006) notes that the present configuration of the Ethiopia agricultural research system does not yet encompass the characteristics internationally recognized as necessary over the long term to successfully support a dynamic agricultural sector.

Though the Local Area Network was established at all RCs with Internet access, the envisaged establishment and efficient utilization of a high quality Management Information System and functional electronic connectivity between RCs for sharing and utilizing data has not been fully achieved.

4. To improve the information base of the EARI research management system an Information and Communication Department (ICD) is established and fully functional with trained staff and equipment.

To maintain effective communication and information exchange between the RCs and the global network a local area network (LAN) has been established in 39 RCs including EIAR and is fully functional in 29 centers. An integrated library system has also been established and is fully functional. To facilitate communications for more effective scientific, technical and administrative information exchange EIAR-ARTP established the Wide Area Networks (WAN) encompassing, EIAR Headquarters, all RCs and the RARI Headquarters with a broadband connection. The ICD conducted a series of training in using modern information technology over the past five years and the department trained over 450 researchers; as a result, most if not all researchers can manage, process and present research findings using ICT. Over 325 junior researchers were trained in how to write research proposals and use improved communications. All information experts and librarians have been trained in information and knowledge management tools. EIAR continues to implement a wide-ranging training program for research and support staff in the use and application of information systems and this has significantly enhanced the efficiency of operations at Headquarters and RCs.

**Table 3: List of Research Centers with WAN Connections**

No.	Center	Technology
1	Adami Tulu	VSAT
2	Adet	VSAT
3	Ambo	VSAT
4	Andasa	VSAT
5	Animal Health	VSAT
6	ARARI	Broadband (ADSL)
7	Areka	VSAT
8	Awassa	Broadband (ADSL)
9	Bako	VSAT
10	Debre Birhan	VSAT
11	Debre Zeit	Broadband (ADSL)
12	EIAR HQs	Broadband (ADSL)
13	Essential Oils	Broadband (ADSL)
14	Fishery	VSAT
15	Fishery (Bahir Dar)	Broadband (ADSL)
16	Forest Products	Broadband (ADSL)
17	Forestry	Broadband (ADSL)
18	Gambella	VSAT
19	Gonder	Broadband (ADSL)
20	Holetta	VSAT
21	Humera	VSAT
22	Jijiga	VSAT
23	Jimma	VSAT
24	Jinka	VSAT
25	Kulumsa	VSAT
26	Mechanization (Bahir Dar)	Broadband (ADSL)
27	Mekelle	Broadband (ADSL)
28	Melkassa	VSAT
29	OARI	Broadband (ADSL)
30	Pawe	VSAT
31	SARI	Broadband (ADSL)
32	Sekota	VSAT
33	Semera	VSAT
34	Sinana	VSAT
35	Sirinka	VSAT
36	Soils Laboratory	Broadband (ADSL)
37	SoRPARI	Broadband (ADSL)
38	Werer	VSAT
39	Yabello	VSAT

Source: ARTP: Project Implementation Status Report, 2006

*Gender:* A gender focal point was established under the Research-Extension-Farmer Linkage Department (REFLD) to integrate gender issues into every aspect of the research endeavors i.e. research design; implementation, and M&E processes. ARTP allocated support for recurrent budgets to facilitate research analysis on gender issues. A major factor in the achievements of the unit in recent years is an



increase in the budget allocated to the unit, which had previously operated with minimal financing. In the past year the unit held 10 training events on gender analysis for over 237 participants from EIAR management, and federal and regional research centers. The unit also coordinated the development of case studies and baseline data collection through surveys at eleven research centers to identify gender disaggregated research priorities. A workshop presenting survey results was held during the supervision mission and the findings are expected to be collected in a proceedings and a summary report.

The Tenth Supervision Mission in 2006 recommended the unit make an inventory of case studies on how research outcomes have addressed issues faced by women. An initial assessment was undertaken and identified several research outputs that could be considered gender-responsive in increasing household food security, reducing household drudgery, mitigating HIV/AIDs and poverty. No formal inventory was produced but the assessment provided an input into training activities and a more substantive report, including case studies, will instead be produced based on the results of the surveys. The report is expected to be finalized in 2007. The unit also plans to continue to implement survey findings in developing research proposals and undertake similar surveys at the regional level. While there has been excellent progress in identifying gender issues and initiating a gender focused research program, there is a need to further institutionalize the collection of gender disaggregated data and the gender focus of research operations.

5. To manage the implementation of the Agricultural Research Fund the ARF Management Committee and Secretariat are established.

Until September, 2007, 10 management committee meetings had been conducted and two more committee meetings were expected to be held before end-December 2007. Two ARF Competitive Grant calls were made resulting in 88 proposals submitted for the 1st call and 66 for the 2nd call. Out of these, 11 proposals were accepted for the 1st round and 20 for the 2nd round. However, only 29 project grants were actually awarded. From the 29 research projects 11 were implemented by Higher Learning Institutes, 10 by federal research centers (one of these in collaboration with the International Livestock Research Institute (ILRI) and 2 with higher learning institutes), 3 by regional RCs, 1 by MoARD in collaboration with the Forestry Research Center, 2 by the National Veterinary Institute, 1 by a private firm (Agri-CEFT Plc) and 1 by a private College (Medco Bio-Medical College). The ARF Secretariat has also conducted twenty-two field evaluations of ARF-supported projects, 2 general implementation review workshops and a completion workshop. Out of the 29 research projects financed, 24 are completed, 2 are ongoing and 3 were discontinued. Final write-ups of the 24 completed projects are in the process of technical editing for publication of proceedings.

**Component 2: Strengthening of the Agricultural Research system**

Rehabilitating existing agricultural research system infrastructure: existing research centers were strengthened through the procurement of goods, equipment and civil works. About 22 existing RCs including those of the RARIs have benefited from this support. The physical infrastructure of the these centers and institutes was rehabilitated, modernized and expanded through civil works, installation of laboratory equipment and other goods and equipment at a total cost of USD 12,909,052.52 ( IDA and GoE). More than 3516 line items of replacement and new laboratory equipment and supplies, 393 of farm equipment, 1561 of IT equipment, 252 vehicles, 5998 books and journals, 3830 line items of office and household furniture were provided to 34 existing RCs and sub centers, 7 RARIs (including the 6 new RCs), and bureaus of agriculture.

**Table 4: Rehabilitation of Existing RCs**

<b>Research center</b>	<b>Status</b>
1. Assosa	Completed
2. Pawe	Completed
3. Melkassa	Completed
4. Kulumsa	Completed
5. Deberzeit	Completed
6. Holeta Bio-Technology	Completed
7. Awassa	Completed
8. Adamitulu	Completed
9. Areka	Completed
10. Bako	Completed
11. Jimma	Completed
12. Srinka	Completed
13. Deberbrehan	Completed
14. Gambella	Completed
15. Addis Ababa Head Office	Completed
16. Sebeta	Completed
17. Adetr	Completed
18. Makele	Completed
19. National Forestry r	Completed
20. Werer AR Center	Completed
21. Wondo-Genet	Completed
22. Ambo AR Center	Completed

Source: GoE ARTP ICR. November, 2007

*New Research Centers:* ARTP established six new RCs (financed by IFAD) to expand the national research network to previously unaddressed largely pastoral areas. Among these six centers, Sekota RC in Amhara Region, Humera RC in Tigray Region, Yabello ARC in Oromiya Region and Jijiga RC in Somali region are completed and have become functional. The construction of Dubti-Semera RC in the Afar Region and the Jinka RC in SNNP regional state are still being completed at the time of writing of this ICR. Despite the fact that the construction of the two RCs is not completed, beginning in 2005, research activities have already been started in all of the six new RCs. Technical backstopping is provided through temporary assignment of senior researchers. About 80 research projects in animal science, crop production, natural resource management and socio-economics are being implemented at Sekota. Livestock production, feed resource inventories, and dry land crops research is ongoing at Yabello. At Jinka, 21 research projects were initiated. At Humera 12 research projects in crop and animal science have started. In Jijiga, 36 projects covering NRM (14), livestock and range (12), dry-land crops (8) and socio-economics (2) are being implemented. Programs for informal seed multiplication and distribution have also been started at some of the new RCs.

**Table 5: Summary of Civil Works in New RCs**

Project Name	Status
Yabello A. Research Center	Completed
Jijiga A. Center	Completed
Sekota A. Research Center	Completed
Humera A. Research Center	Completed
Dubti-Semera AR. Center	51 percent completed
Jinka A. Research Center	34 percent completed
Grand Total	

Source: GoE ARTP ICR. November, 2007

***Biotechnology Research:*** In terms of taking the Ethiopian Agricultural Research System (EARS) to a new frontier, biotechnology research has been given due emphasis. The National Agricultural Biotechnology Strategy document has been prepared with priority programmes identified for implementation focusing on animal, plant and microbial research issues. Following the formulation of the strategy, 6 national biotechnology policies were developed. About 26 biotechnology research projects were implemented including 18 in plant biotechnology, 6 in microbiology and 2 in animal biotechnology. Additionally, about 6 tissue culture laboratories were set up and are functional, and, importantly, a National Biotechnology Institute in Holleta was established. To strengthen the laboratory facilities of the Institute, equipment for genotyping and sequencing, protein analysis, tissue culture research and microbiology biotechnology, animal reproductive biology for embryo transfer, and bioinformatics have been installed. Also 3 researchers at Ph.D. and 5 researchers at M.Sc. levels have been trained and a large number of Agricultural biotechnology research projects initiated at different centers by rehabilitating tissue culture labs at Holletta, Jimma and Melkassa and embryo transfer facilities at the Debre Zeit RC. A total of 11 new research staff in biotechnology has been recruited. Five Cuban expatriates (financed by the Ethiopian government) have been assigned to assist in the initiation and implementation of biotechnology-related activities.

**Table 6: Summary of Functional Tissues Laboratory Centers with Types of Activities**

Center Location	Activities in focus
Jimma	Coffee, spices, fruits (pineapple), roots
Holletta	Potato, Enset, Essential oils, Medicinal plants, Rumen microbiology
Melkassa	Banana and Citrus
Debre Zeit	Tef, Grapevine, Embryo manipulation
National Soils Laboratory	Rhizobial bacteria for bio-fertilizers, bio-remediation & bio-control activity.
Ambo	Plant disease diagnostics & biological control research

Source: ARTP, Project Implementation Status Report, 2006

### Component 3: Human Resource Development

*Training and capacity building:* Considering the (until recently) low attrition rate, there is strong evidence that ARTP has significantly strengthened Ethiopia’s applied research and teaching capacity in the agricultural sector. About half of all 465 trainees were trained abroad, with the large majority studying in South Africa (16 percent), followed by India (12 percent) and Thailand (9 percent). The rest of the “overseas” students were enrolled in University programs in Malaysia, Jordan, UK, Netherlands, Germany and other countries. Even if doing their course work overseas, most of these students completed their thesis research at their home institutions in Ethiopia, likely contributing to high retention rates. The other half of the post-graduate students was trained locally, mainly at Haramaya University (43 percent) and Addis Abeba University (7 percent). The study areas were diversified, and cover the entire spectrum from agricultural economics, engineering, extension, various plan sciences, soil, water and irrigation sciences, to veterinary medicine. Only 7 percent of all post-graduate trainees were female.

More than 88 percent of the trainees completed their study, 6 percent dropped out, and 2 percent deceased. Only 2 percent of the candidates were lost due to attrition during the study process. In addition to the 465 long-term trainees, 26 students were partially sponsored by ARTP. About 200 research staff have been provided with overseas short-term training. Actual data for local short-term local training is not available, but it is estimated that about 4,000 employees have benefited from ARTP. In addition to this, 50 teaching staff from Haramaya University were trained mostly at PhD level and returned home from abroad. Teaching facilities, class rooms, dormitories, a library, a resource center, a clinic, and related construction was build to strengthen the teaching facilities of Haramaya University. The estimated overall attrition rate at the time of completion of the ICR is estimated to be in the order of 5 percent.

**Table 7: Number of Trainees by Type of Training**

	B.Sc	M.Sc.	Ph.D.	Local short-term	Overseas short-term	Total
Long Term Training	1	354	110			465
Partially Sponsored		18	8			26
Over Seas Short term					197	197
local short term Training				4,000* (estimate)		
<b>Total</b>	<b>1</b>	<b>372</b>	<b>118</b>	<b>0</b>	<b>197</b>	<b>688</b>

\*Actual data for short-term local training is not available but it is estimated that about 4000 employees have benefited from the program. Government ICR, November 2007, p. 21.

**Table 8: Number of Trainees by Level of Training and Gender**

Status	PhD			MSc			BSc Female	Grand Total	Percentage
	Female	Male	Sub Total	Female	Male	Sub Total			
Completed	2	86	88	24	301	325		413	88.82
On-going	0	5	5	0	1	1		6	1.29
Dropout	1	5	6	3	19	22		28	6.02
Attrition	0	6	6	0	4	4	1	11	2.37
Deceased	0	5	5	0	2	2		7	1.51
<b>Total</b>	<b>3</b>	<b>107</b>	<b>110</b>	<b>27</b>	<b>327</b>	<b>354</b>	<b>1</b>	<b>465</b>	<b>100.00</b>

Source: Government ICR, November 2007, p. 21

### ANNEX 3. ECONOMIC AND FINANCIAL ANALYSIS

This analysis is limited to a review of the available research evidence as no data has been collected to assess the project’s overall economic and financial benefits. While not equivalent to a standard economic analysis, the review provides a snapshot of the potential impact of improved agricultural technology in Ethiopia and gives insights into selected research activities of ARTP. The first section shows the potential of yield improvements due to increased seed and fertilizer adoption. The second section summarizes an economic analysis that shows maize technology adoption. The third section provides two indicative examples for chickpea and Faba bean adoption around Ethiopia’s oldest RC, Debre Zeit, which has benefited from ARTP’s activities.

#### 1. Yield Potential and General Findings

Byerlee et al. (2007) provide suggestive evidence of the potential impact of improved agricultural technologies in Ethiopia by analyzing the Participatory Demonstration and Training Extension System (PADETES). The extension program, starting in 1994, focused on crop packages combining fertilizers, improved seeds, and better management practices to raise productivity and food production. The bulk of the program’s attention was on wheat, maize, and tef (Table 1). Extensive data from demonstrations indicated that the adoption of seed-fertilizer technologies could more than double cereal yields and was profitable to farmers in moisture reliable areas. While suggestive for potential yields, it is important to keep in mind that the PADETES is different from ARTP, and that seed-fertilizer technology packages may not be very appropriate in heterogeneous rainfed areas of Ethiopia.

**Table 1. Yields in on-farm field trials vs. farmers’ yields, 1995-1999 (metric tons/hectare)**

Crop	NAEIP (1995-1999)		SG2000 (1993-1999)		Current farm yields
	Improved	Traditional	Improved	Traditional	2000-04
Maize	4.73	1.57	4.60	1.57	1.82
Wheat	2.93	1.17	2.31	0.95	1.31
Sorghum	2.79	1.12	2.08	0.92	1.21
Tef	1.43	0.85	1.62	0.64	0.82
Barley	2.15	1.00			1.05

Source: Byerlee et al. (2007). NAEIP is the National Agricultural Extension Intervention Program. SG2000 is Sasakawa Global 2000 program.

These results are also confirmed in academic papers using surveys of limited sample size and focusing on maize. For example Alene et al. (2005; 2006) find that farmers in Ethiopia operate with substantial inefficiency, and that improved adoption of hybrid maize technologies along with higher fertilizer use could raise the profitability of maize production by 40-80 percent. Belay et al. (2004) finds that extension services in south-western Ethiopia have not been participatory, give little consideration to farmer’s knowledge, and lack practical skills. There are also numerous studies on technology adoption of maize varieties, suggesting mainly the importance of a mixed package of credit and fertilizer supply in significantly raising the probability of adoption (Feleke et a. 2005; Zegene et al. 2001a; Zegene et al 2001b). Alemul et al. (2006) provide evidence of improved health impacts of maize biofortification in Ethiopia. Abate (2006) present economic analyses of varying quality on crops other than maize – such as finger millet, several bean varieties, wheat and vegetables.

## 2. Economic Impacts of Maize Technology Development and Transfer

Zegene (2001b) estimates the impact of maize technology and transfer for Ethiopia for the period 1986-2000 (Table 2). The analysis suffers from the lack of reliable data. Administration and overhead costs were not included in the analysis, thus potentially underestimating project costs. The annual benefits of maize research and extension services are estimated by subtracting the sum of annual maize technology development, transfer, and adoption from the estimated net gross benefits. The analysis demonstrates substantial fluctuations over time because of rainfed agriculture, making the analysis sensitive to its assumptions. Calculations suggest an economic internal rate of return (EIRR) in the order of 29 percent. The net present value (NPV) at a discount rate of 10 percent is in the order 194m Birr. In addition, human resource development, international research linkages, environmental impacts, and improved food security are mentioned as non-tangible benefits.

**Table 2. NPV and EIRR for Maize Adoption 1986-2000**

Discount rate	NPV (million Birr)	EIRR
10%	193.5	29%
15%	96.9	29%
20%	43.6	29%

Source: Zegene (2001b).

## 3. Chickpeas and Faba Bean Seeds Adoption in Debre Zeit

Hailemariam et al. (2007) analyze the welfare impacts of chickpea technology adoption under the project at Debre Zeit RC. Chickpea yield at national level is almost stagnant. Chickpea demonstrates in various ways the challenging nature in measuring impacts under a standard economic analysis: the chickpea improvement research program was started in 1972. However, this program has executed several research activities in collaboration with International Research Organizations like International Crop Research Institute for Semi-Arid Tropics (ICRISAT) and International Center for Agricultural Research in the Dry Areas (ICARDA), and national research organizations. 3

During the past 10 years, the research program has benefited from project collaboration in terms of human resources development, information exchange and acquisitions of germplasms and advanced materials for the breeding program. Since the launching of chickpea research program and international collaboration, the chickpea research program has released twelve improved chickpea varieties both from domestic and foreign materials. Chickpea technologies including improved varieties and agronomic practices were subsequently disseminated to farmers through a small survey covering 100 farmers. The improved varieties were verified on farmer's field through participatory technology evaluation and popularized via regular extension activities provided to Farmers Research Groups.

The main findings indicate, surprisingly, that a higher rate of adoption (78 percent) was observed among the non-participants of the project relative to participants. Legese et al. (2007) argue that this might be due to the presence of overlapping interventions in the project area or spillover effects of the project. Though the project reached a limited number of households, the technology has reached several households in the project areas. Adopters of chickpea varieties tend to have a higher income and a relatively less expenditure than non-adopters, though the difference is not statistically significant. The study compared chickpea yields for adopters and non-adopter of improved varieties, and found a statistically significant difference. Chickpea yield was 1.8 tones/ha for adopters and 1.1 tones/ha for non-adopters. The estimated rate of return (farmer level) to improved varieties of chickpea seeds, implicitly derived from an agricultural production function, is in the order of 49 percent (Table 3).

**Table 3. Estimation of chickpea production function (N=100)**

Parameters	Estimates	Std. Error
Constant	-0.515	1.275
Ln area	0.738***	0.162
Ln seed	0.097**	0.040
Ln labor	0.277**	0.116
Ln weed	-0.185	0.246
Ln till	-0.299	0.400
Ln age	0.011	0.278
Dummy for adoption of seed varieties (1=adoption)	0.488**	0.176

\*\*\* Significant at 1% \*\* Significant at 5%

Source: Hailemariam et al. (2007)

Similarly, Legese et al. (2006) estimate the impact of Faba bean for about 200 farmers around Debre Zeit RC in 2004. The most widely adopted Faba bean variety was *Degaga* (41 percent) followed by *Messay* (7 percent of the farmers in the sample). *A limited proportion of sample farmers adopted CS20DK.*

The highest rate of adoption (80 percent) was observed among the participants of the faba bean technology transfer activity funded by IFAD. On the other hand, about 43 percent of the non participants were found to be adopters of the Faba bean improved varieties disseminated through the project intervention, suggesting a spill-over effect of the project is observed in the proportion of non participants that have adopted the improved faba bean technologies. The rate of adoption of recommended seed rate for improved and local faba bean varieties was 4 percent and 14 percent respectively. Most of the sample farmers were found to use a smaller seed rate than recommended. This might be due to the scarcity of seed in the area and with the intension to cover wider areas with small amount of seed. Participants of the project were the sources of seed even for the Ethiopian Seed Enterprise, which paid a premium price for the participant farmers and collected the seed to clean and disseminate it in other parts of the country.

**Estimation of Faba bean production function (N=198)**

Parameters	Estimates	Standard Error
Constant	0.246	0.247
Ln seed	0.037	0.041
Ln fertilizer	0.124***	0.031
Ln area	0.198*	0.119
Ln labor	0.015	0.036
Ln tillage	0.083	0.151
Ln weeding	0.053	0.138
Dummy for variety adoption (1=adopter)	0.717***	0.113

\*\*\* Significant at 1%; \* Significant at 10%

Source: Legese et al. (2006)

There is no significant difference with respect to the impact of the project on household income or expenditures. Yield of faba bean was compared for adopters and non-adopters of improved faba bean varieties. A statistically significant difference was found between adopters and non-adopters. Yields were 0.5 tons/ha for non-adopters and 1.8 tones/ha for adopters. A production function estimate suggests a high

rate of return (farmer's level) equivalent to about 72 percent. Fertilizer use is another important determinant.

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**ANNEX 4. BANK LENDING AND IMPLEMENTATION SUPPORT/SUPERVISION PROCESSES**

**(a) Task Team members**

Names	Title	Unit	Responsibility/ Specialty
<b>Lending</b>			
Amar J.S. Sodhi	Task Team Leader	AFTR2	Team Leader
Samuel Haile Selassie	Sr. Procurement Specialist	AFTPC	Proc. Analyst
Eshetu Yemer	Sr. Financial Management Specialist	AFTFM	Fin Management
Berhane Manna	Agric. Operations Officer	AFMET	Agriculturist
Marie-Louis Ah-Kee	Procurement Analyst	AFTR2	Proc. Analyst
<b>Supervision/ICR</b>			
David Nielson	Lead Agriculture Services Specialist	AFTAR	Team Leader
Jacob Kampen	Agriculture Extension Specialist	AFTAR	Consultant
Assaye Legesse	Senior Agriculture Economist	AFTAR	Operations
Jeeva Perumalpillai-Essex	Sector Leader	AFTAR	Operations
Derek Byerlee	Sr. Adviser	AFTS2	Agricultural Spec.
Eshetu Yimer	Sr. Financial Management Specialist	AFTRM	Fin Management
Samuel Haile Selassie	Sr. Procurement Specialist	AFTPC	Procurement Spec.
Abiy Admassu Temechew	Procurement Analyst	AFTPC	Proc. Analyst
Rahel Lulu	Program Assistant	AFCE3	Supervision Support
Almaz Teklesenbet	Program Assistant	AFTAR	Task Team Member
Malathi Jayawickrama	Operations Officer, ICR Team Leader	AFTAR	ICR Team Leader

## ANNEX 5. BENEFICIARY SURVEY RESULTS

The objective of the survey was to assess perceptions of researchers and administrative staff of the NARS. The survey was not an objective assessment of the main beneficiaries (farmers adopting new technologies) but a survey regarding staff's opinions on ARTP. About 5 percent of the staff serving at least for 3 years was selected randomly. The response rates varied depending on the question of the survey, calling for caution in the interpretation of results.

About 93 percent of the respondents find that ARTP contributed to supporting the development of a research strategy for NARS. However, there is evidence that ARTP may not have sufficiently addressed research strategy development in some regions. The overall contribution of ARTP is rated as moderately or highly significant by the overwhelming majority of respondents. There is a general consensus that the agricultural research system is moving towards a more demand driven and client-centered approach. While there is evidence that ARTP helped in strengthening relations with CGIAR centers, it is not clear whether ARTP helped to link NARS with any of these centers for the first time.

ARTP has built or established different civil works at different RCs. These civil works included offices, laboratories, social centers, libraries, residential buildings, garages, green houses, storage, generator houses and other infrastructure. Very few respondents (less than 1 percent) perceived that civil works built at their center are fully operational though the response rates are surprisingly very low. About half of the respondents find that civil works increased the efficiency of their research work. Additional laboratory equipment and chemicals provided by ARTP improved research activities, but a large number of respondents complained that no sustained support is provided for the laboratory equipment. IT services seem to be fragile. The level of satisfaction of respondents about the IT services is rated as moderately satisfactory (57 percent). The major reasons are non-operational systems. Most of the services envisaged to be in place by ARTP, such as free electronic journal subscriptions, financial management systems, human resource management, farm management and transport management call for a serious evaluation.

The majority of the respondents (85 percent) acknowledge the incremental operating cost provided through ARTP. The project provided operating costs for extension-farmer linkages. However, about a quarter of respondents did not know about the center-based extension advisory councils. Many respondents have doubted the effectiveness of these councils. There are FRGs in most RCs. The overall performance of the FRGs is rated as moderate (60 percent). ARTP seems to have helped in adopting technologies in the vicinity of RCs (77 percent of the respondents). There are, however, significant regional differences between the Centers.

ARTP support helped to increase the number of publications over the project period. A majority of the respondents (69 percent) agreed that there were observable differences in the number of publications. The majority of respondents (83 percent) find that there will be an increased number of released technologies due to the intervention of ARTP. Similarly, a majority of the respondents (82 percent) find that support rendered by ARTP leads to increased production, agricultural productivity, and improved natural resources protection around the RCs. Gender mainstreaming in research has been an area of concern.

**ANNEX 6. STAKEHOLDER WORKSHOP REPORT AND RESULTS**

None

## ANNEX 7. SUMMARY OF BORROWER'S ICR

### Executive Summary<sup>30</sup>

#### Introduction

Ethiopia is characterized by great agro-ecological diversity. However, it has not been possible to satisfactorily address the research need of growing regions. The challenge for the government was to provide the required infrastructure and enabling environment for efficient and effective agricultural research, according to the established priorities. Therefore, Agricultural Research and Training Project (ARTP) were designed to support sustained generation and enhancement of ecologically sound technology for crop and livestock production systems and natural resource management in Ethiopia. This was planned to be realized through strengthening the research management, strengthening the existing agricultural research network, provision of new facilities and infrastructure in unserved environment, and human resource development. The total project amount was USD 90.6 million i.e. USD 60.0 from IDA, USD 18.2 from IFAD and 12.4 from Government over a six years project life. The principal beneficiaries of the project are male and female small farmers, pastoralists and agro-pastoralists who constitute an overwhelming majority of the population engaged in agricultural activities. This is believed to be achieved by strengthening the National Agricultural Research System (NARS) to generate, adapt and popularize modern technologies, through physical and human capacity building to the major NARS constituents i.e. federal and regional agricultural research centers and Haramaya University, formerly known as Alemaya University.

#### Implementation arrangement

The overall responsibility of project implementation and reporting (both to IDA and the Government) was given to the Ethiopian Institute of Agricultural Research (EIAR) the then Ethiopian Agricultural Research Organization (EARO). Hence, a Project Coordination Office was established and housed in the Head Quarters of EIAR. The responsibility of actual implementation of various components and sub-components of the project rests with EIAR, federal and regional research centers and Haramaya University.

#### Physical performance of the project

##### Improving Agricultural Research Management

Ethiopian Agricultural Research Organization (EARO) currently EIAR was newly established as an apex body to guide and coordinate the national research system. The project successfully supported the development of strategy documents and implementation manuals, and research programs and projects were redesigned and structured. These helped to make the agricultural research system participatory and demand driven, to incorporate and focus high value export and industrial crops, to address agricultural problems of pastoralist and agro-pastoralist. In addition to these, increased access to global knowledge pool and increased linkage with national and international organizations is created through subscription of electronic media and establishment of network.

The Research Extension Advisory Councils (REACs) were established and institutionalized at research center based zonal, regional and federal level. One hundred fifty nine Farmer Research Groups (FRGs) with participation of about 3000 farmers are established to strengthen function linkage.

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<sup>30</sup> Government ICR, November 2007.

Agricultural Research Fund (ARF) a competitive grant scheme to open up the agricultural research system is established. The fund made it possible to increase the involvement of all potential stakeholders to work in collaboration on specific agricultural research problems through multi-institutional and multi-disciplinary arrangements of research project planning, implementation, monitoring and evaluation.

### **Strengthening the Agricultural Research System**

Expansion and re-habilitation civil works in 21 existing research centers to provide libraries, laboratories, offices, auditoriums, cafeteria, and garage have been completed and become functional. A centralized biotechnology laboratory, which includes office buildings, laboratories and residential apartment, is also constructed and partially equipped. In order to expand the national research network to previously unaddressed areas, six new research centers have been established. Among the six, Sekota agricultural research center in Amhara Region, Humera agricultural research center in Tigray Region, Yabello agricultural research centers in Oromiya Region and Jijiga agricultural research center in Somali region are completed and have become functional while construction of Dubti-Semera agricultural research center in Afar Region and Jinka Research Center in Southern Nations, Nationalities and Peoples Regional State are completed 51% and 34% respectively. Despite the fact that the construction of the two Research Centers is not completed, research activities have already been started in all of the six new research centers since 2005.

### **Human Resource Development**

In order to enhance human resource capacity of the agricultural research system, 465 research staff and 50 teaching staff from Haramaya University are trained and returned home with less than 5% attrition rate. One hundred ninety seven research staff have also been given an overseas short-term training while more than 4000 research and administrative staff are provided with local short-term training in different subjects. In addition to this, teaching facilities, classrooms, dormitories, library, resource center, clinic, shopping center and related constructions have been completed to strengthen the teaching facilities of Haramaya University. This increased the capacity of the university to open more programs in M.Sc. and Ph.D. and to increase student intake and enhance sustainable human resource development in the agricultural sector.

### **Financial performance**

The project utilized 97% from IDA, 75.45 percent from IFAD and 105.45% from Government sources. The Government disbursement is increased due to inclusion of turn over tax (TOT) after the project start up. Low disbursement from IFAD source is caused due to the delay in the construction of the six new research centers especially Dubti-Semera and Jinka.

### **Project Impact**

The scope and capacity of the research system has been increased significantly to address the needs and priorities of pastoral and agro-pastoral areas. Emphasis is given to address gender issues in agricultural research through mainstreaming gender technically and administratively. Research management is decentralized with administrative and financial autonomy to Agricultural Research Centers. Institutional capacity in terms of human resource development and facility increased. This led to opening and strengthening of new research areas in horticulture and biotechnology, socio-economics, research extension, information system, biometrics, agro-meteorology and the likes. Individual farmers and communities are given access to decide on their priorities and problems and hence empowered to

influence the technology generation process through FRGs and REACS and on-farm collaborations. Scaling up activities to link the farmers with agro-processors, industries, and Seed Agency made it possible for farmers under the scheme to produce quality grain and seed. More over they are guaranteed with access to market and premium price. This covers a range of commodities, mainly, durum wheat, haricot bean, lentil, soybean, onion, tef, and others. An economic assessment done on most of these experiences reveal that income of farmers who participated in these schemes increased up to 300 – 400%.

## **Sustainability**

REACs, FRGs, and ARF are taken up by a follow up World Bank and CIDA supported project, RCBP. More over, there is strong commitment and ownership of the Ethiopian government to modernize the agricultural sector and to continuously support agricultural research. Accordingly, the REACs are institutionalized and put on the permanent government budget category. The Government is also committed to make sure that the newly established research centers will become fully functional. For those whose construction activities have not been completed yet, Jinka and Dubti-Semera, maximum effort is being exerted to finish the work within the extended project life. In case of unforeseen circumstances, which might hinder completion of these civil works, the Ethiopian Government expressed its willingness, in writing to the World Bank, to finish the remaining work from the government treasury.

## **Lesson learned**

- Preparation of the procurement manual and human resource development plan that included global plan of resource allocation by type of procurement, year, method of procurement and beneficiary facilitated timely implementation of procurement training.
- The project launching conference with the involvement of all stakeholders helped to bring all beneficiaries on board and to visualize potential changes that need revision. Accordingly, the project could prepare itself in time for institutional changes and their potential impact on the project implementation in terms of resource requirement.
- The annual World Bank supervision mission contributed a lot in re-shaping the project to address emerging changes and requirements and in giving guidance in the implementation process of most of the components and sub-components although the team size and composition tend to be smaller through time.
- Timely and sufficient flow of matching fund enhanced project implementation with minimum cash constraint even in the case of disbursement delays from foreign sources.
- The Project as it is designed could not directly change or impact the livelihood of farmers, but the innovative approach designed by EIAR made it possible to show how utilization of modern technologies with appropriate choice of intervention and market channel significantly impact farmers lives. This is a huge lesson for both researchers and extension workers and even further for policy makers and development partners.
- The competitive grant scheme implemented through ARF was found to be effective in opening up the agricultural research system to all stakeholders including the private sector. The system made it possible to engage, academicians and researchers in public and private sectors outside of the national agricultural research system in research planning, implementation, monitoring and evaluation process. More over it was possible to conduct research with multi-institutional and multi-disciplinary arrangement with output and result oriented approach.
- Agricultural research projects supported by ARF could have been seriously affected by absence of the principal investigators. But this problem was averted by making the host institutions responsible for the project implementation and to make sure successful completion of the project.
- Attrition rate was considered as a potential threat for human resource development component of the project. Therefore, training in all fields available in the country was given locally. For

overseas studies, universities in developing countries have been selected deliberately and this is considered to be the major factor to keep the attrition rate below 5%.

- It is important to make a project somewhat independent of the bureaucracy in order to facilitate smooth implementation and hence establishing an independent Project Coordination Office (PCO) is good. But staffing the PCO entirely by contractual employees was found to be unproductive. Due to high staff turn over, implementation momentum and institutional memories are lost, inappropriate documentation and lack of commitment was observed. In the last three years permanent staffs were delegated to key positions like the Project Director, the Finance Specialist, the Head of ARF Secretariat and Monitoring and Evaluation Units. This arrangement was found to be very effective to solve critical problems created and to rescue the project implementation process.

## **Recommendations**

- There is a need for closer and frequent involvement and follow-up of the World Bank country office in the project implementation, monitoring and evaluation including field visits. If these were the case unnecessary delays in getting no objection and some issues related to delay and quality of construction could have been prevented.
- In case of jointly supporting a project like IDA and IFAD in case of ARTP, there is a need to clearly detail the implementation arrangement, financial flow and supervision. Otherwise, lack of smooth communication and action could lead to shortage of cash and unnecessary delays.
- The Bank procurement policy needs to have a discriminating mechanism of underperforming and incapable bidders by giving credit for track records of contractors and service providers in general instead of capitalizing on least-cost bidder. In addition to these, it is better to have a mechanism to consider implementers (government's) reservations in selection of contractors/service providers.
- The contractual agreement for construction consultancy services need to have an article to make consultants responsible (at least partially) for any delay in the construction activity instead of indefinitely continue their paid service over the delayed period. The more a construction activity delayed the more they are getting out of it, since they will continue being paid.
- The level of threshold should be related to the type of activities and their level of financial transaction. Providing low level of threshold for high financial transaction activities, like construction activities, coupled with delay in the replenishment process, led to shortage of cash to handle payment requests and created contractors' dissatisfaction and subsequent delay.
- Incentive mechanism to keep project staff for the period of the project life is necessary in order to maintain the momentum of project implementation and to keep and use institutional memories effectively. Therefore, Bank supported projects need to pay salaries comparable to the market with additional incentive mechanisms during the project life and compensation mechanisms at the end of the project life.
- Pre-qualification and post-qualification review of bidders' profile (experience, financial status, manpower, machineries and reputation) should be done on the capacity and track records of contractors.

**ANNEX 8. COMMENTS OF COFINANCIERS AND OTHER PARTNERS/STAKEHOLDERS**  
None



## ANNEX 9. LIST OF SUPPORTING DOCUMENTS

### World Bank Documents

ARTP Project Appraisal Document (PAD), Report No. 17794-ET, May 8, 1998.  
ARTP Project Information Document (PID), Report No. PID676, August 18, 1997.  
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Ethiopia: Interim Country Assistance Strategy, Report No. 21189, November 9, 2000.  
Agricultural Research Project, Implementation Completion Report (Report No. 13760), December 1, 1994.  
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ARTP Project Implementation Performance Reports, EARO/EIAR, 1998-2006.  
Ethiopia's Agricultural Research Sector Policy/Strategy, Addis Ababa, February 26, 1998.

### Other Documents

The Federal Democratic Republic of Ethiopia, ARTP Inception Report, International Fund for Agricultural Development (IFAD), August 19, 1997.  
Hailemariam T. 2007 et al. *Adoption and Impact of IFAD Funded Technology Transfer Activities: A Report on Improved Chickpea Technologies*. Processed.  
Legese, G. and Tolosa A. 2006. *Adoption and Impact of IFAD Funded Technology Transfer Activities A Report on Improved Faba Bean Technologies*. Processed.  
(Also see Annex 3 Bibliography)