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Policy Implementation and Impact of Agriculture and Natural Resources Research

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ABBREVIATIONS

ADB	–	Asian Development Bank
ANR	–	agriculture and natural resources
ANRR	–	agriculture and natural resources research
CGIAR	–	Consultative Group on International Agricultural Research
CIMMYT	–	International Maize and Wheat Improvement Center
CPS	–	country partnership strategy
DNA	–	deoxyribonucleic acid
DMC	–	developing member country
EA	–	executing agency
EARD	–	East Asia Department
ha	–	hectare
IA	–	implementing agency
IARC	–	international agricultural research center
ICARDA	–	International Center for Agricultural Research in the Dry Areas
ICRISAT	–	International Crops Research Institute for the Semi-Arid Tropics
IFAD	–	International Fund for Agricultural Development
IFPRI	–	International Food Policy Research Institute
IRRI	–	International Rice Research Institute
IWMI	–	International Water Management Institute
Lao PDR	–	Lao People's Democratic Republic
NARC	–	Nepal Agriculture Research Council
NARS	–	national agricultural research systems
NGO	–	nongovernment organization
OED	–	Operations Evaluation Department
PhilRice	–	Philippine Rice Research Institute
PRC	-	People's Republic of China
RDTA	-	Research and development technical assistance
RETA	–	regional technical assistance
RSDD	–	Regional and Sustainable Development Department
Strategy 2020	–	Long-Term Strategic Framework, 2008–2020
SES-2000	–	Special Evaluation Study in 2000
t	–	ton
TCR	–	technical assistance completion report
USAID	–	United States Agency for International Development

NOTES

In this report, "$" refers to US dollars and ₱ refers to Philippine pesos.

Key Words

adb, asian development bank, agriculture sector, agriculture and natural resources research sector, anr sector, anrr, cgiar, climate change, environment, iarc, natural resources management, ses-2000, strategy 2020

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The guidelines formally adopted by the Operations Evaluation Department (OED) on avoiding conflict of interest in its independent evaluations were observed in the preparation of this report. R. Keith Leonard, former Director, Operations Evaluation Division 1, supervised the study until the end of July 2008. Mercedita A. Sombilla, (Agricultural Economist) and Emmanuel L. Genio (Evaluation Research Associate) were the consultants. To the knowledge of the management of OED, there were no conflicts of interest of the persons preparing, reviewing, or approving this report.

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EXECUTIVE SUMMARY

The Agriculture and Natural Resources Research (ANRR) Policy paper of 1995 (the ANNR Policy) articulated the Asian Development Bank's (ADB) approach to supporting research in the agriculture and natural resources (ANR) sector. The ANRR Policy paper identified six main agenda items that pertain to research related on the sustainable management of natural resources, agricultural productivity gains, and poverty reduction. It specified funding support of $5 million per year. The regional technical assistance (RETA) modality operationalized the policy agenda. ADB's major partners in undertaking ANRR have been the international agricultural research centers (IARCs), which comprise both the centers under the Consultative Group on International Agricultural Research and other international research institutes that have a regional or international scope. A special evaluation study conducted in 2000 (SES-2000) on the implementation and impact of the ANRR Policy concluded that the policy objectives were generally relevant and modalities used in supporting ANRR were effective towards achieving the overall objective of poverty reduction. Audit Committee of the ADB Board of Directors endorsed the findings and recommendations of SES-2000 and asked ADB Management to implement them fully.

Since the completion of SES-2000, there have been several developments in ANR sector globally and also in developing member countries (DMCs). Key emerging concerns include the increasing scarcity of inputs such as land and water for agriculture; and the impact of trade liberalization, global climate change, and biofuel development. How the agriculture sector will adjust to these changes and what interventions in ANRR would contribute more effectively to the achievement of ADB's objectives of poverty reduction and inclusive growth while conserving natural resources are important questions in this regard.

ADB has also made several changes to its policies, institutional setup, and operational guidelines since 2000 in relation to ANR sector. The Long-Term Strategic Framework, 2008–2020 (*Strategy 2020*) places sustainable management of natural resources high on its agenda for achieving sustainable and inclusive growth. Agriculture is identified as one of the sectors that will continue to be supported under *Strategy 2020*. Further, the donor community has made commitments to make aid more effective through the Paris Declarations.

Given these major changes, the Operations Evaluation Department (OED) carried out an update of SES-2000. The main purposes of the evaluation update were to (i) determine the extent of adoption of the SES-2000 recommendations and ascertain their continued relevance or otherwise in the current context; (ii) evaluate the relevance and effectiveness of ADB support to ANRR since 2000; (iii) examine the extent to which ADB has used ANRR products by incorporating them in its country operations and by disseminating them widely within ADB, DMCs, and beyond; and (iv) assess the relevance of further support for ANRR in the context of current ANR issues, ADB's current corporate strategies, and the emerging international donor practices.

SES-2000 had made six major recommendations for ADB: (i) refine and sharpen the focus of the ANRR research agenda; (ii) ADB's ANRR implementation strategies to include funding for cutting-edge research in improving agriculture yield and productivity and their dissemination by IARCs, and lending and nonlending support to DMCs for adapting research based on local needs and production factors; (iii) continue restrictive funding modality with a TA cluster approach of about $20 million in real terms once every 3 years to IARCS and NARCs; (iv) geographic focus on areas with high poverty incidence; (v) strengthening of ADB's institutional capacity to administer, supervise, monitor, and promote ANRR; and (vi) undertaking policy dialogue with DMC governments to promote ANRR and generate government funding for national agricultural research systems (NARSs).

In response to these recommendations, ADB Management issued a guideline paper that clarified ADB's requirements for research proposals and provided a structure to the

project selection process. The guidelines were aimed at addressing two of the recommendations (i and iv). Projects approved after SES-2000 adhered to the guidelines. They emphasized sustainable pro-poor growth, supported enhancement of agricultural productivity, and improved ANRR management. Many of the projects included capacity development of NARSs as well as the promotion of public policy reforms. The projects covered primarily the unfavorable geographical environments and focused on improving subsistence production systems.

The rest of the recommendations were only partially adopted, especially those related to strengthening of ANR capability at ADB and raising the budget support. Funding for RETA projects in support of ANRR has declined precipitously in recent years.

Twelve RETAs were supported by ADB since implementation of the ANRR Policy in 1996. The first four RETAs (1st to 4th) were included in SES-2000. This update evaluation study includes the next eight RETAs (5th to 12th) consisting of 28 individual projects with total funding of $24 million. Four of the eight RETAs (5th to 8th) under the evaluation period have been completed. The technical assistance completion reports (TCRs) are available for three of the five projects of the 5th RETA, and for all projects for 6th and 7th RETAs. Both the 6th and 7th RETAs, were rated *successful*. Two of the completed projects under the 5th RETA were rated *highly successful*, and one was rated *successful.* The remaining four RETA (9th to 12th) are ongoing, with the completion date of the 12th RETA being 2010. Overall, OED concurs with the TCRs' ratings based mainly on overall alignment with development challenges, capacity development, and the outputs generated. The RETA projects adhered closely to the ANRR Policy agenda, which included (i) enhancing the capacity of NARSs (ii) enhancing the productivity of agriculture, (iii) developing remunerative farming systems for poor farmers, (iv) improving sustainable management of ANR, and (v) generating policy options through policy and socioeconomic research.

The main findings of this evaluation update study for each of the study objectives are as follows:

(i) Of the six recommendations made by SES-2000, the first (refine the ANRR Policy for sharper focus) and the fourth (support for less favorable environments) were fully adopted. The rest of the recommendations were only partially adopted, especially those related to strengthening of ANRR and increasing the funding support. Most of the recommendations of SES-2000 continue to be relevant in the current context.

(ii) RETA projects are found to be relevant for addressing the key constraints to sustainable development. They were effective in achieving expected outputs and immediate purpose outcome. However, the full utilization of these outputs to generate eventual development impact will require time and concerted efforts from both ADB and DMC governments.

(iii) ADB has made partial use of RETA products in its program and project design, both at the sector and country operations levels. Gaps include the absence of institutional linkages between RETA projects and ADB country operations, less effective use of RETA products within ADB, and inadequate support from ADB for technology scaling-up. There is, however, some evidence of the use of RETA outputs by DMCs and other development partners. Some of the activities initiated by RETA have been incorporated in other follow-up projects or have received continued support from other development partners. Some activities were also absorbed into the IARCs' core agendas. DMCs in general and low income DMCs like Nepal in particular, highly value the support provided by ADB funded RETAs.

(iv) ADB's future support for ANRR is relevant and has potentially high rates of return in the context of current ANR issues. It is also relevant to ADB's current corporate strategy- *Strategy 2020* and emerging international

donor practices in supporting ANRR. Recent changes such as the relocation of the ANR focal point to the Agriculture and Rural Development and Food Security Unit in the Regional and Sustainable Development Department and the establishment of the research and development technical assistance are useful steps in right direction, which have potential to make ADB an effective supporter of ANRR which will ultimately contribute to achieving poverty reduction, environmental sustainability, and inclusive growth.

Overall, RETA projects have made substantial contributions to the generation of improved technologies, knowledge, and information. Despite the relatively modest level of support, RETA projects have been able to leverage major efforts in scientific innovations. RETA projects have also contributed to the overall capacity development of NARSs, and promoted partnerships among various stakeholders, and facilitated regional cooperation. The objectives of RETA projects have been relevant to address the key constraints to sustainable development. RETA outputs, especially those related to policies, have also influenced the broader design of agricultural development strategies of DMCs as well as of other development partners.

Despite the evidence of these positive contributions of RETA projects, the low and decreasing level of funding support for ANRR, poor linkages of RETA projects with ADB country operations, insufficient dissemination of RETA products, inadequate support from ADB and NARSs for technology scaling up have appeared as weak areas needing improvement.

The following recommendations are put forward for consideration by ADB Management.

Recommendation	Responsibility
1. **Develop a strategy and an action plan for ANRR.** An update of the ANRR Policy and related guidelines is needed to align the objectives, focus, and emphasis more closely to *Strategy 2020,* international donor practices, and emerging concerns in the ANR sector.	SPD, RSDD, and regional departments.
2. **Support both short- and long-term research.** ADB should embark on supporting ANRR that clearly addresses both short- and long-term issues.	SPD, RSDD, and regional departments
3. **Restore the level of ANRR funding.** Funding should be raised to at least $5 million per year in real terms as stipulated in the current ANRR Policy developed in 1995 and endorsed by SES-2000.	SPD, RSDD, and regional departments
4. **Promote effective and wider utilization of ANRR products.** ADB should develop a knowledge management system consisting of a central repository for cutting-age ANR technology related knowledge products, and an effective knowledge dissemination system to outreach and ensure effective linkages with country operations, and partnership with DMCs for greater development impact.	RSDD, and regional departments.

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I. INTRODUCTION AND BACKGROUND

A. Introduction

1. Agriculture is an important sector of most Asian countries, as a large number of rural poor derive their livelihoods from it. However, growth in agricultural productivity has slowed down considerably in recent years.[1] A number of factors have contributed to this deceleration in productivity growth. In addition, new developments emanating from changes in demographic, economic, and environmental drivers are likely to increasingly affect the future performance of the agriculture and natural resources (ANR) sector. The structure of the Asian economy is undergoing changes with the expansion of the nonfarm sector, and with general economic growth and development in recent years. There is increasing competition for land, labor, water, and capital from other economic activities. Emerging opportunities for utilization of biofuel are likely to impact in a major way on the capacity of ANR to meet food needs, as food and energy prices become more linked. An increase in the price of the staple food is equivalent to a reduction in real income of the poor, as food accounts for a large share of their total expenditure (especially the landless rural and the urban poor). Trade liberalization can have important implications for the comparative advantages of various forms of agriculture among and within developing member countries (DMCs). These phenomena are already resulting in a major upward move in basic food grain prices, which is likely to negate the progress made in rural poverty reduction in the past.[2] The likely impact of broader environmental factors such as global climate change on ANR and the impact of agriculture on the environment are also important concerns.

2. Earlier investments in agriculture led to the Green Revolution, which successfully increased the food supply and contributed to poverty reduction by keeping food prices low. However, the low and declining food prices led to a reallocation of public investments from agriculture to other sectors. The growth rate in overall investment in agriculture declined during the 1990s, as agriculture was accorded a lower priority relative to other sectors. The 2008 *World Development Report* (footnote 1), which is focused on agriculture, is likely to put the issue of agricultural development back in the main agenda of many development agencies. The report emphasizes the continued importance of technological and institutional innovations in agriculture for productivity growth and poverty reduction.

3. The Agriculture and Natural Resources Research (ANRR) Policy paper (1995)[3] articulated the Asian Development Bank's (ADB) approach to supporting research in the ANR sector. The Operations Evaluation Department (OED) conducted a special evaluation study in 2000 (SES-2000)[4] on the implementation and impact of the Policy. SES-2000 concluded that the policy objectives were generally relevant and the modalities used in supporting ANRR were effective towards achieving the overall objective of poverty reduction. The Audit Committee of ADB Board of Directors[5] endorsed the findings and recommendations of SES-2000 and asked ADB management to implement them fully.

4. It has been more than 8 years since SES-2000 was conducted. ADB has made several changes to its policies, institutional setup, and operational guidelines since 2000 in

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[1] World Bank. 2008. *Agriculture for Development. World Development Report 2008*. Washington, D.C.

[2] Von Braun. 2007. *The World Food Situation: New Driving Forces and Required Actions.* The International Food Policy Research Institute's (IFPRI) Biannual Overview of the World Food Situation presented to the CGIAR Annual General Meeting, Beijing, 4 December 2007.

[3] ADB. 1995. *The Bank's Policy on Agriculture and Natural Resources Research*. Manila.

[4] ADB. 2000. *Special Evaluation Study on Policy Implementation and Impact of Agriculture and Natural Resources Research*. Manila. Available: http://www.adb.org/Documents/PERs/SST-STU-2000-17/Policy-Implementation.asp

[5] The Development Effectiveness Committee was established by ADB's Board of Directors in December 2000. The committee initiated its activities on behalf of the Board in 2001.

relation to ANR sector approaches. The *Long-Term Strategic Framework, 2008–2020* (*Strategy 2020*)[6] placed sustainable management of natural resources high on the agenda for achieving sustainable and inclusive growth. Agriculture is identified as one of the sectors that will continue to be supported under *Strategy 2020*. In addition, the recent emphasis among the donor community on making aid more effective makes it appropriate to evaluate if support to ANRR as specified in the ANRR Policy contributes positively towards fulfillment of ADB's commitments to the Paris Declaration.[7]

B. Purpose of the Special Evaluation Study Update

5. Given these major changes, this update of SES-2000 was undertaken to

(i) determine the extent of adoption of the SES-2000 recommendations and ascertain their continued relevance or otherwise in the current context;
(ii) evaluate the relevance and effectiveness of ANRR support provided since 2000;
(iii) examine the extent to which ADB has used ANRR products by incorporating them in its country operations and by disseminating them widely within ADB, DMCs, and beyod; and
(iv) assess the relevance of further support for ANRR in the context of current ANR issues, ADB's current corporate strategies, and the emerging international donor practices.

C. Approach and Methodology

6. The performance of support to ANRR was assessed on the basis of the relevance and effectiveness of regional technical assistance (RETA) in terms of achieving outputs and immediate purpose outcome. The relevance of RETA projects at the time they were designed as well as their continued relevance was considered. Outputs and immediate outcomes such as the use of RETA-generated technologies and of information and policy advice by ADB, national agencies, and other development partners were also considered. A full quantitative assessment of long-term impact was not possible as most of the research projects funded by RETA after 2000 are still ongoing. Information from projects that were completed before 2000 but not included in SES-2000 was also utilized in this assessment.

7. The study was conducted using a combination of (i) document reviews, (ii) interviews with relevant ADB staff,[8] (iii) e-mail questionnaire surveys to RETA executing agencies (EAs)—the international agricultural research centers (IARCs), (iv) interviews and focus group discussions with RETA implementing agencies (IAs)—the national agricultural research systems (NARSs), and (v) case studies. These multiple sources of information were used for triangulation.

8. Document reviews was one of the main source of information to determine the extent of adoption of the findings and recommendations of SES-2000 and to identify keys issues related to ADB support to ANRR, potential impact, and future opportunities. The reviews also included policies and strategies of IARCs and other organizations receiving RETA support, and recent achievements and performance particularly related to RETA projects since the completion of SES-2000.

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[6] ADB. 2008. *The Long-Term Strategic Framework of the Asian Development Bank (2008–2020)*. Manila. Available: http://www.adb.org/documents/Policies/Strategy2020/default.asp?p=strtg

[7] ADB. 2008. *Special Evaluation Study on the Evaluation of the Implementation of the Paris Declaration at the Asian Development Bank: A Development Partner's Study for an OECD-DAC Joint Evaluation*. Manila. Available: http://www.adb.org/Documents/SES/REG/SST-REG-2008-03/SST-REG-2008-03.asp

[8] ADB staff included those working in the ANR sector and those outside the ANR sector from various departments at Headquarters and the Nepal Resident Mission.

9. The IARC[9] e-mail survey was aimed at soliciting comments on (i) the relevance of RETA projects, (ii) RETA processing and implementation procedures for ANRR, (iii) effectiveness of current modalities, (iv) likely alternative funding sources, (vi) RETA linkages with country operations and/or other development projects, and (v) adequacy or otherwise of RETA support for impact. ADB staff interviews aimed also to get feedback on almost the same set of issues, but more in the context of ADB's operational system and structure.

10. The Philippines and Nepal were selected for case studies to assess the nature of collaboration between the NARSs and IARCs for RETA implementation. Two national institutes—the Philippine Rice Research Institute (PhilRice) and the Nepal Agriculture Research Council (NARC) were included to represent one relatively strong and one relatively weak NARS. These two countries were selected to represent low and middle income countries. Further details on methodology and data sources are provided in Appendix 1.

D. Report Outline

11. The rest of this SES update is organized into four major sections. Section II consists of an evaluation of the extent to which ADB has implemented the recommendations of SES-2000. Evaluation of RETA projects from 2000 to 2007 is discussed in Section III. This is followed by an assessment of the future relevance of support to ANRR in the context of emerging ANR issues, *Strategy 2020*, and the international donor practices. The main findings, issues, lessons, and recommendations are provided in the final section.

II. ASSESSMENT OF IMPLEMENTATION OF RECOMMENDATIONS MADE BY SES-2000

A. Overview of the ANRR Policy and Support

12. The ANRR Policy paper of 1995 (the ANRR Policy) articulated ADB's approach to supporting research in this area to promote sustainable and inclusive economic growth in the Asia and Pacific region (footnote 3). The ANRR Policy paper identified six main agenda items that pertain to the sustainable management of natural resources, agricultural productivity gains, and poverty reduction. Specifically, it included (i) sustainable and remunerative farming systems for poor farmers, (ii) enhancing the incomes and living standards of rural women, (iii) sustainable management of ANR, (iv) enhancing the productivity of agriculture, (v) enhancing the capacity of NARSs, and (vi) conducting research on socioeconomics and public policy. Particular emphasis was placed on unfavorable farming systems; neglected crops; and research on integrated farming of crop, livestock, and forestry activities.

13. The RETA modality was prescribed to operationalize the policy agenda listed above. The ANRR Policy objectives were to be achieved through IARCs, NARSs, and a limited number of special grants to regional research centers. ADB's major partners in undertaking ANRR have been the IARCs, which comprise both the centers under the Consultative Group

[9] IARCs supported during the evaluation period (2000–2007, RETA Projects 5th to 12th year) were included in the mail questionnaire. These include 11 centers: The World Vegetable Center (Asian Vegetable Research and Development Center [AVRDC]), International Center for Tropical Agriculture (CIAT, *Centro Internacional de Agricultura Tropical*), International Maize and Wheat Improvement Center (CIMMYT, *Centro Internacional de Mejoramiento de Maíz y Trigo*), International Center for Agricultural Research in the Dry Areas (ICARDA), International Crops Research Institute for Semi-Arid Tropics (ICRISAT), International Food Policy Research Institute (IFPRI), International Livestock Research Institute (ILRI), International Plant Genetic Resources Institute (IPGRI), International Rice Research Institute (IRRI), International Water Management Institute (IWMI), and the WorldFish Center (originally International Center for Living Aquatic Resources Management [ICLARM].

on International Agricultural Research (CGIAR)[10] and the non-CGIAR centers that have a regional or international scope.

14. The ANRR Policy specified funding support of $5 million per year. Since the adoption of the ANRR Policy, 12 annual RETAs, each supporting one or several projects (total of 52 projects) targeting the poor, have been implemented. So far, the total funding support provided through RETA has amounted to approximately $50.4 million (Appendix 2). The RETA support has aimed primarily at (i) productivity improvement, which includes genetic enhancement and better management practices for food crops, fisheries, livestock, and vegetables; (ii) management of natural resources—soil, water, and forestry; (iii) improving linkages among researchers, practitioners, and policy makers to better disseminate research results; (iv) capacity development of NARSs and improved research networks among the scientists; and (v) policy analysis and advocacy. The International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), the International Food Policy Research Institute (IFPRI), the International Maize and Wheat Improvement Center (CIMMYT), the International Water Management Institute (IWMI),[11] the International Rice Research Institute (IRRI), and the World Vegetable Center[12] were the main EAs of these RETAs.

B. Recommendations Made by SES-2000 and Assessment of Their Implementation

15. SES-2000 was conducted to assess and evaluate the relevance, effectiveness, and impacts of ADB's policy on ANRR and to determine whether ADB's research projects had contributed to the achievement of its strategic objectives.[13] The assessment ascertained that ANRR Policy objectives remained generally relevant and consistent with ADB's poverty reduction strategy. The RETA projects were reported to have played an integral role in fulfilling ADB's operational objectives in participating DMCs. The RETA modality was also reported to be effective in the context of ADB's overarching goal of poverty reduction and related priorities such as regional cooperation and sustainable environmental management. Specifically, it was stated that the benefits of research reached the poor through four main avenues: (i) raising farm income and employment; (ii) lowering food prices in the market; (iii) providing pathways out of poverty by raising incomes, thus providing more education for children, better health, and other household services, and creating rural and urban employment; and (iv) promoting broad-based economic growth. The impact assessment of a

[10] CGIAR, established in 1971, is a strategic partnership of countries, international and regional organizations, and private foundations supporting the work of 15 international centers. In collaboration with NARSs, civil society, and the private sector, CGIAR fosters sustainable agricultural growth through high-quality science aimed at benefiting the poor through stronger food security, better human nutrition and health, higher incomes, and improved management of natural resources.

[11] IWMI was founded under the International Irrigation Management Institute (IIMI) in 1984. Research at the Institute is focused on improving water and land resources management for food, livelihoods, and nature. It has offices throughout Asia and Africa and focuses the bulk of its work on basin-scale research and development in benchmark river basins. The research agenda revolves around the central research question—viz., to demonstrate that increasing water productivity at the river basin scale can indeed create livelihoods and improve human health, while maintaining ecosystem services—and is organized in four themes: (i) basin water management; (ii) land, water, and livelihoods; (iii) agriculture, water, and cities; and (iv) water management and environment.

[12] It was founded in 1971 as the Asian Vegetable Research and Development Center, an international, not-for-profit institute for vegetable research and development. It works towards reducing malnutrition and alleviating poverty in developing countries through the improved production and consumption of safe vegetables. The Center's work has expanded globally over the past decades. The Center's revised title reflects its increased global role in promoting and supporting vegetable research and development in Africa and other regions of the world. Headquartered in Taipei,China, the Center has established regional centers in Thailand, India, and Tanzania and has offices or staff located in many other developing countries.

[13] The study objectives were to (i) assess the appropriateness of ADB's ANRR policy and contribution to support ANRR, (ii) evaluate the effectiveness of implementation and impact of ADB-funded research activities and projects, and (iii) determine the adequacy of ADB-financed ANRR activities in meeting ADB's policy requirements.

selected group of projects provided high rates of return, averaging 82% for IRRI projects, 43% for ICRISAT projects, and 91% for the projects managed by the World Vegetable Center. Research on genetic improvements of fish also showed high rates of return. These returns provide economic benefits to both producers and consumers.

16. SES-2000 also recommended continued support to IARCs and other institutes. This recommendation was based on estimated high returns to research investments, relevance to research outputs produced by the supported projects, relevance to the ANRR Policy, and overall effectiveness of the annual RETA modality. A review of funding for ANRR in 2005[14] also asserted that ADB needed to expand its support to these activities. This message is echoed in ADB's Working Group Paper on Rural Poverty, which mentions that productivity growth in agriculture is crucial to providing food security to an additional 750 million people in the region by 2025.[15]

17. The specific recommendations of SES-2000 were as follows:

(i) Refine the ANRR Policy for sharper focus to emphasize sustainable pro-poor growth, sustainable management of ANR, enhancement of agricultural productivity, strengthening of NARS capacity, and promotion of public policy reforms.
(ii) Embark on a two-pronged approach to ANRR by providing RETA grants to IARCs, and a combination of loans and grants to NARSs, universities, and nongovernment organizations (NGOs). The support to IARCs is recommended to focus on cutting-edge science to achieve another quantum jump in productivity growth and to maintain ADB's role as a leader in funding of cutting-edge science in the region. The support to other agencies is to focus on adaptive research based on local needs and production factors.
(iii) Continue with the restricted funding modality but process a cluster of technical assistance projects with total value of about $20 million in real terms every 3 years.
(iv) Focus on supporting research on crops and livestock grown under less-favorable agroecological environments characterized by high poverty incidence.
(v) Strengthen ADB's institutional capacity to supervise, monitor, and evaluate ANRR project activities by providing adequate resources for administration and processing functions.
(vi) Undertake active policy dialogue with DMC governments to promote ANRR and generate adequate government funding support for NARSs.

18. In response to these recommendations, ADB Management issued a guideline paper that clarified ADB's requirements in research proposals and provided a structure for the project selection process.[16] The guidelines were aimed at addressing two of the recommendations (i and iv). Projects approved after SES 2000 (i.e., RETA projects from the 5th to the 12th year) in most cases adhered closely to the guidelines. As can be noted from Appendix 3, the projects emphasized sustainable pro-poor growth, enhanced agricultural productivity and improved ANR management. Many of the projects included NARS capacity building (see paras. 41–43) as well as the promotion of public policy reforms (paras. 45–48). The projects covered primarily unfavorable environments and focused on improving subsistence production systems.

[14] ADB. 2005. *Funding for Agriculture and Natural Resources Research: Is There Still a Role for ADB?* Manila.
[15] ADB. 2007. *Rural Poverty Reduction and Inclusive Growth. Draft Report of the Working Group on Rural Poverty.* Manila.
[16] ADB. 2003. *Guidelines for Project Proposal Submissions as Part of the Agriculture and Natural Resources Research at International Agricultural Research Centers*. Manila.

19. The rest of the recommendations were not adopted or only partly adopted, specifically those related to strengthening of ANRR and raising the budget support. The details on the extent of adoption of the recommendations made are discussed below.

20. **ANRR Research Agenda: Recommendation (i).** This recommendation was fully implemented (para 18). However, there is a need to develop a revised strategy and action plan for ANRR to improve alignment with *Strategy 2020*. This is further discussed in Table 2 in the final Chapter (para. 93).

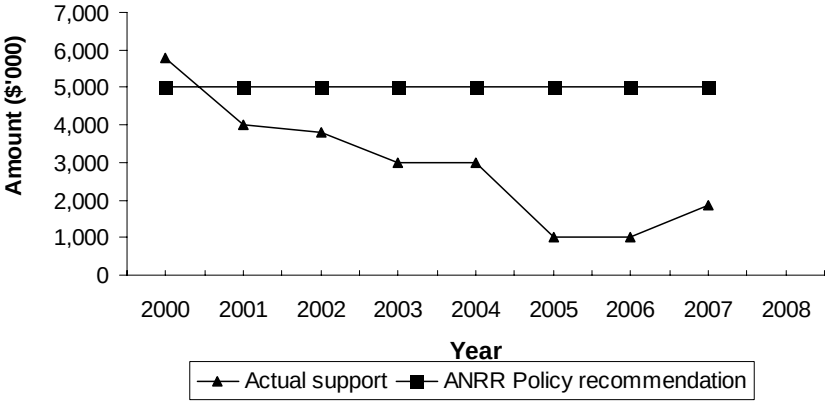
21. **ANRR Implementation Strategies: Recommendation (ii).** The suggested two-pronged approach to providing support for ANRR was partially pursued. The RETA projects continued to be awarded to IARCs, and the support to NARSs was provided in partnership with the IARCs as implementing agencies. Direct project grants to NARSs to continue and expand the outreach of research results did not become available. Country loans generally did not include funds for NARSs for continuation of research and extension work.[17] A review of country partnership strategies (CPSs) illustrates the need for such assistance targeted directly to DMCs.[18]

22. The current partnership arrangement with IARCs is not sufficiently inclusive, as NARSs, universities, and regional organizations have not been awarded direct RETA support. They are involved in implementation only indirectly through partnerships with IARCs. The decision was made to limit the RETA funding mainly to IARCs for greater focus while reducing the transaction costs of dealing with numerous organizations. This strategy also avoided thinly spreading the limited available funding.

23. **Funding Modality: Recommendation (iii).** The RETA funding in support of ANRR declined precipitously over the years. The annual funding level decreased from almost $6 million in 2000 to $2 million in 2007 (Appendix 4). The overall funding is far below the level recommended by SES-2000 (see figure). The amount provided was $3 million annually in 2003 and 2004, but this was reduced further to $1 million per year during 2005 and 2006. The 12th RETA, approved in December 2007, provided $2 million, a slight increase over the 2006 level[19] Reduced funding for ANRR RETA was partly due to a general decline in the ANR sector profile and the implied lower priority to ANRR at the institutional level (para. 90).[20]

[17] Linking research results with country loans took place in some projects due primarily to the initiative of individual ADB staff.
[18] A review of CPSs for over 15 DMCs indicated needs and opportunities for such support.
[19] The level increased further to approximately $3.5 million in 2008, partly in response to the food crisis.
[20] In the Medium-Term Strategy I (2001–2005) and Medium-Term Strategy II (2006–2008) the ANR did not rank high in the institute's priority.

Figure: RETA Support for ANRR Policy, 2000–2007



ANRR = agriculture and natural resources research, RETA = regional technical assistance.
Source: Asian Development Bank project files (Appendix 4).

24. **Geographic Focus: Recommendation (iv).** This recommendation regarding geographic focus supporting research on crops and livestock in less favorable agroecological environments with high poverty incidence was fully implemented.

25. **Strengthening of ADB's Institutional Capacity to Administer, Supervise, Monitor, and Promote ANRR: Recommendation (v).** The recommendation for strengthening ADB's institutional capacity to supervise, monitor, and evaluate ANRR project activities by providing adequate resources for administration and processing functions has not been fully implemented. The specific recommendation was for the Agriculture East Department and Agriculture West Department, which existed at that time, to jointly create a lead ANRR specialist position to formally oversee, supervise, and act as focal person for all ANRR activities. Following this recommendation, a Steering Committee on ANRR was setup, and it was housed in the Agriculture and Natural Resources Division of the Regional and Sustainable Development Department (RSDD) after ADB's reorganization in 2002. The ANR focal point was taken out of RSDD in 2006 and housed in the Agriculture, Environment, and Natural Resources Division of the East Asia Department (EARD),[21] one of the departments with a specific operational and regional assignment.[22] In this setup, the ANR focal point was given responsibility for only five[23] of eight subsectors under the ANR sector. RSDD continued to be responsible for the remaining three sub-sectors—environment and biodiversity, irrigation and drainage, and water resource management. This segmentation was perceived to be a down-scaling of the ANR sector at ADB, and support to ANRR became fragmented.

26. The ANR focal point took charge primarily of the call for RETA proposals, evaluation, selection, and awarding. But implementation and day-to-day RETA responsibilities were assigned to individuals across the various regional departments of ADB, depending on the country coverage of the project. Appendix 5 shows the spread of RETA management across various departments. Projects within each RETA were often managed by several regional departments. This made the coordination of RETA activities somewhat difficult, and adversely affected implementation. The ANR focal point was not recognized as a community of practice and had neither the budget nor the status similar to those of other sectors.

[21] Budget, Personnel, and Management Systems Department and RSDD memo to Management dated 4 August 2006 on *Focal Points for ADB-wide Sector and Thematic Functions.*
[22] The ANR focal point has recently moved back to RSDD (para. 80).
[23] The five sebsectors were (i) agri-production, agroprocessing, and agribusiness; (ii) fishery; (iii) forestry; (iv) livestock; and (v) agriculture sector development.

27. **Adequate Funding and Other Support for NARSs: Recommendation (vi).** The purpose of this recommendation was to promote policy dialogue in DMCs to identify strategic directions for future research. Such policy dialogues were, however, rarely conducted. Where such dialogues did indeed take place, it was due to the personal interest and initiative of the individual ADB staff rather than as an institutional process.

28. The mechanism to link RETA project results with other development activities of ADB in the DMCs is not straightforward. Some RETA project results have been used as inputs in loan preparation (paras. 55–59 and Box 5). However, the process is not institutionalized and is often carried out mostly because of ADB staff initiative. A summary of the extent of adoption of the recommendations is provided in Appendix 6.

III. EVALUATION OF REGIONAL TECHICAL ASSISTANCE TO SUPPORT ANRR

A. RETA Assistance from 2000 to 2007

29. As mentioned previously, 12 RETAs have been provided by ADB since 1996. The first four RETAs (1st to 4th) were included in SES-2000. This study assesses the next eight RETAs (5th to 12th) consisting of 28 individual projects with total funding of $24 million.

30. A brief summary of individual projects in terms of their main objectives, expected outputs, issues addressed as stated in the ANRR Policy, EAs/IAs, and DMCs covered is presented in Appendix 3. The RETA projects adhered closely to the ANRR Policy agenda mentioned above. The frequently supported agenda items were, in decreasing order of frequency, (i) enhancing the capacity of NARSs, (ii) enhancing the productivity of agriculture, (iii) sustainable and developing remunerative farming systems for poor farmers, (iv) sustainable management of ANR, and (v) public policy and socioeconomic research. Only two RETAs were explicitly focused on enhancing women's incomes and improving their living standards.

31. Four of the eight RETAs (5th to 8th) under the evaluation period have been completed. The technical assistance completion reports (TCRs) are available for three of the five 5th RETA projects, and for all projects for the 6th and 7th RETAs. Both the 6th and 7th RETAs were rated *successful*. Seven out of eight projects from these two RETAs were rated *successful*, with the eighth rated *partly successful*. Two of the completed projects under the 5th RETA were rated highly successful, and one successful. The rationale for such ratings in TCRs, and the key recommendations included, are presented in Appendix 7. Overall, OED concurs with TCRs' rating based mainly on overall alignment with development challenges, capacity development, and the outputs generated.[24] The remaining four RETAs (9th to 12th) are ongoing, with the completion date of the 12th RETA being 2010.

32. The EAs were 11 IARCs, 10 of which where in the CGIAR group. The projects were implemented in partnership with the NARSs from various DMCs. A complete list of the RETA projects implemented during the evaluation period, the EAs, DMCs represented, expected completion dates, and level of financial support for each of the RETA projects is provided in Appendix 4.

B. Relevance of Outputs to Developing Member Countries

33. The RETA objectives and activities have been mostly in accordance with the national development priorities of the DMCs in Asia and are closely aligned with ADB's priorities for

[24] Seven completed and ongoing individual projects in Nepal under different RETAs were evaluated as a part of the current study. Overall, these seven projects were rated successful; the details are included in Appendix 8. A brief note on the RETA projects providing data and information for this assessment is presented in Appendix 9.

the sector.[25] Almost all the target countries face similar issues and constraints that the projects seek to address.[26]

34. The RETA projects generated six major categories of outputs: (i) genetic characterization and deoxyribonucleic acid (DNA) markers that are used for varietal improvement; (ii) improved varieties and cultivars; (iii) improved management practices, including the award-winning[27] zero-tillage technology for rice-wheat production systems in Asia (Box 1); (iv) natural resource conservation technologies; (v) capacity building through training, extension, and consortium/network development; and (vi) policy advocacy to influence national development strategies and program design for increasing agricultural production and improving the lives of the poor and marginal farmers. A detailed account of outputs generated and their relevance (and/or expected relevance) is presented in Appendix 10. These outputs are relevant, as they address the key constraints to and issues concerning sustainable agricultural growth and income generation. These constraints and issues include increasing the productivity and ensuring the sustainability of major staples and other crops; raising incomes of poor farmers, especially in unfavorable production systems; and rapidly delivering technologies to poor farmers.

Box 1: ANRR RETA Generates Water Efficient Technologies in Rice-Wheat Production Systems (Zero-Tillage Wheat Technology)

The South Asian rice-wheat rotation system is one of the world's principal agricultural production systems and covers 13 million hectares (ha). It provides food security, income, and employment to over 200 million rural and urban people in Bangladesh, India, Nepal, and Pakistan. Productivity growth in these production systems has stagnated, due mainly to degradation of the resource base. Deteriorating soil fertility, weakening soil health, water scarcity, salinity and sodicity, and weed and pest infestations pose increasing problems.

Tillage and establishment innovations, varietal changes, nutrient management, improved irrigation management, and diversification can address these problems. Large-scale adoption of resource-conserving technologies will have considerable environmental benefits. Through rice-wheat rotation systems, farmers in South Asia have begun using practices that save water, fuel, and other inputs; facilitate timely planting; reduce tillage needs and burning of crop residues; and allow farmers to diversify the cropping system. The most prominent of these practices—zero tillage to sow wheat after rice—was used on nearly 1.3 million ha during the 2003–04 wheat season, up from practically nothing just a few years before.

Adoption of zero tillage in a million hectares could save as much as 100 million cubic meters of water/year plus 60 million liters of diesel fuel. Use of zero tillage for wheat saves more than 50 liters of diesel per hectare, representing a savings of 75 million liters, worth more than $40 million regionwide, and reduces the emission of greenhouse gases substantially.

ANRR = agriculture and natural resources research, RETA = regional technical assistance.

Source: Hobbs, P., R. Gupta, and C. Meisner. *Conservation Agriculture and Its Application in South Asia*. Available: http://www.css.cornell.edu/faculty/hobbs/Papers/SBB24%20Conservation%20Agriculture_last.pdf

35. The RETA projects and outputs are relevant for stimulating rural farm and non-farm economic activities, enhancing rural household incomes, strengthening human resource

[25] ADB. 2007. *Rural Poverty Reduction and Inclusive Growth, ADB*. Manila.

[26] One exception is the selection of the country coverage in RETA 6208 of IWMI on Enabling Communities in the Aral Sea Basin to Combat Land and Water Resource Degradation through the Creation of "Bright Spots," where ADB did the selection, the basis of which is not clear to the Center proponent.

[27] The Rice-Wheat Consortium of the Indo-Gangetic Plains (led by CIMMYT) won the prestigious King Baudoin Award in 2004 for their combined efforts in promoting conservation agriculture benefiting large numbers of farm families in the Indo-Gangetic Plains of South Asia.

capacity, reversing environmental degradation, promoting public-private sector partnerships, and strengthening regional cooperation (Appendices 7 and 10).

C. Growth in Productivity and Incomes, and Poverty Reduction

36. Impact studies indicate that RETA outputs have contributed towards improving the welfare of small farmers and reducing poverty. Some examples include the virus-free sweet potato, which increased yield by 30%-40% in the People's Republic of China (PRC), and the lentil research that generated $12 million in annual benefits to Bangladesh.[28] Similarly, a new variety of tomato (CLN1462A) and the postharvest technologies that were introduced and disseminated under RETA 6802 contributed to income growth and improvement in the welfare of farmer-cooperators. The new varieties commanded a higher market price, and improved postharvest technologies reduced losses.[29] In the Philippines, coconut technologies generated under RETA 6005 doubled the incomes of poor coconut farmers and reduced poverty in the project communities from 44% to 6%.[30] Appendix 11 illustrates the impact of postharvest technologies for vegetables on poor farmers' welfare in Cambodia and Lao People's Democratic Republic (Lao PDR).

37. The RETA projects have yielded good economic returns in general. For example, the internal rate of return of the genetically improved carp strain ranged from 17% to 53%, and the national benefit was estimated to be as much as $76 million.[31] These benefit estimates include both the production side (i.e., increased production of carp, which enhanced profits and provided farmers alternative sources of income) and consumption-side impacts.

D. Natural Resource Management, Biodiversity, and Climate Change

38. Most of the technologies generated or expected to be generated promote, directly or indirectly, more effective management of natural resources and protect the environment. Resource conservation technologies such as zero tillage on rice and wheat, alternate wetting and drying of rice farms, integrated crop and resource management, integrated pest management, and water harvesting technologies are not only friendly to the environment but are also efficient in terms of labor, water, energy, and nitrogen use.

39. Specific efforts related to biodiversity protection have been promoted by the on-farm conservation of coconut genetic resources that have safeguarded the characteristics of local coconut varieties and subsequently the economic base of coconut farmers primarily dependent on the coconut industry for livelihood. A similar effort in vegetables led to the accession of 4,326 indigenous vegetable cultivars kept in the gene bank of the World Vegetable Center. Protection of these genetic materials enhances the biodiversity of vegetables.

40. RETA 6439[32] is expected to deliver strategies and capacity to reduce production losses likely to result from extreme events and long-term climate changes. Annual losses resulting from typhoons and frequent incidence of El Niño (drought) or La Niña phenomena

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[28] Brian Fawcett and Tumurdavaa Bayarsaihan. 2004. Consultative Group on International Agricultural Research Annual General Meeting 2004, Mexico City, 25-29 October 2004. *Back-to-Office Report*. Manila. 29 November.

[29] AVRDC. 2006. *Technical Assistance for Improving Rural Livelihoods through Development of Vegetable-Based Post-Harvest Technologies in Cambodia, Lao People's Democratic Republic, and Viet Nam: Initial Impact Documentation in Cambodia, Lao PDR, and Viet Nam*. RETA 6802, AVRDC report to ADB.

[30] Bioversity Center's Annual Report. 2005. *Coconut Incomes and Equity*. Abstract on RETA 6005 on Developing Sustainable Coconut-Based Income Generating Technologies in Poor Rural Communities.

[31] ADB. 2003. *Technical Assistance for the Eighth Agriculture and Natural Resources Research at International Agricultural Research Centers*. Manila (RETA 6136, for $3 million, approved on 11 November, is on Poverty Alleviation by Dissemination of Improved Carp Strain to Fish Farmers).

[32] ADB. 2007. *Technical Assistance for the Twelfth Agriculture and Natural Resources Research at International Agricultural Research Centers*. Manila (RETA 6439, for $2 million, approved on 18 December) is on Vulnerability to Climate Change: Adaptation Strategies and Layers of Resilience.

are substantial. Better adaptation to climate change is expected to reduce the vulnerability and improve the livelihoods of rural farm households. The ongoing research on the topic includes development of adaptive strategies to reduce vulnerability to climate change.

E. Capacity Building, Networking, and Regional Cooperation

41. Almost all RETA projects have capacity building as a key component. Capacity building has primarily involved training in the form of bilateral scientific exchanges, promoting development and use of analytical models, raising public awareness and community mobilization, and networking to facilitate technology dissemination in the region.

42. Training offered varied from short-term technology or knowledge transfer to long-term degree programs. During the implementation of RETA 5945,[33] NARSs from India, PRC, and Viet Nam received training at ICRISAT on applied genomics (marker development, phenotyping and genotyping, and data analysis). In addition, two MS and eight PhD students conducted their thesis/dissertation programs on applied genomics in sorghum, groundnut, and chickpea. ICRISAT scientists also provided technical inputs to NARSs for the upgrading of molecular biology labs to facilitate applied genomic research. DNA markers and associated protocols and software for data management and analysis were also provided to participating NARSs in India, PRC, and Viet Nam.

43. RETA 6011[34] contributed to capacity development in Cambodia, Lao PDR, and Viet Nam (Phase II). The World Vegetable Center organized regional training sessions in collaboration with the Asia and Pacific Seed Association, the International Seed Testing Association, Kasetsart University, and NARSs. Forty researchers attended this training, which focused on seed production and integrated management of diamondback moth. Twenty-one officials were trained in the management and regulation of seed production. Approximately 144 extension specialists received in-country training on various technologies for vegetable production. A total of 593 lead farmers representing target areas were trained in vegetable production technologies or attended demonstrations of promising varieties. A total of 1,088 farmers observed new varieties and new production technologies and received seeds of these varieties and fact sheets. Exchange of information was also done through the Internet. Databases of the World Vegetable Center were updated and made accessible.

44. Establishment of regional research networks was the other key output related to capacity building. Several formal (i.e., AMBIONET, CURE) and informal (CASREN, CLVNET, CLAN) networks were developed and implemented with RETA support to spread the project benefits on a wider scale. The returns to these networks are likely to be substantial considering the small investment cost incurred.[35] Some of the technologies developed in CURE are presented in Appendix 12. Brief accounts of two networks—CURE (Box 2) and AMBIONET (Box 3)—are presented below. These networks have promoted regional cooperation among member countries and national, regional, and international organizations.

[33] ADB. 2000. *Technical Assistance for the Fifth Agriculture and Natural Resources Research at CGIAR Centers*. Manila (RETA 5945, for $5.8 million, approved on 18 October), is on Rapid Crop Improvement for Poor Farmers in the Semiarid Tropics of Asia.

[34] ADB. 2001. *Technical Assistance for the Strengthening the Collaborative Vegetable Research Network in Cambodia, Lao PDR, and Viet Nam (Phase II)*. Manila (RETA 6011, for $650,000, approved on 14 December).

[35] Pray, C. 2006. The Asian Maize Biotechnology Network (AMBIONET): *A Model for Strengthening National Agricultural Research Systems*. Mexico, D.F.: CIMMYT.

Box 2: Consortium for Unfavorable Rice Environments

The Consortium for Unfavorable Rice Environments (CURE) was established in 2002 with the support of RETA 6136. The Consortium builds on the knowledge gained, technologies developed, and partnerships established over the past decade. The consortium is coordinated by the International Rice Research Institute. Ten DMCs are members of this Consortium—Bangladesh, Cambodia, India, Indonesia, Lao PDR, Myanmar, Nepal, Philippines, Thailand, and Viet Nam.

CURE emphasizes bringing technologies and knowledge to farmers using a participatory mode of identifying problems and working out their solutions. Frequent and wide consultations among CURE partners and stakeholders were conducted during the implementation of the RETA. Three major rainfed lowlands (drought, submergence, and salt-affected lowlands across monsoon Asia) and three distinct highland (drought-affected plateaus in South Asia, drought-prone and mountain areas of Southeast Asia, and the rainy but intensively cultivated uplands of Indonesia and Philippines) environments were identified for CURE to focus on.

Outputs of the project include (i) cropping innovations that combine complementary technologies for increasing rice productivity and reducing risk in rice-based cropping systems; (ii) knowledge distilled into decision tools, management principles, and operational guidelines that are extension ready; (ii) capacity building for NARSs for implementing integrative and participatory technology development and dissemination; and (iv) acceptability to farmers and viability of innovative rice-based production systems assessed based on their biophysical performance and socioeconomic circumstances. Specific technologies for the fragile rice ecosystems were developed and tested. The "Star technologies" identified to be most suitable for wider application and adoption, are shown in Appendix 12.

CURE activities have continued even after the completion of the support from the RETA project. IRRI and NARS partners have realized the value of CURE and are supporting its operation through their own funds. The member countries believe that the "Star technologies" could provide opportunities for improving rice productivity in the most adverse production systems and for improving the livelihood of the poor and subsistence households who live in these areas. The technologies have been validated by NARSs to ensure that they work under local conditions. The collaboration with NARSs that has enhanced capacity in extending knowledge, technologies, and skills to NGOs, local communities, and farmers ensures realization of impact.

DMC = developing member country, NGO = nongovernment organization, RETA = regional technical assistance.

Source: Appendix 12 of ADB. 2003. *Technical Assistance for the Eighth Agriculture and Natural Resources Research at International Agricultural Research Centers*. Manila (RETA 6136, for $3 million, approved on 11 November). Available: http://www.irri.org/cure/ cure.htm

Box 3: Asian Maize Biotechnology Network: Its Activities and Impact

Five DMCs—India, Indonesia, Philippines, PRC, and Thailand—established the Asian Maize Biotechnology Network (AMBIONET) in 1998. This network succeeded in developing the capacity of national maize improvement programs to apply biotechnology tools to maize improvement, established fully operational biotechnology laboratories in all five NARSs, established regional collaborative research on maize improvement, and promoted information exchange among members.

AMBIONET has been instrumental in achieving four significant advances in maize biotechnology.[a] The network was able to (i) construct molecular maps for maize in advanced biotechnology laboratories to locate genes of economic importance and a string of many minor genes called QTL; (ii) determine that the arrangement of genetic and DNA markers on the chromosomes of major cereals such as maize, rice, wheat, barley, and rye is similar, and based on concept of genome collinearity it means that the location of a gene can be inferred from one map to another, thus extending the usefulness of such molecular maps; (iii) develop gene machines allowing identification of the function of a gene sequence; and (iv) introduce novel gene sequences to express desired traits in genetic engineering of maize.

AMBIONET supported by RETA 6005 was able to achieve the following: (i) strengthen maize research capacity in Asia, particularly at the institutes in, India, Indonesia, and PRC; (ii) increase research outputs, as measured by publications, research tools, and improved lines and hybrids; (iii) increased the number and quality of new maize cultivars; and (iv) increase research focus on the problems of small-scale farmers, such as development of disease resistant and drought-tolerant lines that can be used in breeding programs.

DMC = developing member country, DNA = deoxyribonucleic acid, NARS = national agricultural research system, QTL = quantitative trait locus, RETA = regional technical assistance.

[a] Biotechnology is providing maize researchers with a powerful tool for crop improvement that is faster, cheaper, and more precise than other chemical techniques. With this technology, researchers can identify one or more genes that confer the desired economic traits using molecular markers which shortens the time needed for developing improved crop varieties.

Source: Pray, C. 2006. *The Asian Maize Biotechnology Network (AMBIONET): A Model for Strengthening National Agricultural Research Systems*. Mexico, CIMMYT.

F. Policy Advocacy and Database Development

45. Policy recommendations to facilitate the achievement of inclusive and sustainable growth in Asia were also developed from the RETA projects, some key ones of which are listed in Appendix 13. For example, the International Center for Agricultural Research in the Dry Areas (ICARDA) helped develop several specific recommendations focused on creating an enabling environment for wide scale adoption of conservation agriculture, crop diversification, and water saving technologies. Some of these policy recommendations have been adopted and integrated into agricultural policies in the central Asian countries.[36] A detailed account of policy strategies for irrigated agriculture in Bangladesh, Indonesia, and Pakistan is also included in the same appendix.

46. Various irrigation policies generated by RETA 5945 were favorably viewed by the Pakistan Government's top level management for possible inclusion in the country's next five-year development plan (Appendix 13). Similarly, policy outputs generated by RETA 5812 in Nepal (Appendices 8 and 9) were also considered to be relevant and were partly incorporated in the Water Resources Strategy (2002) and the National Water Plan (2005).

47. Another valuable contribution of the RETA projects is the development of a database of new knowledge needed for planning and designing policies. An example is the report on "The World's Most Deprived: Characteristics and Causes of Extreme Poverty and Hunger" generated by IFPRI under RETA 6376. This study provided detailed information on the nature, extent, and spatial distribution of poverty. This type of information is essential for identifying and targeting suitable interventions for poverty reduction. Similarly, the WorldFish Center's research work on fish supply, demand, and impact helped assess the potential impact of alternative management strategies in addition to strengthening capacity in this important area of work. Prior to this RETA, the information base for designing sound and sustainable development plans for this subsector was weak.

48. It is difficult to determine the extent of adoption of policy recommendations generated by the RETA projects since they represent a complex set of policy issues that are addressed in phases by DMCs. Nevertheless, there are indications of positive moves towards their inclusion in development plans/programs and/or strategic actions. For example, the public and private sectors in several countries are now providing support for hybrid rice research, seed production, and technology dissemination. Similarly, support for the zero tillage technology by the Government of India has been demonstrated by their contribution up to a 25% subsidy towards the purchase of zero tillage drills and other tools.

G. RETA Links with Development Partners, National Agencies, and ADB Country Operations

49. The potential use of RETA outputs for project identification or project preparatory technical assistance activities of ADB was implicit in the ANRR Policy. Several RETA projects have provided outputs that were used to design loan projects or were directly linked to ongoing and/or proposed projects under various funding sources.

[36] RETA 6136 is on Improving Rural Livelihood through Efficient On-Farm Water and Soil Fertility Management in Central Asia.

50. **Links with Other Research and Development Initiatives.** Some RETA projects have established links with other similar research and development initiatives of national governments, NGOs, and the private sector, and other development partners (Appendix 14). Two RETA projects were linked to International Fund for Agricultural Development (IFAD) projects: (i) RETA 6005 is linked to the Program for Overcoming Poverty in Coconut-Growing Communities: Coconut Genetic Resources for Sustainable Livelihood (2005–2008), and (ii) RETA 6138 contributed to the development of the Community Action in Integrated Market Oriented Project. RETA 6138 of ICARDA provided inputs to the development of the CACILM Multi-country Partnership Framework Support Project on Sustainable Management Research (ADB TA 6357). In Indonesia, RETA activities and outputs were continued through agroforestry projects funded by the United States Agency for International Development (USAID).

51. The coconut-based livelihood technologies from RETA 6005 on Developing Coconut-Based Income-Generating Technologies in Poor Rural Communities have been expanded for wider scale testing in a number of communities in Asia, Latin America, and Africa with funding from IFAD. Similarly, wider scale testing of coconut-based livelihood technologies was supported by the Philippine Government in four communities. RETA 5945, implemented by IRRI and IFPRI,[37] for example, was instrumental in the development of the CGIAR Harvest Plus Challenge Program that is now jointly funded by the Gates Foundation, World Bank, USAID, and United Kingdom Government through the Department for International Development.

52. **Links with National Agricultural and Extension Systems.** ADB's ANRR partnership with NARSs has been primarily through RETA awarded to IARCs. Selection of specific NARS partners by IARCs is based primarily on their proven track record in conducting similar research projects; familiarity with issues, especially those being addressed by the project; availability of expertise to collaborate in the project; and commitment and willingness to participate in the dissemination of results and follow up project activities. More often than not, the selected NARSs had long-standing partnerships with the IARCs. A case study for the Philippines illustrates how the RETA projects have fostered close collaboration between PhilRice and IRRI (Box 4).

Box 4: ADB Support in Strengthening of National and International Research Institutes in the Philippines

The Philippine Rice Research Institute (PhilRice) is mandated to build a self-sufficient and competitive rice economy through research, technology promotion, and policy advocacy. It was established in 1985, with its headquarters initially located inside the University of the Philippines, Los Banos campus and close to the International Rice Research Institute.[a]

RETA projects have supported strengthening of the PhilRice-IRRI collaboration. PhilRice has been a recipient, directly or indirectly, of RETA funds coordinated by IRRI. The establishment of the Asian Rice Biotechnology Network[b] aimed at developing disease-resistant rice varieties through the application of DNA marker technology was a firm example. The network played a key role in developing capacity for marker-aided analyses of pathogens and host-plant resistance in several national breeding programs, which resulted in the development of elite or commercial rice lines with multiple disease resistance genes. RETA projects has supported close collaboration in further improvements of technologies in favorable rice ecosystems[c] as well as in unfavorable and fragile environments.[d]

PhilRice valued the collaboration, particularly the contribution on the capacity development. In regard to technology development, it was difficult to identify which activities belong to specific RETA, because such activities are usually incorporated in a broader research agenda. Nonetheless, there is general agreement among the staff and senior officials that RETA has played a significant role

[37] RETA 5945 is on Breeding Iron Rich Rice to Reduce Iron Deficiency Anemia in Asia

increasing productivity growth in 1997–2006. The growth came mostly from yield increases in both the irrigated and rainfed ecosystems. Yield levels reached about 4 tons per ha in the irrigated areas and close to 3 tons per ha in rainfed areas. Rice farmers benefited from their use of modern varieties and new production practices and technologies. They experienced net income gains, which increased almost fourfold (from ₱3,268 per ha to ₱12,142 per ha) in the irrigated systems and twofold (₱3,085 per ha to ₱6,263 per ha) in the rainfed ecosystems between 1994 and 2004.

Three outputs were clearly related to RETA projects (i) the Asian Rice Biotechnology Network, in which PhilRice was a key actor from the very start; (ii) the hybrid rice project, which enabled some PhilRice staff to undertake short-term training courses or to participate in international workshops; and (iii) the CURE project, wherein PhilRice provided inputs to the preparation of the proposal. PhilRice continues to support the activities of many of these projects even after completion of the RETA projects. It has sustained their activities and expanded their coverage from its own budget. This is a plus factor when considering the long-term returns to ADB's investment in ANRR and sustainability of outcomes generated through such investments.

ADB = Asian Development Bank, ANRR = Agriculture and Natural Resources Research, CURE = Consortium for Unfavorable Rice Environments, DNA = deoxyribonucleic acid, IRRI = International Rice Research Institute, RETA = regional technical assistance.

[a] It was then transferred to its current location in Muñoz, Nueva Ecija so that it could properly expand its manpower and program to support its mandate of developing a strong Philippine rice industry.

[b] The RETA projects (i.e., RETA 5510, RETA 5667, RETA 5711, and RETA 5812) were provided prior to this evaluation period (2000–2007).

[c] Such Projects are RETA 5026, RETA 5349, RETA 5510, RETA 5667, RETA 5711, RETA 5812, and RETA 6005.

[d] RETA projects such as RETA 5059, RETA 5194, RETA 5208, RETA 5261, RETA 5606, RETA 6136, RETA 6208, and RETA 6276.

Note: See Appendix 15 for the list of RETA projects and reference.

Source: Various PhilRice documents and interviews with PhilRice staff.

53. Generally, NARSs were involved from the initial stage of development of RETA proposals, which has contributed to effective design and efficient implementation.[38] This consultative process has also promoted project ownership among NARSs.

54. The capabilities of NARS partners vary substantially across countries. There are strong and highly qualified NARSs (for example, India, and PRC) that could carry out advanced research and transfer knowledge to their neighbors. However, weaker NARSs are still dependent on IARC partners for research direction and work. An example of the nature of CGIAR's collaboration with more advanced NARSs such as China and recently-established NARS in Afghanistan is presented in Appendix 16.

55. **Links with ADB Country Operations.** Several RETA projects have some components or results linked to ADB country operations.[39] For example, results of RETA 5945 included action plans for both aquaculture and capture fisheries. The results and action plans were available for use in the formulation of national fisheries action plans in the country strategies. They were used by ADB for preparing Loan 1911 in Sri Lanka.[40]

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[38] Twenty (of 24) RETA projects that responded to the question "Are NARS partners directly involved in the development of RETA proposals?" ticked either "always" or "often".

[39] The exact number of RETA projects that are linked to country operations has been difficult to determine. This is primarily due to the lack of documents/information about the status of the projects, especially after they are completed. The monitoring of RETA projects, as has been mentioned earlier, is fragmented and lack continuity. There is little knowledge from the ADB staff interviewed about the linkages of RETA projects to ADB country operations.

[40] ADB. 2002. *Report and Recommendation of the President to the Board of Directors on a Proposed Loan to Sri Lanka for Aquatic Resource Development and Quality Improvement*. Manila. 5 September. Major loan project components include inland fisheries and aquaculture development, fish quality improvement and marketing, and institutional strengthening. Available: http://pid.adb.org:8040/pid/LoanView.htm?projNo=34318&seqNo=01&typeCd=3

Moreover, results were incorporated in the design of a new aquaculture project in Indonesia that emphasized public-private partnerships in aquaculture development and biodiversity conservation.

56. The Lao PDR's Smallholder Development Loan No. 1949[41] capitalized on several RETA projects awarded to IRRI, which engendered improved rice technologies for intensification and commercialization of agriculture. The projects were focused on rice production in less favorable areas. The project is now showing some evidence of increased economic opportunities for smallholders and small and medium entrepreneurs through increased productivity and improved linkages to markets.

57. In Bangladesh, the school garden component of the World Vegetable Center, RETA 6067, was linked with the Northern Crop Diversification Project.[42] The same RETA project was also linked with an ADB project supported by the Japan Fund for Poverty Reduction. In both projects, RETA 6067 provided indigenous vegetable seeds for development of home gardening. The Philippine Department of Agriculture has also continued to support RETA activities related to the indigenous vegetable project.

58. Some perceived benefits of linking RETA projects with country operations as perceived by the IARCs are summarized in Appendix 17. They indicated that the most vital benefit from a close linkage with ADB operations in the DMC is the facilitation of dissemination and adoption of research results and the leveraging of additional funds to continue applied research and extension work.[43]

59. Despite some of these positive examples, there is substantial scope for improving utilization of RETA results through more effective management of information/knowledge. ADB resident missions in DMCs are often unaware of ongoing ANRR activities in their countries of operation because there is no formal institutional setup for such a link (Box 5 is a case study from Nepal). Information on RETA results does not always filter through to them. The RETA modality of support does not appear in ADB's country partnership strategies.

[41] ADB. 2002. *Report and Recommendation of the President to the Board of Directors on a Proposed Loan to Lao People's Democratic Republic for the Smallholder Development Project*. Manila. Available: http://pid.adb.org:8040/pid/LoanView.htm?projNo=31351&seqNo=01&typeCd=3

[42] ADB. 2002. *Technical Assistance for the Seventh Agricultural and Natural Resources Research at International Agricultural Research Centers*. Manila (RETA 6067, for $3.8 million, approved on 6 December) is on Promoting Utilization of Indigenous Vegetables for Improved Nutrition of Resource-Poor Households in Asia.

[43] IARCs that work with specific NARSs reported that their local partners almost always continue the activities after completion (12 projects out of 14 projects that responded "always" or "often" to the question "Are RETA project activities continued by NARSs after the projects have been completed?") or use project results to develop new proposals for funding support (13 out of 14 projects responded "always" or "often" to the question "Are you aware of NARSs partners using results of any of the RETA projects in the development of new research proposals?").

Box 5: Nepal Case Study: RETA projects and ADB Country Operations

Seven RETA projects have provided support for research and technology development in Nepal from 2000 to 2007. Five CGIAR institutes—CIMMYT, International Plant Genetic Resources Institute (IPGRI), International Food Policy Research Institute (IFPRI), IRRI, and IWMI—were the EAs, and NARC was the national counterpart implementing most of the RETA projects. The objectives of these RETAs were mainly to (i) improve food security, and (ii) contribute towards increased productivity of the agricultural sector. The RETA projects supported the development of technologies for raising the productivity of staple crops—rice and wheat—through (i) varietal enhancement and improved management practices, (ii) development of effective water management institutions, (iii) conservation of native fruit species, and (iv) socioeconomic and policy research. One of the RETA projects has a TCR, which rated the project *successful*. A list of these projects is included in Appendix 8.

NARC considered the collaboration with the IARCs to be valuable in several aspects: (i) access to research and technologies including germplasm; (ii) support in the development of locally adaptable technologies; (iii) international exposures, training, and capacity building; (iv) networking opportunities and confidence building among national scientists; and (v) in some cases, the only linkage to the international scientific community. NARC's recent shift in research from varietal trials towards research targeted to meeting farmers' immediate problems and concerns—such as cost-efficient technologies, sustaining rice-wheat cropping systems, promotion of water saving technologies, and resource conservation technologies—was attributed to CGIAR's guidance and influence. One of the main concerns expressed by NARC staff was that a RETA is implemented with many NARSs and partners. In such collaborations, small countries like Nepal often do not receive adequate support compared with larger countries that have greater scientific capacity.

The programs supported by RETAs are generally in line with national development priorities (the Ninth [1997–2001] and Tenth [2002–2007] Five-Year National Development Plans) and the priorities indicated in NARC's Strategic Vision 2021. Most of the research and technologies developed were assessed as relevant to highly relevant. They were, in some cases, ready for immediate use. RETA also supported much-needed enhancement of the knowledge base of native products and practices. Further, these RETA projects generated information relevant to socioeconomic issues in research and technology development in general and subsector-specific issues such as introduction of integrated water resources management. The Department of Irrigation has acknowledged that these outputs have been used in preparing two key documents: (i) Formulation of Water Resources Strategy (2002), and (ii) National Water Plan (2005). It was stressed that inadequate follow up for scaling up through appropriate policy support and stronger linkages with extension were the main bottlenecks for generating impact.

Focus group discussions and key informant interviews were held with officials of the Ministry of Agriculture and Cooperatives, ADB staff including Nepal Resident Mission (NRM), NARC; and officials of EAs of the investment, technical assistance, and grant projects did not reveal clear links across ADB's country operations and the support provided through the RETA modality. The RETA projects were implemented directly from Manila and NRM was not fully aware of the types of support provided through RETA. Given that RETA-generated outputs have the potential for immediate use in most cases for improving productions systems, some form of linkage was considered to be highly desirable.

Some examples of RETA outputs that could have been better utilized include information generated and technologies developed for high-value crops such as mango and citrus (RETA 5866). These crops are economically important, are grown widely in Nepal, and have the potential to improve the incomes of small farm households. Development and scaling up of these technologies matched the objectives of two ADB investment projects in at the time of RETA implementation. Despite congruent objectives, the investment projects did not fully benefit from RETA technology products due to poor linkages.

RETA projects are processed at Headquarters directly with the IARCs. There is no formal institutional setup to link up RETA outputs with country operations. The RETA modality does not appear in ADB's country partnership strategies. Nor does it appear in the country's budget for research and technology development. Potential synergies among various components of ADB support for increasing the overall impact are not fully utilized as a result.

ADB = Asian Development Bank, CGIAR = Consultative Group on international Agricultural Research, CIMMYT = International Maize and Wheat Improvement Center (*Centro Internacional de Mejoramiento de Maíz y Trigo*), EA = executing agency, IARC = international agricultural research center, IFPRI = International Food Policy Research Institute, IPGRI = International Plant Genetic Resources Institute, IRRI = International Rice Research Institute, IWMI = International Water Management Institute, NARC = Nepal Agriculture Research Council, NRM = Nepal Resident Mission, RETA = regional technical assistance.
Source: Appendices 8 and 9.

60. Information available on RETA projects (such as the progress reports regularly submitted by IARCs) is not kept in a central file but is scattered across several departments

depending on who is handling each project (Appendix 5). There is no website or other electronic repository that captures the knowledge products and lessons generated by RETA to facilitate efficient use of such information and knowledge. TCRs do not adequately highlight information relevant to future loan projects. A proper synthesis of useful knowledge products generated by RETA is not generally accomplished. Brown bag seminars or forums on RETA results are organized on limited occasions only. These factors constrain effective utilization of RETA results.

H. ADB's Performance in the Management of RETA

61. The process of developing and managing RETA within ADB was found to be less effective. After 2006, the ANR focal point housed in EARD was responsible for decisions regarding RETA, but day-to-day management responsibilities were assigned to individuals across various regional departments. This approach was adopted for better linkages between RETA projects and country operations. However, in reality, this led to limited ownership of RETA projects by implementing officers, who also had other operational responsibilities. Implementation by multiple departments also constrained the level of direct involvement of the ANR focal point in project monitoring. ADB staff interviewed from across the departments mentioned that less attention was paid to developing an effective management system for RETA, as the ANR sector received only medium priority under the medium-term strategy. Low priority and the low level of RETA funding led to poor attention for developing an effective management system. The frequent changes in project officers assigned to a RETA, not to mention the project officers' involvement in other missions, made monitoring fragmented and resolution of operational problems inefficient.

62. The staffing constraint applies to the ANR sector as a whole. A review of staffing positions in the ANR sector suggests that the staff strength has weakened over time.[44] There are no permanent experts or subject matter specialists to screen, develop, monitor and supervise the projects and to provide feedback into the next project cycle. Important institutional memory is lost as a result.

63. IARC partners also raised issues related to RETA project implementation (Appendix 18), mainly concerning the substantial time lag between awarding and project initiation, and delays in the release of funds.[45] Funds are needed to mobilize partners, especially at the beginning of a RETA, and delays in fund release will inevitably delay implementation. Another problem identified was confusion due to frequent changes in the project preparation guidelines. A short 3-year cycle was also considered to be insufficient for ANRR projects, which tend to have substantial startup delays. The frequency of reporting on a quarterly basis was considered to be too cumbersome, and inappropriate for reporting the research process.

64. Overall, IARCs considered ADB to have a weak institutional commitment to ANRR. Most of the IARCs also expressed concerns regarding the high frequency of reporting required on project progress. Despite the substantial time invested in preparing these frequent reports, the IARCs were unclear about how they were being used by ADB. However, ADB has made some changes recently (para. 79).

[44] ADB. 2008. *Biennial Sector Report for 2005–2006*. Manila.

[45] The delays are due to three main reasons: (i) long time lag from the initial call for proposal to proposal selection and report preparation (ii) the RETA paper approval process within ADB, and (iii) once the Board approves, ADB needs to get non-objection letters from all the countries included in a RETA.

IV. RECENT DEVELOPMENTS AND RELEVANCE OF ANRR POLICY

65. The challenges to ANRR are more complex now as compared with 30 years ago, when the primary focus was on increasing food production. The global landscape surrounding agriculture has been rapidly changing. Awareness of the direct link between agriculture, or rural economy (and the prevailing poverty within), and the ongoing structural transformation in many DMCs is increasing. Also, as demonstrated by the recent food crisis, agriculture is not as isolated as in the past. It is now directly linked with finance (e.g., equity market), energy (oil price and biofuel linkage), and trade and fiscal management (e.g., food subsidy and food policies). The increasing share of nonfarm rural incomes is yet another example of the exogenous factors affecting performance and the role of agriculture in rural Asia. Similarly, the increasing globalization of economy and trade, and the ongoing changes in agricultural value chains also bring many exogenous factors to the agriculture agenda, such as trade, industry, food, and public health.

66. These challenges have to be addressed, and as quickly as possible, to sustain the gains achieved in the past and to effectively develop solutions for emerging problems. In the current context, several factors are driving the changes in the ANR sector. These factors broadly define the major ANRR challenges.

67. **Population Growth and Rapid Urbanization.** Population growth, rapid urbanization, and economic growth will continue to put pressure on agricultural production and its resources. The pressure will be not only in terms of increasing food production per se but also in making available a variety of foods to cater to changing preferences. The dietary shifts toward high-value foods like fruits and vegetables as well as meat and milk result from higher incomes and growing urbanization. The supply of all commodities, including grains, especially for animal feed, will have to be accelerated.

68. **Increasing Competition for Resources.** The required increase in production will have to be based on more efficient use of natural resources, as other sectors of the economy will increasingly compete for land, water, and labor. The conversion of agricultural land into residential, commercial, and industrial areas; the stiff competition for water with urban and industrial users; and more lucrative opportunities for labor outside the farm sector are all indicative of this growing resource scarcity. Productivity gains will have to be the primary source of future production growth.

69. **Trade Liberalization and Globalization of Markets.** Trade liberalization opens up domestic markets so that more goods become available at possibly lower and more affordable price levels. While this is beneficial to consumers, it puts pressure on local producers, who will have to compete with cheaper imported goods. Promotion of investment and innovation is greatly needed to enhance the efficiency of the region's agriculture sector to compete in the global market.

70. Alongside trade liberalization is the globalization of agrifood systems. Even small farmers are now increasingly linked with commercialized agrifood systems, nationally and globally. Research and innovation are even more vital because of the need to ensure productivity increases along the whole food chain (not merely crop yields) as changes take place in the use of production inputs such as water, seeds, feeds, and machinery. Taking advantage of the opportunities afforded by the new market modalities will also depend largely on the ability of small producers to overcome the barriers posed by the concerns for food safety and quality standards by both food processors and retailers.

71. **Climate Change.** Warming of the global climate system is now evident from observations of increases in average global air and ocean temperatures, widespread melting

of snow and ice, and rising global average sea level.[46] The warmer ocean temperatures resulting from global warming may have increased in intensity and frequency of El Niño and La Niña events in recent decades.

72. IFAD[47] estimates that agricultural productivity could decrease by 10% to 25% by 2080 as a result of global climate change. For some countries, the decline in the productivity of rainfed agriculture is estimated to be as much as 50% of the current level. Poor rural households engaged in subsistence and smallholder farming in developing countries would be most vulnerable to impacts of climate change. Their livelihood opportunities and the level of nutritional intake are both likely to be adversely affected.[48] ANRR can provide useful information and knowledge in helping agriculture to adapt to, as well as mitigate, the adverse impacts of climate change.

73. **Steady Growth in Biofuel Production.** The recent rise in energy prices had a major impact on agricultural production.[49] Biofuel is seen as a cheaper alternative to the petroleum-based source of energy. Biofuels have good potential but also involve substantial risks. The competition in the use of grain and oilseed for feed and food use versus their use for bioenergy is already contributing to food price increases. The challenge for ANRR is the development of appropriate renewable energy technologies[50] that address broader socioeconomic and environmental issues.

A. ADB's *Strategy 2020* and Support to ANRR

74. *Strategy 2020* was developed to guide future activities of ADB in the context of the emerging issues mentioned above. Nine major challenges are identified for the region:

(i) poverty, the central challenge;
(ii) widening disparities in well-being within and between DMCs;
(iii) demographic changes;
(iv) environmental strains arising from rapid economic growth;
(v) infrastructural constraints to market-led growth and access to social services;
(vi) need for more regional cooperation and integration;
(vii) inability of the financial systems to effectively mobilize the savings;
(viii) need for innovation, technology, and higher education; and
(ix) weak governance.

75. The strategic agenda developed by *Strategy 2020* for meeting these challenges emphasizes the need to promote inclusive and environmentally sustainable growth through more effective regional integration. The agriculture and environment sectors clearly play important roles in addressing several of the above major challenges such as poverty reduction, environmental protection, and equitable growth.

76. The need for ANRR interventions and ADB's support for such activities is firmly implied in *Strategy 2020*. This need has been made more immediate and actually heightened by the global food crisis. A long-term solution of the global food crisis will require

[46] IPCC WG I. 2007. *Assessing the Physical Science of Climate Change*. Available: http://ipcc-wg1.ucar.edu/
[47] Climate change and the future of smallholder agriculture: How can rural poor be a part of the solution to climate change? Discussion paper prepared for the Round Table on Climate Change at the Thirty-first session of IFAD's Governing Council. 14 February 2008.
[48] The increased levels of carbon dioxide (CO_2) also tend to reduce the plant intake of nitrogen that affects its nutritional value (Conroy, et al 1994).
[49] Key inputs to production such as fertilizer, irrigation, and farm machinery are oil dependent. Their use in farm production is being greatly reduced, which affects yield gains.
[50] The more appropriate production technologies are those that use alternative crops that are not used for food or feeds and that do not compete with the food sector in terms of the use of production resources. Increasing focus has to be made on second generation biofuels such as those based on cellulosic materials.

increased investments in ANRR to develop and disseminate improved technologies for increasing agricultural production in an efficient and equitable manner while conserving the environment. [51]

77. During ADB's 41st Annual Meeting in May 2008, the President made two major commitments to deal with the global food crisis: First is the provision of up to $500 million in immediate budgetary support to the hardest-hit countries in Asia and the Pacific. Second is a twofold increase of ADB lending for agriculture and rural development to more than $2 billion in 2009.[52] These financial commitments are available for short-term as well as long-term assistance to the ANR sector to enhance productivity, improve market access, and deepen reforms.

78. ADB's medium- to long-term assistance to the ANR sector is also expected to come from the additional $11.3 billion in pledges by donors to the Asian Development Fund. Such assistance may target farm productivity and profitability gains through improved rural infrastructure and services (including rural roads and bridges, rural electrification, and water and irrigation services), better access to rural finance and information, and enhanced agricultural market infrastructure. ADB will continue to promote agricultural and food policy research through collaboration with IARCs. In the context of new aid modalities, *Strategy 2020* clearly spells out the need to partner with the specialist international organizations for more effective development outcomes.

79. The recent decision to move the ANR focal point back to RSDD under the Knowledge Management and Sustainable Development is consistent with the almost unanimous view expressed by the ADB staff interviewed. This relocation of the ANR focal point, referred to now as Agriculture and Rural Development and Food Security Unit, underscores ADB's commitment to addressing the emerging issues in the ANR sector effectively for ensuring continued progress toward achieving the Millennium Development Goals. This unit is expected to develop strategies for effective management and dissemination of knowledge and technologies by reducing the institutional gaps identified in Chapter III. In addition, RETA system has been restructured and a research-oriented technical assistance[53] scheme has been established for improving the collaboration and coordination between regional and the knowledge departments. These changes are expected to improve the linkage of research and development technical assistance (RDTA)[54] with operations.

B. Returns on Investments in ANRR

80. What would the world look like if ANRR were not undertaken? Without CGIAR research,[55] the following scenario is likely to have resulted: (i) world food production would be 4–5% lower, and developing countries would have 7–8% less food, thereby exacerbating hunger, malnutrition, and poverty; (ii) world food and feed grain prices would be 18–21% higher to the detriment of the poor; (iii) the area planted to crops would be higher for all food crops, as cultivated area in developing countries would have expanded by 11–13 million ha at the expense of primary forest and fragile lands with high biodiversity; (iv) in developing countries, per capita food consumption would have declined by 5% on average, and up to 7% in the poorest regions, causing food, income, and nutritional insecurity; and (v) most

[51] ADB. 2008. *Soaring Food Prices: Response to the Crisis*. Manila. Available: http://www.adb.org/Documents/Papers/soaring-food-prices/default.asp
[52] ADB. 2008. *ADB's Response to Food Crisis. Board Document*, IN 185-08. Manila.
[53] ADB. 2008. Increasing the Impact of the Asian Development Bank's Technical Assistance Program, Board Paper (R-87-08), Manila.
[54] With the restructuring of RETA systems, research-oriented technical assistance are categorized separately and will be referred to as research and development technical assistance (RDTA).
[55] Snapshot of CGIAR impacts. Available: http://www.cgiar.org/impact/snapshots_impacts.html

importantly, 13–15 million more children would be malnourished. Indeed, past investments in agricultural research and development have generally yielded high rates of return (footnote 1). More recent syntheses of the rates of return studies for crops, livestock, forestry, and other subsectors[56] are summarized in Appendix 19.

81. Alston et al. additionally found that not only are rates of return on research and development in agriculture high, but there is also a low probability that these rates are below acceptable levels.[57] In a more recent study that employed a "meta benefit cost analysis" of all investments in agricultural research of the CGIAR IARCs, it was shown that benefit-cost ratios are more than one, ranging from 1.96 to 17.94.[58] These figures clearly indicate that investments in agricultural research have been economically very rewarding. However, it is generally recognized that the growth rate in investment in agriculture has decreased over time (footnote 1) and that the overall investment in agricultural research and development has been insufficient.[59]

C. Returns to ADB's Contribution in ANRR

82. ADB contributed to past research efforts despite its relatively small financial investment compared with other development banks. This investment has been appreciated by the IARCs, especially the major centres such as, CIMMYT, ICRISAT, IRRI, IWMI, and World Vegetable Center. The RETA projects undertaken by these centres addressed high priority research issues with potentially large payoffs. Some of the major outcomes/impacts of the RETA projects were summarized earlier in Section III. Although no formal impact assessment has been conducted, the outputs and outcomes generated so far clearly have a high potential for impact.

D. Possible Partners for Research and Technology Development

83. The pool of research institutions with which ADB can partner for ANRR is expanding: the IARCs, the regional research centers, the national research centers (which are capable and dependable centers in India and PRC), the private sector, and civil society organizations. Each of these partners carries with it distinct expertise and a comparative advantage that have to be appropriately and suitably tapped based on ADB's research focus. The current partnership arrangement, however, is not sufficiently inclusive, as NARSs, universities, and regional organizations are not directly involved in RETA.

84. **IARCs.** ADB's major partners in undertaking ANRR have been the IARCs that comprise CGIAR and others that have a regional or international mandate. The global impact of these centers is multiplied through their network of collaboration with many well-established partner organizations including national and regional research institutes, national governments, civil society organizations, and the private sector to conduct cutting edge and adaptive research, and to ensure that research results move rapidly from laboratories to farmers' fields. Farmers' organizations are also currently engaged in collaborative research programs with the IARCs.[60]

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[56] Alston, J., C. Chang-Kan, M.C. Marra, P.G. Pardey, T.J. Wyatt. 2000. *A Meta–Analysis of Rates of Return to Agricultural R&D: Ex Pede Herculum,* IFPRI Research Report No. 113, IFPRI, Washington D.C.

[57] Alston, J.M., G.W. Norton and P.G. Pardey. 1996. *Science Under Scarcity: Principles and Practice for Agricultural Research Evaluation and Priority Setting*. Ithaca, NY: Cornell University Press.

[58] Various scenarios were analyzed in this study from the most conservative, based on studies where benefits were "significantly demonstrated" until the cutoff point of 2001, to the most optimistic, where benefits were judged to be plausible and extrapolated to the year 2011. (Raitzer, D. A., 2003. *Benefit-Cost Meta-Analysis of Investment in the International Agricultural Research Centres of the CGIAR*. Rome, Italy: Science Council Secretariat, FAO. 45 p.)

[59] Beintema, N.M. and Gert-Jan Stad. 2008. Measuring AGriucltural Research Investments: A Revised Golbal Picture, International Food Policy Research Institute, Washington DC.

[60] See www.cgiar.org/who/partners.html

85. The IARCs' research portfolio now includes several components that are directly relevant to ADB's goal (Appendix 20). It can be noted from that, while upstream research remains a key element, IARCs are also engaged in downstream and more applied research. The IARCs' broad research areas of concern include

(i) climate change, especially as it affects agricultural production systems;
(ii) water conservation and enhnacing water use efficiency;
(iii) the food crisis as it impacts food security and poverty reduction;
(iv) natural resources and environmental protection; and
(v) better communication with farmers and other stakeholders.

86. To effectively address these multiple concerns, the IARCs have expanded their partnership alliances beyond the public-funded research institutions to other organizations including the private sector. This partnership enables them to enhance their outreach for impact. Their broader research agenda as well as their enhanced linkages with partners have aligned their research portfolios more closely with the Millennium Development Goals.

87. **Regional Partners.** Effective implementation of the development agenda involving a portfolio of activities requires comprehensive approaches involving multiple partnerships. Regional centers such as the Southeast Asian Regional Center for Graduate Studies and Research in Agriculture[61] and South Asian Association for Regional Cooperation[62] have enhanced their research and implementation capacity. These regional organizations can play an increasingly effective role in generating development outcomes and impacts due to their greater familiarity with and understanding of local problems. Some large DMCs such as India and PRC have developed a dynamic research and development system that could contribute effectively to South-South cooperation.

88. **Public-Private Partnerships.** Public research institutions and private industry are increasingly joining forces to pursue agricultural research directed toward meeting the needs of poor farmers and consumers. Over the past decade, private companies have become a major source of innovations in agricultural research, but these have been primarily channeled to the developed countries. Their interest in agricultural research arose in part because of the advent of biotechnology. Many of the technologies used in biotechnology—including individual genes and the technologies used to transfer them to different plants—received patent protection, and companies earn higher returns from them than they could from conventional plant breeding. On the other hand, agricultural research to benefit the poor has remained within the public arena. The public-private partnership is a potentially effective way of mobilizing technological advances in agriculture for the benefit of poor farmers and consumers in developing countries.

E. ANRR Funding Support and Modality

89. The level of ADB's funding support to ANRR has been low and declining. Concerns regarding this shortfall were raised by ADB staff interviewed as well as by the IARCs. Inadequate support to ANRR has constrained the full realization of benefits of the research outputs already produced as well as the opportunities for future gains from cutting-edge research. The realization of full impact on the intended beneficiaries requires adequate investment in technology scaling up over several years. Similarly, cutting-edge research aimed at developing new and improved technologies to overcome emerging problems and challenges requires sustained and stable funding. The substantial drop in RETA funding that took place during 2000-2005 is bound to have an adverse effect on such research. This

[61] See www.searca.org/web
[62] See http://www.idrc.ca/fr/ev-127185-201-1-DO_TOPIC.html

precipitous drop in funding has led to marginalization of RETA, and inadequate attention has been paid to its effective formulation and implementation.

90. RETA support is currently in the form of restricted grants, usually for 3 years, with the possibility of extension of 1–2 years. This modality encourages a short-term perspective and is inappropriate for supporting cutting-edge research designed to address important long-term issues such as environmental protection, global climate change, and conservation of biodiversity. Many of the research projects submitted for RETA support are components of the core research agenda of IARCs that require long-term funding to ensure full achievement of expected outputs and impact.[63] Support for subsequent phases is provided to some projects is not automatic, as the project is still subject to usual review and evaluation. Clearly, the short funding cycle, and the uncertainty associated with continuation of funding have been detrimental to scientific progress and effective translation of scientific outputs into development outcomes and impact.

91. Relative to other international development banks, ADB has invested very little in ANRR (Table 1). The World Bank has continued its strong support for ANRR, with its unrestricted contribution to the CGIAR Group being around $50 million a year. Additionally, it provides competitive grants to the tune of $60 million that are open to all other research institutions. IFAD, likewise, has supported ANRR through its Grant Financing Policy at an annual average level of about $6.6 million to CGIAR and at a slightly higher level of $8.7 million to the non-CGIAR group.

[63] Because of funding insufficiency, IARCs slice up their research agenda to enable them to cater to some donors that provide restricted funds such as ADB and UK Department for International Development.

Table 1: Support to ANRR by Multilateral Development Banks

Multilateral Development Banks	Approach to funding ANRR /Modality	Description of Approach	ANRR Funding Support Granted (Total amount from 2000 to present in $)
ADB	Competitive grant funding through RETA fund	Solicits a call for proposals to be granted on a competitive basis for an annual RETA, which is generally funded on a 3–to 5-year basis	$23.8 million since 2000 or about $2.8 million average annually
AfDB	Direct support to CGIAR until 2006, when support shifted to purely regional networks with research mandate in Africa	Established a Secretariat in 2006 to manage funds directly awarded to regional agricultural research network led by African-based NARSs	$15.7 million CGIAR support in 1972–1999; $3.9 million CGIAR support in 2000–2006; $23 million grant to Promotion of Science and Technology for Agricultural Development in Africa Project starting 2006
IADB	Support to research slowly taken over by FONTAGRO from 1998; competitive research funding through this endowment (RETA fund)	IADB and IICA established an endowment fund to permanently support regional agricultural research on a yearly basis. Accredited research organizations from LAC countries would submit proposals to compete for this grant on a yearly basis.	$168.7 million CGIAR support in 1972–1999; $3.9 million in 2000–2006; With FONTAGRO, $4 million annual support to ANRR (target is $15 million annually)
WB	Direct support for unrestricted core funding to CGIAR supplemented with competitive grant funding	Provides CGIAR with unrestricted funding of $50 million/year; competitive grants are peer-reviewed, with criteria defined by research priorities and scientific merit	$50 million yearly to CGIAR's core funding and approximately $60 million in competitive grant funding.
IFAD	Competitive grant funding (CGIAR and non-CGIAR) as prescribed by the Grant Financing Policy for Research (2003 updated 2005)	Competitive grant funding for IARCs, CBOs, and NGOs	$53.07 million for CGIAR and $69.75 million for non-CGIAR since 2000 or about $6.6 million for CGIAR and $8.7 million for non-CGIAR G annually

ADB = Asian Development Bank, AfDB = African Development Bank, ANRR = agriculture and natural resource research, CGIAR = Consultative Group on International Agricultural Research, CBO = Congressional Budget Office=, FONTAGRO = Regional Fund for Agricultural Technology for Latin America and the Caribbean, IADB = Inter-American Development Bank, IARCs = international agricultural research centres, IDB = International Development Bank, IFAD = International Fund for Agricultural Development, IICA = Inter-American Institute for Cooperation on Agriculture, LAC = Latin American and Caribbean, NARS = national agricultural research system, NGO = nongovernment organization, RETA = regional technical assistance, WB = World Bank.

Source: ADB. 2005. *Funding for Agriculture and Natural Resources Research: Is there still a Role for the ADB?*; and Various internet sites of the MDBs.

92. New modalities of enhancing ANRR have been developed such as the Regional Fund for Agricultural Technology for Latin America and the Caribbean by the Inter-American Development Bank. Similarly, the African Development Bank has also developed a new project on the Promotion of Science and Technology for the Agricultural Development of Africa with a funding level of $23 million in 2006.

V. MAIN FINDINGS AND RECOMMENDATIONS

A. Main Findings

93. The main findings of this evaluation update study are summarized in Table 2 by each of the study objectives specified.

Table 2: Main findings of the Update Evaluation Study and Implications

Specific Objectives of the Study	Main Findings	Implications for ADB
(i) To determine the extent of adoption of the SES-2000 recommendations and to ascertain their continued relevance or otherwise in the current context.	Of the six recommendations made by SES-2000, the first (refine the ANRR Policy for sharper focus) and the fourth (support for less favorable environments) were fully adopted. The rest of the recommendations were not adopted or only partly adopted, especially those related to strengthening of ANRR and increasing the funding support. Most of the recommendations of SES-2000 continue to be relevant in the current context.	(i) Strategies and action plans for fully implementing of the recommendations (except the second one related to a two-pronged approach, paras. 21–22) of SES-2000 need to be developed. (ii) The funding support should be raised to at least $5 million per year in real terms as stipulated in the current ANRR Policy developed in 1995. Such increased funding support should be conditional on the implementation of strategies for effective utilization of RETA outputs. A higher level of support is desirable to effectively produce international public goods that are critical for addressing food insecurity and poverty while protecting the environment and mitigating the effects of global climate change. The level of funding of ANRR should be determined based on the potential impact of ANRR investment, priority areas identified in Strategy 2020, and ADB's overall positioning in the ANR sector.
(ii) To evaluate the relevance and effectiveness of ANRR support provided since 2000.	RETA projects are found to be relevant for addressing the key constraints to sustainable development. They were effective in achieving expected outputs and immediate purpose outcome. However, the full utilization of these outputs to generate eventual development impact will require time and concerted efforts from both ADB and DMC governments.	ADB should embark on a modality of supporting ANRR for addressing both short- and long-term issues. The current RETA project mode is appropriate for short-term activities such as (i) supporting adaptive research; (ii) promoting policy dialogue; (iii) developing the capacity of NARSs; and (iv) linking up with the regional centers, private sector, and ADB country operations. The long-term objectives are to support development of cutting-edge science and technology that has the potential to deliver a quantum leap in productivity to meet the current and future food demand of DMCs in an environmentally sustainable basis.
(iii) To examine the extent to which ADB has used ANRR products by	ADB has made partial use of RETA products in its program and project design, both at the sector and country operations levels.	(i) An outreach strategy needs to be developed to widely and effectively disseminate RETA outputs to ADB country operations, national

Specific Objectives of the Study	Main Findings	Implications for ADB
incorporating them in its country operations and by disseminating them widely within ADB, DMCs, and beyond.	Gaps include the absence of institutional linkages between RETA projects and ADB country operations, less effective use of RETA products within ADB, and inadequate support from ADB for technology scaling-up. There is, however, some evidence of the use of RETA outputs by DMCs and other development partners. Some of the activities initiated by RETA have been incorporated in other follow-up projects or have received continued support from other development partners. Some activities were also absorbed into the IARCs' core agendas. DMCs in general and low income DMCs like Nepal in particular, highly value the support provided by ADB funded RETAs.	governments, and other development partners. (ii) Approaches need to be developed to enhance the visibility/awareness of the RETA activities and to promote better linkages of these projects with ADB country operations. One of the ways this could be achieved is through including RETA projects in country partnership strategies. (iii) For ADB to position itself as an effective provider of knowledge solutions, an improved knowledge management system consisting of a central repository for technologies, knowledge products, and information generated by RETA should be established. Such a system should permit effective linkage with country operations, country partnership strategies, and other development activities for greater impact.
(iv) To assess the relevance of further support for ANRR in the context of current ANR issues, ADB's current corporate strategies, and the emerging international donor practices.	ADB's future support for ANRR is relevant and has potentially high rates of return in the context of current ANR issues. It is also relevant to ADB's current corporate strategy- Strategy 2020 and emerging international donor practices in supporting ANRR. Recent changes such as the relocation of the ANR focal point to the Agriculture and Rural Development and Food Security Unit in the Regional and Sustainable Development Department and the establishment of the research and development technical assistance are useful steps in right direction, which have potential to make ADB an effective supporter of ANRR which will ultimately contribute to achieving poverty reduction, environmental sustainability, and inclusive growth.	(i) The ANRR policy should be aligned more closely with the objectives, focus, and priorities of *Strategy 2020*. Such an updating is timely, given the major institutional changes, new aid modality for development effectiveness, and current developments in the ANR sector. (ii) Continue to provide support to IARCs with the proven track record of achieving scientific breakthroughs and translating those into tangible technology and knowledge products. In addition, funding opportunities should be opened to other regional private and nongovernment organizations. Alternative funding modalities including unrestricted funding and attributed funding should be evaluated to reduce the transaction costs while increasing the focus and relevance of ADB support.

ADB = Asian Development Bank, ANR = agriculture and natural resources, ANRR = agriculture and natural resources research, DMC = developing member country, IARC = international agricultural research center, NARS = National Agricultural Research Systems, RETA = regional technical assistance, SES-2000 = Special Evaluation Study in 2000.

94. Overall, RETA has made substantial contributions to the generation of improved technologies, knowledge, and information. Despite the relatively modest level of support, RETA has been able to leverage major efforts in scientific innovations of IARCs and NARSs.

RETA has also contributed to the overall capacity development of NARSs and the promotion of partnerships among various stakeholders, and has facilitated regional integration. The objectives of RETA projects have been relevant to address the key constraints to sustainable development. RETA outputs, especially those related to policies, have also influenced the broader design of agricultural development strategies of DMCs as well as of other development partners.

95. The evidence of positive contributions of RETA in terms of outputs produced is likely to generate long-term development impact. However, it will depend upon the extent of adoption of ANRR products by DMCs and other beneficiaries. There have not been in-depth studies to quantify adoption and impact in most cases. Methodological challenges exist for assessing the impact of resource management technologies, as the impact pathway is influenced by a suite of policy and institutional factors in addition to technology. The poor linkage of RETA with ADB country operations, the inadequate support from ADB and NARSs for technology scaling up, and insufficient dissemination of RETA products have appeared as weak areas needing improvement.

B. Recommendations

96. The following recommendations are put forward for consideration by ADB Management.

Recommendation	Responsibility
1. **Develop a strategy and an action plan for ANRR.** An update of the ANRR Policy and related guidelines is needed to align the objectives, focus, and emphasis more closely to *Strategy 2020,* international donor practices, and emerging concerns in the ANR sector.	SPD, RSDD, and regional departments.
2. **Support both short- and long-term research.** ADB should embark on supporting ANRR that clearly addresses both short- and long-term issues. The current RETA mode is appropriate for short-term activities. The long-term objectives are to support the development of cutting-edge science and technology that have the potential to deliver a quantum leap in productivity to meet the current and future food demands of DMCs on an environmentally sustainable basis.	SPD, RSDD, and regional departments
3. **Restore the level of ANRR funding.** Funding should be raised to at least $5 million per year in real terms as stipulated in the current ANRR Policy developed in 1995 and endorsed by SES-2000. A higher level of support is desirable to effectively produce international public goods that are critical for addressing food insecurity and poverty while protecting the environment and mitigating the effects of global climate change.	SPD, RSDD, and regional departments
4. Promote effective and wider utilization of ANRR products. ADB should develop a knowledge management system consisting of a central repository for cutting-age ANR technology related knowledge products, and an effective knowledge dissemination system to outreach and ensure effective linkages with country operations, and partnership with DMCs for greater development impact.	RSDD, and regional departments.

EVALUATION FRAMEWORK AND METHODOLOGY

1. The performance of support to agriculture and natural resources research (ANRR) was assessed on the basis of the relevance and effectiveness of regional technical assistance (RETA) outputs. The relevance of RETA projects at the time they were designed as well as their continued relevance was considered. Outcomes such as the use of RETA-generated technologies and of information and policy advice by ADB, national agencies, and other development partners were also considered. A full quantitative assessment of impact was not possible as most of the research projects funded by RETA after 2000 are still ongoing. Information from projects that were completed before 2000 but not included in SES-2000 was also utilized in this assessment.

2. The study was conducted using a combination of (i) document reviews, (ii) interviews with relevant ADB staff,[1] (iii) e-mail questionnaire surveys to RETA executing agencies (EAs)—the international agricultural research centers (IARCs), (iv) interviews and focus group discussions with RETA implementing agencies (IAs)—the national agricultural research systems (NARSs), and (v) case studies. These multiple sources of information were used for triangulation.

A. Document Review

3. Document reviews was one of the main source of information to determine the extent of adoption of the findings and recommendations of SES-2000 and to identify keys issues related to ADB support to ANRR, potential impact, and future opportunities. The reviews also included policies and strategies of IARCs and NARSs receiving RETA support, and recent achievements and performance particularly related to RETA projects since the completion of SES-2000. It helped identify the extent to which recent RETAs are aligned with the overall DMCs' country poverty reduction strategies and ADB country operations.

B. Client Survey of IARCs

4. Eleven IARCs supported during the evaluation period were included in the e-mail survey.[2] A structured questionnaire consisting mainly of open-ended questions, tailored to each IARCs, was emailed. A sample of the questionnaire sent to the International Maize and Wheat Improvement Center is provided in Table 1. The survey was aimed at soliciting comments on (i) the relevance of RETA projects, (ii) RETA processing and implementation procedures for ANRR, (iii) effectiveness of current modalities, (iv) likely alternative funding sources, (vi) RETA linkages with country operations and/or other development projects, and (v) adequacy or otherwise of RETA support for impact.

5. As most of these RETA projects are on-going, the main objectives of the survey were to obtain updates on the outputs, potential outcomes, and impact of the projects. Depending on project objectives, evaluation questionnaire was designed to link how research outputs contributed (or likely to contribute) towards reducing poverty in less favored environment in agro-ecological areas characterized by high incidences of rural poverty and if such benefits are sufficiently widespread (socially inclusive).

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[1] ADB staff included those working in the ANR sector and those outside the ANR sector from various departments at Headquarters and the Nepal Resident Mission.

[2] These include 11 centers: The World Vegetable Center (Asian Vegetable Research and Development Center [AVRDC]), International Center for Tropical Agriculture (CIAT, *Centro Internacional de Agricultura Tropical*), International Maize and Wheat Improvement Center (CIMMYT, *Centro Internacional de Mejoramiento de Maíz y Trigo*), International Center for Agricultural Research in the Dry Areas (ICARDA), International Crops Research Institute for Semi-Arid Tropics (ICRISAT), International Food Policy Research Institute (IFPRI), International Livestock Research Institute (ILRI), International Plant Genetic Resources Institute (IPGRI), International Rice Research Institute (IRRI), International Water Management Institute (IWMI), and the WorldFish Center (originally International Center for Living Aquatic Resources Management [ICLARM].

C. Informant Interviews with ADB Staff

6. A semi-structured questionnaire was used to interview ADB staff. ADB staff working in the ANR sector and those outside the ANR sector from regional and operations support departments at Headquarters and the Nepal Resident Mission was interviewed. Most staff involved in the RETA preparation and implementation was included in the interviewed. The main purpose of the interviews were to obtain staff perspectives on (i) adequacy and relevance of support, (ii) effectiveness of current modalities used, and (iii) suggestions for alternative means to support ANRR. This was used as one of the key sources of information for recommendations for future ADB support to ANRR. A sample of guide questions used in generating the information is provided in Table 2.

D. Case study on the national agricultural research systems

7. The Philippines and Nepal were selected for case studies to assess the nature of collaboration between the NARSs and IARCs for RETA implementation. Two national institutes—the Philippine Rice Research Institute (PhilRice) and the Nepal Agriculture Research Council (NARC) were included to represent one relatively strong and one relatively weak NARS. These two countries were selected to represent low and middle income countries. The evaluation team visited the both the NARSs and conducted key informant interview and focus group discussion with the over 50 senior officials, scientists and staff directly involved in implementations of the RETA projects.

Table A1: A Sample of Questionnaire Sent to IARCs

EVALUATION OF THE ASIAN DEVELOPMENT BANK'S SUPPORT FOR THE AGRICULTURAL AND NATURAL RESOURCES RESEARCH

International Maize and Wheat Improvement Center (CIMMYT)		**Approval Date**	**Expected Completion date**
RETA 5945	Sustaining the Rice-Wheat Production Systems in Asia	17 Oct. 2000	Dec. 2003
RETA 6005	Developing New Maize Germplasm Through Biotechnology for Resource Poor Farmers in Asia	6 Nov. 2001	Dec. 2004
RETA 6208	Improving Farmer's Income Through Enhanced Maize Productivities in Drought-Prone Environments in East and Southeast Asia	16 Dec. 2004	Dec. 2007

Note: RETA = regional technical assistance.

Please refer to the above list of RETA projects in answering the following questions.

1. For each RETA listed below, which outputs/technologies do you think would likely to have the most significant impact? (Please include the outputs/technologies of on-going projects also).

RETA Project No.	Outputs and Technologies	Reasons
RETA 5945		

RETA Project No.	Outputs and Technologies	Reasons
RETA 6005		
RETA 6208		

2. Please list technologies developed (i.e., breeding/varietal development, improved management technologies) that have been disseminated/on trial?

RETA Project No.	List of Technologies	Technologies ready to be used? (**Yes** or **No**)	Disseminated, on Trials, Don't know?	Countries where technologies have been disseminated or trials conducted?	Who disseminated/ conducted trials (your center, NARES or others?
RETA 5945	1.				
	2.				
	3.				
RETA 6005	1.				
	2.				
	3.				
RETA 6208	1.				
	2.				
	3.				

Note: NARES= National Agricultural Research and Extension Systems

3. Where RETA technologies have not yet been disseminated, what are the reasons for the non-dissemination?

RETA Project No.	Outputs and Technologies	Reasons for non-dissemination
RETA 5945		
RETA 6005		
RETA 6208		

4. If the RETA project had policy components, how effective have they been in achieving the desired outcomes?

RETA Project No.	List policy recommendations (if applicable)	Medium used for policy advocacy[1]	How has the policy facilitated in advancing research agenda in your institute?
RETA 5945			
RETA 6005			
RETA 6208			

[1] Examples of medium used to advance policy recommendation could be following: policy briefs, journal articles, policy dialogues with concerned stakeholders, workshops).

5. Have any of the policies been adopted by governments?

RETA Project No.	Name policies adopted (if applicable)	Countries	What have been the benefits?
RETA 5945			
RETA 6005			
RETA 6208			

6. If the RETA projects had developed regional research networks, have they been sustained after the completion of the RETA project funding completion?

RETA Project No.	Name of network developed (if applicable)	Purpose and benefits	Are they still in operation? (i.e. Yes or No)
RETA 5945			

RETA Project No.	Name of network developed (if applicable)	Purpose and benefits	Are they still in operation? (i.e. Yes or No)
RETA 6005			
RETA 6208			

7. If ADB had not provided support for the following RETA projects, would your institute have conducted those project related activities?

RETA project	Continue without RETA support? **Yes** or **No**	What would be your alternative funding source?	Value addition of ADB's support
RETA 5945			
RETA 6005			
RETA 6208			

8. What may be some implications for linking the RETA projects to ADB's country operations? Please explain your answer briefly.

_____
_____
_____
_____
_____

19. Are there on-going researches or proposed research activities that may be a follow-on of past RETA projects? (Please identify)

RETA Project linkage	On-going research / proposed project	Funding source

10. What three key factors would help ensure sustainability of outputs generated by RETA after the projects are completed?

a._____
_____
_____

b._____
_____
_____

c._____
_____
_____

11. Are there other research agencies/institutions that you have partnered with in addition to NAREs. Please identify briefly potential benefits of such partnership (i.e., state colleges and universities, NGOs, private sector, regional research agencies, development institutes).

Other Possible Partners	Possible benefits and concerns

NARES = National Agriculture Research and Extension Systems

12. How are countries and in particular NARES partners selected/identified for collaboration in the RETA projects? Please comment on selection criteria used.

a._____
_____
_____

b._____
_____
_____

c._____
_____
_____

13. Please provide comments/suggestions on how RETA project operations and management facilitate/hinder in achievement of the desired outcomes. Suggest any changes that you may consider would help improve.

a. ADB guideline for concept proposal and proposal preparation
_____
_____
_____

b. Project awarding and initiation
_____
_____
_____

c. Project monitoring and frequency of report submission

_____
_____
_____

d. Funding modality used

_____
_____
_____

e. Others

_____
_____
_____

14. Please indicate answers for the following questions.

	Always	Often	Never	Don't Know	Comments, if any.
i. Are the activities conducted for RETA projects an integral part of the core research mandate for your center?					
ii. Does any ADB staff other than the RETA Project officer contact you for information on the project?					
iii. Have the results of any of the RETA projects used to justify ADB country operations?					
iv. Are you aware of the ADB's country operations in the Agriculture and Natural resources sector?					
v. Do you visit ADB's country offices in countries where the RETA projects are implemented?					
vi. Once RETA project is completed, are you requested by ADB to present the results at seminar/workshop at ADB?					
vii. Are NAREs partners directly involved in the development of RETA project proposals?					

	Always	Often	Never	Don't Know	Comments, if any.
viii. In preparing a proposal for RETA, is it a standard practice to include a dissemination plan for results/technologies expected to be generated?					
ix. Are you aware of NARES partners using results of any of the RETA projects in the development of new research proposal?					
x. Are the RETA projects activities continued by NARES after the projects have been completed?					

15. Please list five priority research issues/themes that your institute may consider seeking funding from ADB in next 5-10 years?

Priority issues and themes	Reasons

16. Please indicate the reports submitted to ADB during the RETA project implementation? Please tick reports that apply.

RETA No. (Please list all as appropriate)	Yes/No	Reports
	___	Inception report
	___	Annual update
	___	Bi-annual update
	___	Mid-term project report
	___	Final report
	___	Others (pls. specify):

(Please send the reports submitted to ADB on the RETA projects, including the final report of completed ones in the list).

17. What purposes do these reports serve at ADB? Please identify at most three uses that you have knowledge about, or indicate **Don't Know** if you are not aware of any.

a._____
_____
_____

b._____
_____
_____

c._____
_____
_____

18. Has your institute conducted an impact assessment study on the research and technologies developed through any of the RETA Projects? If yes, please provide a brief account of the impact.

RETA No.	RETA Project Technologies	Brief Description of Impact
RETA 5945		
RETA 6005		
RETA 6208		

(We would appreciate receiving a copy of the impact reports).

Table A2: A Sample of Guide Questions Used During Key Informant Interviews and Focus Group Discussions

Objectives	Guide Questions	Required Information
(i) To determine the extent of adoption of the Special Evaluation Study (SES-2000)[a] recommendations and to ascertain their continued relevance or otherwise in the current context.	• What are the actions taken to address SES-2000 recommendations? • What are the reasons for non-adoption of some recommendations? • Are the recommendations still relevant and implementable given institutional restructuring and policy changes since the completion of the study? • Are the recommendations currently relevant and adequate given the emerging issues in the region in agriculture and natural resource (ANR) sector?	• Actions taken to address the recommendations. • Extent of adoption of recommendations and lessons identified in the SES-2000 • Rationale for the types of support provided for the Agriculture and Natural Resources Research (ANNR) since the SES-2000 • Possible constraints to non-adoption of the recommendations. This may include factors that are internal and/or external to the Asian Development Bank (ADB). • Regional ANR sector priority issues.
(ii) To determine the relevance and effectiveness of ANRR support provided since 2000 and key determinants of effectiveness.	• Have RETA projects supported ANR priority issues with high potential for large scale poverty alleviation in developing member countries? • How effective and relevant have the outputs of RETA projects been in contributing	• DMCs position and priorities for the ANR sector • Absorption capacity of the DMCs research institutional systems to make use of the RETA outputs. • ADB's decision making process

Objectives	Guide Questions	Required Information
	towards poverty reduction? • How balanced is the RETA portfolio of support for different components of the ANR sector (crop, livestock, resource management, and capacity development, policy research)? • To what extent have the post-2000 RETA projects followed the recommendations of the SES-2000? • How well does ADB determine the relevance and effectiveness of investments in cutting edge scientific endeavors?	for different RETA support • ADB's general and country - specific priorities for ANR.
(iii) To determine the extent to which ADB has used the findings of ANNR supported projects and included these in its country operations and/or contributed to knowledge dissemination.	• To what extent are ADB country operations linked to support provided under RETA projects? • Is RETA support in line with the ADB's Country Partner Strategies of select DMCs? • How are the findings of the ANRR supported projects disseminated? • To what extent are IARC mandate aligned with ANRR policy/ ADB's overall poverty reduction strategies? • Are the outputs of the RETA projects and other projects available in forms that are user-ready? Are there any bridging support provided to make the outputs user-ready when needed? • What are alternatives other than IARCs for producing the international public goods research for ANR sector?	• RETA projects link with ADB specific country operations • RETA projects and Regional departments operations that are linked. • Rationale and criteria for RETA project selection made by different departments. • IARCs mandate, policies and strategies. • Country priorities for research areas supported by RETA projects • Institutions other than IARCs for ANR research such as national systems, universities and other international institutes.

Objectives	Guide Questions	Required Information
(iv) To assess the future relevance of support for ANRR in the context of current ANR issues and ADB's current corporate strategies.	• What are some of the current issues in ANR sector that need to be reflected in any future support to ANNR policy? • How well does the ANRR policy of 1995 reflect the current ANR sector issues facing DMCs? • Does the current modality used to support ANNR aligned to aid effectiveness agenda as per the Paris Declaration? • How can ANRR be supported effectively in the context of new Long-tem Strategic Framework 2008–2020 *(Strategy 2020)*?	• Emerging ANR priority issues facing the ANR sector in the region. • Priority ANR issues for ADB and DMCs • Research priorities of IARCs and how it relates to the needs of ADB and DMCs. • Support to ANRR through IARCs that may contribute to the Paris Declaration agenda • LTSF 2008–2020's priorities for ANR sector and strategies to addressing them

SUPPORT PROVIDED FOR AGRICULTURE AND NATURAL RESOURCES RESEARCH BY ADB RETA, 1996–2007

TA No.	TA Name	Date	TA Amount ($'000)
A. CGIAR Centers			
1. Center for International Forestry Research			
RETA 5812[a]	Planning for Sustainability of Forest Through Adaptive Co-Management	22 Oct 1998	1,100
	Subtotal (A1)		**1,100**
2. International Center for Agricultural Research in the Dry Areas			
RETA 5866[b]	On-Farm Soil and Water Management for Sustainable Agricultural Systems in Central Asia	14 Oct 1999	1,200
RETA 6136[c]	Improving Rural Livelihoods Through Efficient On-Farm Water and Soil Fertility Management in Central Asia	11 Nov 2003	1,000
RETA 6439[d]	Enabling Policy Options for Sustainable Land Management in Central Asia, PRC, and Pakistan	18 Dec 2007	775
	Subtotal (A2)		**2,975**
3. The WorldFish Center (International Center for Living Aquatic Resources Management)			
RETA 5711[e]	Genetic Improvement of Carp Species in Asia	12 Dec 1996	1,300
RETA 5766[f]	Sustainable Management of Coastal Fish Stocks in Asia	29 Dec 1997	1,400
RETA 5945[g]	Strategies and Options for Increasing and Sustaining Fisheries and Aquaculture Production to Benefit Poor Households in Asia	17 Oct 2000	1,100
RETA 6136[c]	Integrating and Mobilizing Rice Knowledge to Improve and Stabilize Crop Productivity to Achieve Household Food Security in Diverse and Less Favorable Rain-Fed Areas of Asia	11 Nov 2003	950
	Subtotal (A3)		**4,750**
4. International Centre for Research in Agroforestry			
RETA 5711[e]	Policy Research for Sustainable Upland Systems	12 Dec 1996	1,200
	Subtotal (A4)		**1,200**
5. International Center for Tropical Agriculture			
RETA 5866[b]	Developing Sustainable Forage Technologies for Resource-Poor Upland Farmers in Asia	14 Oct 1999	1,200
RETA 6067[h]	Improving Livelihoods of Upland Farmers Using Participatory Approaches to Develop More Efficient Livestock Systems	6 Dec 2002	950
	Subtotal (A5)		**2,150**
6. International Crops Research Institute for the Semi-Arid Tropics			
RETA 5711[e]	Legume-Based Technologies for Rice and Wheat Production	12 Dec 1996	600
RETA 5812[a]	Improving Management of Natural Resources for Sustainable Rain-Fed Agriculture	22 Oct 1998	1,250
RETA 5945[g]	Rapid Crop Improvement for Poor Farmers in the Semiarid Tropics of Asia	17 Oct 2000	1,200
RETA 6067[h]	Participatory Watershed Management for Reducing Poverty and Land Degradation in the Semiarid Tropics	6 Dec 2002	1,300
RETA 6439[d]	Vulnerability to Climate Change: Adaptation Strategies and Layers of Resilience	18 Dec 2007	1,100
	Subtotal (A6)		**5,450**
7. International Food Policy Research Institute			
RETA 5866[b]	Irrigation Investment, Fiscal Policy, and Water Resource Allocation	14 Oct 1999	1,200
RETA 5945[g]	Breeding Iron-Rich Rice to Reduce Iron Deficiency Anemia in Asia	17 Oct 2000	1,300
RETA 6067[h]	Poverty Reduction through Advisory Network, Policy Research, and Capacity Strengthening in South Asia	6 Dec 2002	568
RETA 6376[i]	Promoting a Multi-Stakeholder Dialogue on New Strategies and Actions for Reducing Hunger and Poverty with a Focus on Agriculture and Rural Development in Asia	18 Dec 2006	500
	Subtotal (A7)		**3,568**
8. International Water Management Institute			
RETA 5812[a]	Development of Effective Water Management Institutions	22 Oct 1998	1,250
RETA 5945[g]	Pro-Poor Intervention Strategies in Irrigated Agriculture in Asia	17 Oct 2000	1,000
RETA 6208[j]	Enabling Communities in the Aral Sea Basin to Combat Land and Water Resource Degradation through the Creation of “Bright Spots”	16 Dec 2004	700
	Subtotal (A8)		**2,950**
9. International Livestock Research Institute			
RETA 5812[a]	Increasing Productivity of Crop-Livestock Systems in Asia	22 Oct 1998	1,000

TA No.	TA Name	Date	TA Amount ($'000)
RETA 6005[k]	Improving Crop-Livestock Production Systems in Rainfed Areas of Southeast Asia	6 Nov 2001	1,000
	Subtotal (A9)		**2,000**
10. International Maize and Wheat Improvement Center (*Centro Internacional de Mejoramiento de Maíz y Trigo*)			
RETA 5766[f]	Application of Biotechnology to Maize Improvement in Asia	12 Dec 1997	1,400
RETA 5945[g]	Sustaining the Rice-Wheat Production Systems in Asia	17 Oct 2000	1,200
RETA 6005[k]	Developing New Maize Germplasm Through Biotechnology for Resource Poor Farmers in Asia	6 Nov 2001	1,000
RETA 6208[j]	Improving Farmer's Income Through Enhanced Maize Productivities in Drought-Prone Environments in East and Southeast Asia	16 Dec 2004	750
	Subtotal (A10)		**4,350**
11. International Plant Genetic Resources Institute			
RETA 5766[f]	Coconut Genetic Resources Network and Human Resources Strengthening in Asia and the Pacific (Phase II)	29 Dec 1997	1,200
RETA 5866[b]	Conservation and Use of Native Tropical Fruit Species Biodiversity in Asia	14 Oct 1999	1,200
RETA 6005[k]	Developing Coconut-Based Income-Generating Technologies in Poor Rural Communities	6 Nov 2001	1,000
	Subtotal (A11)		**3,400**
12. International Potato Center			
RETA 5711[e]	Field Testing of True Potato Seed (Phase II)	12 Dec 1996	600
	Subtotal (A12)		**600**
13. International Rice Research Institute			
RETA 5667[l]	Asian Rice Biotechnology Network—From Products to Impact	9 Jan 1996	850
RETA 5711[e]	Exploiting Biodiversity for Sustainable Rice Pest Management	12 Dec 1996	1,500
RETA 5766[f]	Development and Use of Hybrid Rice in Asia	29 Dec 1997	1,500
RETA 5812[a]	Asian Rice Biotechnology Network: Achieving Impact and Sustainability	22 Oct 1998	1,000
RETA 6005[k]	Sustaining Food Security in Asia Through the Development of Hybrid Rice Technology	6 Nov 2001	1,000
RETA 6136[c]	Integrating and Mobilizing Rice Knowledge to Improve and Stabilize Crop Productivity to Achieve Household Food Security in Diverse and Less Favorable Rain-Fed Areas of Asia	11 Nov 2003	900
RETA 6208[j]	Enhancing Farmers' Income and Livelihoods through Integrated Crop and Resource Management in the Rice-Wheat System in South Asia	16 Dec 2004	700
RETA 6276[m]	Development and Dissemination of Water-Saving Rice Technologies in South Asia	2 Dec 2005	1,000
	Subtotal (A13)		**8,450**
14. International Service for National Agricultural Research			
RETA 5866[b]	Building Performance-Based Management Systems in the National Agricultural Research Systems in Asia	14 Oct 1999	800
	Subtotal (A14)		**800**
	Subtotal (A)		**43,743**
B. Other Centers and Organizations			
1. The World Vegetable Center (originally Asian Vegetable Research and Development Center)			
RETA 5680[n]	Establishment of a Vegetable Research Network for Cambodia, Lao People's Democratic Republic and Viet Nam	8 Apr 1996	600
RETA 5719[o]	RETA to AVRDC for South Asia Vegetable Research Network (Phase II)	10 Jan 1997	600
RETA 5839[p]	Collection, Conservation, and Utilization of Indigenous Vegetables	29 Mar 1999	550
RETA 6011[q]	Strengthening the Collaborative Vegetable Research Network in Cambodia, Lao PDR, and Viet Nam (Phase II)	17 Dec 2001	650
RETA 6067[h]	Promoting Utilization of Indigenous Vegetables for Improved Nutrition of Resource-Poor Households in Asia	6 Dec 2002	1,000
RETA 6208[j]	Improving Rural Livelihoods through Development of Vegetable-Based Post-Harvest Technologies in Cambodia, Lao People's Democratic Republic, and Viet Nam	16 Dec 2004	700
RETA 6376[i]	Supporting Pro-poor Vegetable Value Chains in Greater Mekong Subregion Countries	18 Dec 2006	490
	Subtotal (B1)		**4,590**
2. International Board for Soil Research and Management			
RETA 5803[r]	TA to the International Board for Soil Research and Management for the Catchment Approach to Managing Soil Erosion in Asia	13 Aug 1998	1,300
	Subtotal (B2)		**1,300**

TA No.	TA Name	Date	TA Amount ($'000)
3. International Centre for Integrated Mountain Development			
RETA 5784[s]	Appropriate Technology for Soil Conserving Farming Systems (Phase II)	23 Mar 1998	600
	Subtotal (B3)		**600**
4. Other Research Studies and Training[t]			
RETA 6208[j]	Workshops for Strengthening Partnerships for More Effective Planning, Research and Development in Agriculture in Mekong and Southeast Asia Regions	16 Dec 2004	150
	Subtotal (B4)		**150**
	Subtotal (B)		**6,640**
	Total (A+B)		**50,383**

ADB = Asian Development Bank, CGIAR = Consultative Group on International Agricultural Research, RETA = regional technical assistance.

[a] A component of ADB. 1998. *Technical Assistance for the Third Agriculture and Natural Resources Research at CGIAR Centers.* Manila (RETA 5812, for $5.6 million, approved on 22 October).

[b] A component of ADB. 1999. *Technical Assistance for the Fourth Agriculture and Natural Resources Research at CGIAR Centers.* Manila (RETA 5866, for $5.6 million, approved on 14 October).

[c] A component of ADB. 2003. *Technical Assistance for the Eighth Agriculture and Natural Resources Research at International Agricultural Research Centers.* Manila (RETA 6136, for $3.0 million, approved on 11 November).

[d] A component of ADB. 2007. *Technical Assistance for the Twelfth Agriculture and Natural Resources Research at International Agricultural Research Centers.* Manila (RETA 6439, for $2.0 million, approved on 18 December).

[e] A component of ADB. 1996. *Technical Assistance for the Agriculture and Natural Resources Research at CGIAR Centers.* Manila (RETA 5711, for $5.2 million, approved on 12 December).

[f] A component of ADB. 1997. *Technical Assistance for the Second Agriculture and Natural Resources Research at CGIAR Centers.* Manila (RETA 5766, for $5.5 million, approved on 29 December).

[g] A component of ADB. 2000. *Technical Assistance for the Fifth Agriculture and Natural Resources Research at CGIAR Centers.* Manila (RETA 5945, for $5.8 million, approved on 17 October).

[h] A component of ADB. 2002. *Technical Assistance for the Seventh Agriculture and Natural Resources Research at International Agricultural Research Centers.* Manila (RETA 6067, for $3.8 million, approved on 6 December).

[i] A component of ADB. 2006. *Technical Assistance for the Eleventh Agriculture and Natural Resources Research at International Agricultural Research Centers.* Manila (RETA 6376, for $1.0 million, approved on 18 December).

[j] A component of ADB. 2004. *Technical Assistance for the Ninth Agriculture and Natural Resources Research at International Agricultural Research Centers.* Manila (RETA 6208, for $3.0 million, approved on 16 December).

[k] A component of ADB. 2001. *Technical Assistance for the Sixth Agriculture and Natural Resources Research at CGIAR Centers.* Manila (RETA 6005, for $4.0 million, approved on 6 November).

l Component of ADB. 1996. *Technical Assistance to the International Rice Research Institute for the Asian Rice Biotechnology Network from Products to Impact*. Manila (RETA 5667, for $850,000, approved on 09 January).

[m] ADB. 2005. *Technical Assistance for the Tenth Agriculture and Natural Resources Research at International Agricultural Research Centers.* Manila (RETA 6276, for $1.0 million, approved on 2 December 2005.

[n] ADB. 1996. *Technical Assistance for the Establishment of a Vegetable Research Network in Cambodia, Lao PDR, and Viet Nam*. Manila (RETA 5680, for $600,000, approved on 8 April).

[o] ADB. 1997. *Technical Assistance for the South Asia Vegetable Research Network (Phase II)*. Manila (RETA 5719, for $600,000, approved on 10 January).

[p] ADB. 1999. *Technical Assistance for the Collection, Conservation, and Utilization of Indigenous Vegetables*. Manila (RETA 5839, for $550,000, approved on 29 March).

[q] ADB. 2001. *Technical Assistance for Strengthening the Collaborative Vegetable Research Network in Cambodia, Lao PDR, and Viet Nam (Phase II)*. Manila (RETA 6011, for $650,000, approved on 17 December).

[r] ADB. 1998. *Technical Assistance to the International Board for Soil Research and Mgt. for the Catchment Approach to Managing Soil Erosion in Asia*. Manila (RETA 5803, for $1.3 million, approved on 13 August).

[s] ADB. 1998. *Technical Assistance for the Appropriate Technology for Soil-Conserving Farming Systems (Phase I)*. Manila (RETA 5784, for $600,000, approved on 23 March).

[t] Executing agencies indicated.

Source: ADB. 2007. *Technical Assistance for the Twelfth Agriculture and Natural Resources Research at International Agricultural Research Centers*. Manila (RETA 6439, for $2 million, approved on 18 December).

DESCRIPTION OF THE FIFTH TO THE TWELFTH RETA PROJECTS

RETA/Project	Objectives	ANRR Agenda/s Addressed	Executing Agency (IARCs)	Implementing Agencies (NARS partners)	Expected Outputs
A. RETA 5945: Fifth ANRR at CGIAR Group[a]					
Sustaining the Rice-Wheat Production Systems of Asia	Develop system solutions for the site-specific productivity and sustainability problems of intensive rice-wheat cropping systems in the Indo-Gangetic Plains.	1,3,4,5,6	International Maize and Wheat Improvement Center (Centro Internacional de Mejoramiento de Maíz y Trigo [CIMMYT])	• BAN - Bangladesh Agricultural Research Council (BARC) • IND - Indian Council of Agricultural Research (ICAR) • NEP - Nepal Agriculture Research Council (NARC) • PAK - Pakistan Agricultural Research Council (PARC)	• Trained scientists • Research tools and aids (e.g., project information system, regional geographic information system atlas, etc.) • Publications on impact of policies on productivity and sustainability • Site-specific technologies
Strategies and Options for Increasing and Sustaining Fisheries and Aquaculture Production to Benefit Poor Households in Asia	Assist developing member countries (DMCs) in (i) developing appropriate strategies for helping poor (often landless) fisherfolk to escape poverty, and (ii) identfy appropriate fish species and technologies in aquaculture and fisheries management to increase fish production and improve the income and nutrition of poor fishers and fish farmers, and to protect fisheries resources.	1,3,4,5,6	WorldFish Center (originally International Center for Living Aquatic Resources Management)	• Study will require collaborative work among teams of fisheries specialists (national agriculture research system [NARSs]), economists, and extension workers in DMCs covered	• Policy guidelines and strategies for sustainable aquaculture development and fisheries management targeted to poorer households in Asia • Trained NARSs to do policy analysis and strategic planning • Fisheries database
Rapid Crop Improvement for Poor Farmers in the Semiarid Tropics	Reduce poverty by enhancing the production and productivity of the crops grown in semi-arid tropics, resulting in economic gains for the resource poor farming community; rapidly generate breeding materials with improved resistance to most important pests and diseases of sorghum, chickpea, and groundnut to enable NARS scientists to select	1,3,4,5	International Crops Research Institute for Semi-Arid Tropics (ICRISAT)	• BAN - Bangladesh Agricultural Research Institute (BARI) • PRC - Sorghum Research Institute, Oil Crops Research Institute, Institute of Crop Germplasm Resources • IND - National Research Centre for Sorghum	• High-yielding varieties of sorghum, chickpea, and groundnut • Marker-aided assistance tools associated with certain diseases/pests for breeding

RETA/Project	Objectives	ANRR Agenda/s Addressed	Executing Agency (IARCs)	Implementing Agencies (NARS partners)	Expected Outputs
	adapted high-yielding varieties in a shorter time.			• PAK - National Agricultural Research Centre • VIE - Viet Nam Agricultural Science Institute, Oil Plants Institute of Viet Nam	• Trained NARS staff and visiting scientists on use of genetic markers
Study on Pro-Poor Intervention Strategies in Irrigated Agriculture in Asia	Promote and catalyze equitable economic growth in rural areas through pro-poor irrigation interventions in participating DMCs. Immediate objective is to determine what can be done to improve the overall performance and sustainability of established irrigation schemes.	1,3,4,5,6	International Water Management Institute (IWMI)	• BAN - Bangladesh Institute of Development Studies, Bangladesh Unnayan Parishad • PRC - Chinese Academy of Agricultural Sciences (CAAS) • IND - Indian Council of Social Science Research, Agricultural Development and Rural Transformation Unit, Institute for Social and Economic Change • INO - Indonesian Irrigation Communication Network, Center for Irrigation Studies • PAK - PARC Water Resources Research Institute • VIE - Center for Irrigation and Water Supply Research, Viet Nam Institute for Water Resources Research	• Guidelines for pro-poor interventions and enabling policy and institutional framework to improve overall performance of irrigation systems
Breeding for Iron-Rich Rice to Reduce Iron Deficiency Anemia in Asia	(i) Carry-out agronomic research and human nutrition efficacy trials to increase the iron content of seed and iron bioavailability in rice diets; (ii) develop capacity of selected NARS for adapting iron-dense varieties to local growing conditions for eventual dissemination to farmers; (iii) support economic research to demonstrate feasibility and cost-	2,4,5	International Food Policy Research Institute (IFPRI) and International Rice Research Institute (IRRI)	• BAN - Bangladesh Rice research Institute (BRRI) • INO - Research Institute for Rice • PHI – Philippine Rice Research Institute (PhilRice) • VIE - Cuu Long Delta Rice Research Institute	• IR68-144 adoption trials completed and approved by 4 NARSs • Bioavailability studies show adequate iron stores related to consumption of iron-dense rice • Acceptance by consumers

RETA/Project	Objectives	ANRR Agenda/s Addressed	Executing Agency (IARCs)	Implementing Agencies (NARS partners)	Expected Outputs
	effectiveness of plant breeding strategy, prepare regional investment plan for rapid dissemination of seed technology into national production system.				• Trained NARS on adapting varieties to local conditions
B. RETA 6005: Sixth ANRR at CGIAR Centers[b]					
Developing New Maize Germplasm through Biotechnology for Resource-Poor Farmers in Asia	Advanced biotechnology research and varietal development in nine NARSs in six ADB DMCs to benefit resource-poor farmers in rainfed environments. Develop locally adapted high-yielding maize varieties with resistance to major diseases, tolerance for soil-related stresses, and improved nutritional value.	1,3,4,5,6	CIMMYT	• PRC - CAAS, Sichuan Agricultural University • IND - Indian Agricultural Research Institute • INO - Research Institute for Maize and Other Cereals • PHI - Institute of Plant Breeding, University of Mindanao • THA - Department of Agriculture • VIE - Maize Research Institute, Agricultural Genetics Institute	• Increase maize production by 15% by 2007 • Protect the environment through reduced pesticide use
Improving Crop-Livestock Production Systems in Rainfed Areas of Southeast Asia	(i) Use participatory approaches to spread appropriate technologies that enhance the productivity of crop-livestock systems; (ii) develop and recommend policy changes to improve market participation, competitiveness, and trade for smallholders and conduct policy dialogue with governments on these policy issues; (iii) continue to develop the capabilities of NARS to conduct independent research on crop livestock systems, and of extension workers to promote technology diffusion.	1,2,4,5,6	International Livestock Research Institute	• PRC - CAAS, Yunnan Beef Cattle and Pasture Research Centre, Sichuan Agricultural Bureau • INO - Central Research Institute of Animal Sciences, Research Institute for Animal Production, Garut Agricultural Services, Assessment Institute for Agricultural Technologies • PHI - Philippine Council for Agriculture, Forestry and Natural Resources Research and Development (PCARRD) • THA - Department of Livestock Development, Faculty of Agriculture • VIE - Institute of Agricultural Sciences of South Viet	• Farmer incomes increased by 30% due to technological advances in rainfed crop-livestock systems and better functioning livestock markets by 2006

RETA/Project	Objectives	ANRR Agenda/s Addressed	Executing Agency (IARCs)	Implementing Agencies (NARS partners)	Expected Outputs
				Nam; Department of Science, Technology and Environment	
Developing Sustainable Coconut-Based Income Generating Technologies in Poor Rural Communities	Develop sustainable coconut-based, income-generating technologies for resource-poor rural communities in eight DMCs in the Asia and Pacific region; promote the production and marketing of high-value coconut products, intercropping and livestock/fodder production, and production and marketing of quality planting materials.	1,3,4,5	International Plant Genetic Resources Institute	• BAN - Horticulture Research Centre • FIJ - Koronivia Research Station • INO - Central Research Institute for Estate Crops • IND - Central Plantation Crops Research Institute, Coconut Development Board • PNG - Cocoa and Coconut Research Institute, Cocoa and Coconut Extension Agency • PHI - Philippine Coconut Authority, Coconut Extension Training Center • SRI - Coconut Research Institute • VIE - Oil Plant Institute of Viet Nam, Department of Agricultural and Forestry Extension	• Increase income and food production from coconut-based farming; Increase coconut production • Increase conservation of coconut genetic diversity in rural areas
Sustaining Food Security in Asia through the Development of Hybrid Rice Technology	(i) Strengthen the capabilities of researchers and extension workers in nine DMCs by providing specialized training according to the specific needs of each country for developing and disseminating hybrid rice technology; (ii) strengthen the capabilities of private, public, and nongovernment organization-based seed enterprises by providing specialized training in hybrid rice seed production and marketing; (iii) strengthen government commitments, policy,	4,5,6	IRRI	• BAN - BRRI • IND - Directorate of Rice Research • INO - Central Research Institute for Food Crops PHI - PhilRice • SRI - Rice Research and Development Institute • VIE - Viet Nam Agricultural Sciences Institute • KOR - National Crop Experiment Station • MYN -Central Agricultural Research Institute • THA - Rice Research	• Policies strengthened to support government programs to expand areas planted to hybrid rice by 2006 • Hybrid rice yields increased by at least 15% by 2006 compared with standard varieties • Hybrid seed yields increased to 2.5 tons per hectare (ha) by 2006 compared with

RETA/Project	Objectives	ANRR Agenda/s Addressed	Executing Agency (IARCs)	Implementing Agencies (NARS partners)	Expected Outputs
					1.6 tons
	and financial support to promote hybrid rice research and development with policy makers.			Institute	per ha
C. RETA 6067: Seventh ANRR at IARCs[c]					
Improving Livelihoods of Upland Farmers Using Participatory Approaches to Develop More Efficient Livestock Systems	(i) Improve the sustainability of livelihoods of small farmers in the uplands through intensification of crop-livestock systems using farmer participatory approaches to improve and deliver forage and feeding technologies; and (ii) improve delivery mechanisms in participating DMCs for the dissemination of these technologies.	1,3,4,5	International Center for Tropical Agriculture (CIAT)	• CAM - National Animal Health and Production Investigation Centre • INO - Dinas Peternakan • LAO – National Agriculture and Forestry Research Institute • PRC - Chinese Academy of Tropical Agriculture Sciences • PHI - PCARRD • THA - Department of Livestock Development • VIE - National Institute of Animal Husbandry	• Within 10 years (by 2013): 30% reduction in poverty in crop-livestock farms in districts where the project operates
Participatory Watershed Management for Reducing Poverty and Land Degradation in the Semi-Arid Tropics	Scale up and sustain the benefits of improved watershed management by establishing 25 nucleus watersheds in four countries. Also, evaluate improved institutional and technological options to sustainably manage natural resources in the watershed	1,3,5,	ICRISAT	• IND - Central Research Institute for Dryland Agriculture, BAIF Research and Development Foundation, Indian Institute of Soil Sciences, M. Venkatarangaiya. Drought Prone Area Programme, Andrha Pradesh Rural Livelihood Project • VIE – Viet Nam Agricultural Sciences Institute • THA - International Water Management Institute, Department of Agriculture, Khon Kaen University • PRC - CAAS, Yunnan Academy of Agricultural Sciences, Hainan Academy of Agricultural Sciences	• Increased income of rural households • Increased water resources in watersheds • Increased productivity of rain-fed farms

RETA/Project	Objectives	ANRR Agenda/s Addressed	Executing Agency (IARCs)	Implementing Agencies (NARS partners)	Expected Outputs
Poverty Reduction through Advisory Network, Policy Research, and Capacity Strengthening in South Asia	Bring together policymakers and policy researchers, generate information through policy research, and strengthen local capacity for policy research and analysis in South Asia.	5,6	IFPRI	• BAN - Bangladesh Institute of Development Studies; • IND - Planning Commission, Indian Council for International Economic Relations, Indian Council for Agricultural Research, Ministry of Agriculture, Indira Gandhi Institute of Development Research, Centre for Economic and Social Change • NEP - NARC, Tribhuvan University • PAK - Pakistan Institute of Development Economics, Lahore University of Management Sciences	• Development of policy options aimed at reducing the number of poor, food insecure, and malnourished people in South Asia
Promoting Utilization of Indigenous Vegetables for Improved Nutrition Of Resource-Poor Households in Asia	Promote food security and good health in rural households of Asia and improve the nutrition of resource-poor households in Asia through enhanced utilization of indigenous vegetables.	4,5	World Vegetable Center (originally Asian Vegetable Research and Development Center [AVRDC])	• BAN - BARI • CAM - Kbal Koh Vegetable Station • INO - Research Institute for Vegetables • LAO - Hatdokkeo Horticulture Research Center • MAL - Malaysian Agricultural Research and Development Institute • PHI - National Plant Genetic Resources Laboratory (Univ. Phil.), Bureau of Plant Industry • THA - Tropical Vegetable Research (Kasetsart Univ.) • VIE – Viet Nam Agriculture and Science Institute, Research Institute for Fruits and Vegetables	• Enhance the role of indigenous vegetables for diversifying farm income and nutrition of resource-poor farmers

RETA/Project	Objectives	ANRR Agenda/s Addressed	Executing Agency (IARCs)	Implementing Agencies (NARS partners)	Expected Outputs
D. RETA 6136: Eighth ANRR at IARCs[d]					
Improving Rural Livelihoods through Efficient Farm Water and Soil Fertility Management in Central Asia	(i) Contribute to poverty reduction, food security, and conservation of natural resources in Central Asia by promoting diversified and sustainable agricultural production systems; and (ii) farmer's adoption of technological and institutional innovations that conserve soil and water, are input-use efficient, generate greater economic returns to rural households, and are sustainable.	1,3,5,6	International Center for Agricultural Research in Dry Areas (ICARDA)	• Project has a large NARS involvement, but no specific NARS were identified in the RETA	• Sustainable and remunerative farming systems for poor farmers and sustainable management of agricultural and natural resources
Integrating and Mobilizing Rice Knowledge to Improve and Stabilize Crop Productivity to Achieve Household Food Security in Diverse and Less Favorable Rain-Fed Areas of Asia	Improve food security and livelihoods of rice-growing farmers living in unfavorable rain-fed areas in monsoon Asia.	1,4,5	IRRI	• Project has a large NARS involvement but no specific NARS were identified in the RETA	• Better food security for poor farmers in the marginal and diverse rainfed environments in monsoon Asia through more sustainable and resilient rice-based production systems
Achieving Greater Food Security and Eliminating Poverty by Dissemination of Improved Carp Strains to Fish Farmers	Increase fish production and improve nutrition and income of small-scale fish farmers and poorer fish consumers	4,5	WorldFish Centers	• BAN - Bangladesh Fisheries Research Institute, Bureau of Socioeconomic Research and Training • PRC - Fisheries Research Centre • IND - ICAR, Central Institute for Freshwater Aquaculture, Central Inland Fisheries Research Institute • INO - Agency for Marine and Fisheries Research	• Improved nutritional status and economic conditions of fish farmers through the culture of improved and superior carp strains

RETA/Project	Objectives	ANRR Agenda/s Addressed	Executing Agency (IARCs)	Implementing Agencies (NARS partners)	Expected Outputs
				• THA - Department of Fisheries-Aquatic Animal Genetics Research and Development Institute, Fisheries Economic Division • VIE - Ministry of Fisheries-Research Institute for Aquaculture	
Regional Workshops on Agriculture and Natural Resources Research in the Central and South Asian Region	(i) Advance the process of regional and subregional cooperation in agriculture by sharing information and successful technologies; (ii) reinforce partnerships and commitment among IARCs, NARSs, and ADB so as to focus agricultural research on eradicating poverty.	6	Asian Development Bank (ADB)	• ADB Regional Workshop	• Workshop
E. RETA 6208: Ninth ANRR at IARCs[e]					
Improving Rural Livelihoods through Development of Vegetable-Based Post-Harvest Technologies in Cambodia, Lao People's Democratic Republic (Lao PDR), and Viet Nam	(i) Reduce poverty, enhance rural economic development, and improve food security in Cambodia, Lao PDR, and Viet Nam by promoting the vegetable postharvest sector; (ii) reduce postharvest losses of high volume, high value commodities; and (iii) develop and promote low-cost, postharvest technologies in collaboration with both public and private sectors.	1,4,5	World Vegetable Center	• CAM - Ministry of Agriculture, Forestry and Fisheries • LAO - Ministry of Agriculture and Forestry • VIE - Ministry of Agriculture and Rural Development, Research Institute of Fruits and Vegetables	• Reduced postharvest losses of high-volume, high-value vegetable crops • Low-cost postharvest technologies with the public and private sectors
Improving Farmers' Income through Enhanced Maize Productivities	Increase and stabilize maize productivity in five major tropical maize-growing countries of East and Southeast Asia by developing and enhancing the capacity of NARSs to develop and deliver stress tolerant, high-	4,5	CIMMYT	• INO - Indonesian Center for Food Crops Research and Development • PRC - Yunnan Academy of Agricultural Science • PHI - Department of Agriculture	• Increase maize productivity in stressed areas

RETA/Project	Objectives	ANRR Agenda/s Addressed	Executing Agency (IARCs)	Implementing Agencies (NARS partners)	Expected Outputs
in Drought-Prone Environments in East and Southeast Asia	yielding maize varieties for drought prone areas.			• THA - Nakhon Sawan Field Crops Research Center • VIE - National Maize Research Institute	
Enhancing Farmer's Income and Livelihoods through Integrated Crop and Resource Management in the Rice-Wheat System in South Asia	Reduce rural poverty, improve farmers' livelihoods, and promote resource conservation in rice-based cropping systems in South Asia.	1,3,4,5	IRRI	• BAN - BRRI, BARI • IND - Department of Agriculture, Haryana Agricultural University, Baranas Hindu University • NEP - NARC, Regional Agricultural Station • PAK - National Agricultural Research Center, On-farm Water Management	• Increased farm productivity in rice-wheat systems in four South Asia DMCs
Enabling Communities in the Aral Sea Basin to Combat Land and Water Resource Degradation through the Creation of "Bright Spots"	Reduce poverty, improve food security at the household level, and enhance environmental security by developing and promoting strategies that enhance the productivity of existing irrigated farming systems in Central Asia.	1,3,5	IWMI	• KAZ - Scientific Research Institute of Water Economy TAJ - Irrigation Research Institute of Hydraulic Engineering and Amelioration • TKM - Soil Institute of the Ministry of Agriculture • UZB - Central Asian Institute of Irrigation, Ministry of Agriculture and Water Resources, Tashkent Institute of Irrigation and Agriculture Mechanization Engineers	• Innovative technologies that enhance productivity and income generation opportunities for disadvantaged farmers
Workshop for Strengthening Partnership for More Effective Planning, Research and Development in Agriculture	Identify practical options for effective collaboration and information exchange among stakeholders in agriculture sector planning, research, and development.	6	ADB	• DMCs	• Workshop

RETA/Project	Objectives	ANRR Agenda/s Addressed	Executing Agency (IARCs)	Implementing Agencies (NARS partners)	Expected Outputs
in Mekong and Southeast Asia Regions					
F. RETA 6276: Tenth ANRR at IARCs[f]					
Development and Dissemination of Water-Saving Rice Technologies in South Asia	Enhance food and income securities of rural and urban population, and improved environmental sustainability of rice production systems in water-short and drought prone areas of South Asia through (i) enhanced rice productivity in water-short regions, (ii) improved water use efficiency in rice production, and (iii) water saving rice technologies.	1,3,4,5	IRRI	• IND - Tamil Nadu Agricultural University • NEP - NARC • PAK - Pakistan Rice Research Institute • BAN - BRRI	• Increased rice yields in project areas (30%) • Widespread adoption of water saving technologies (50% in target areas) • Increased water savings (30%) • Strengthened NARSs
G. RETA 6376: Eleventh ANRR at IARCs[g]					
Supporting Pro-Poor Vegetable Value Chains in Greater Mekong Subregion (GMS)	Increase incomes of farmer households and reduce rural poverty for vegetable growers in upland rural areas of the GMS countries. Expand pro-poor agricultural research and dissemination with regards to postharvest operations and processing technologies for vegetable commodities.	1,4,5	World Vegetable Center	• VIE - Ministry of Agriculture and Rural Development, Research Institute of Fruits and Vegetables • CAM - Ministry of Agriculture, Forestry, and Fisheries • LAO - Ministry of Agriculture and Forestry	• Reduction of postharvest losses of vegetable commodities by 20% • Expanded pro-poor agricultural research and dissemination
Promoting a Multi-Stakeholder Dialogue on New Strategies and Actions for Reducing Hunger and Poverty with a Focus on Agriculture and Rural	Contribute towards increasing incomes of farmer households and reducing rural poverty and hunger in Asia.	6	IFPRI	• DMCs	• Knowledge-based on international experience with strategies and actions for reducing hunger and poverty • High-level policy forum on the role of agriculture and rural development • Global conference on "Halving Hunger and Poverty Is Not

RETA/Project	Objectives	ANRR Agenda/s Addressed	Executing Agency (IARCs)	Implementing Agencies (NARS partners)	Expected Outputs
Development in Asia				•	Enough: New Strategies and Actions beyond the MDGs" • Follow-up strategic briefings at ADB and key Asian institutions
H. RETA 6439: Twelfth ANRR at IARCs[h]					
Enabling Policy for Sustainable Land Managament in Central Asia, Pakistan, and the People's Republic of China	Contribute to improved soil and water management, increased agricultural productivity, and reduced poverty and malnutrition in the rural areas of Central Asia, Pakistan, and PRC.	1,3,5,6	ICARDA	• KAZ - Kazakh Research Institute of Soil Sciences • KYZ - Kyrghz Research Institute of Agriculture • TAJ - Tajik Research Institute of Soil Sciences • TKM - National Institute of Deserts, Flora and Fauna • UZB - Central Asian Research Institute of Irrigation • PRC - CAAS • PAK – PARC	• Reduced rural poverty, increased rural household incomes and welfare • Reduced land degradation and increase agricultural growth
Vulnerability to Climate Change: Adaptation Strategies and Layers of Resilience	Provide science-based solutions and pro-poor approaches for adoption of agricultural systems to climate change for rural poor and most vulnerable farmers in semi-arid regions of Asia, especially of India, PRC, Sri Lanka, Bangladesh, and Pakistan.	6	ICRISAT	• IND - Central Research Institute for Dryland Agriculture • PRC - CAAS • SRI - Council for Agricultural Research Policy • BAN - Center for Policy Dialogue • PAK - PARC	• Identify and prioritize the sectors most at risk and develop gender-equitable agricultural adaptation and mitigation strategies

ANRR = agriculture and natural resources research, BAN = Bangladesh, CAM = Cambodia, CGIAR = Consultative Group on International Agricultural Research, DMC = developing member country, FIJ = Fiji Islands, IARC = international agricultural research center, IND = India, INO = Indonesia, KAZ = Kazakhstan, KOR = Republic of Korea, KYZ = Kyrgyz Republic, LAO = Lao People's Democratic Republic, MDG = Millennium Development Goal, MYN = Myanmar, NARS = national agricultural research system, NEP = Nepal, PAK = Pakistan, PHI = Philippines, PNG = Papua New Guinea, PRC = People's Republic of China, RETA = regional technical assistance, SRI = Sri Lanka, THA = Thailand, TKM = Turkmenistan, UZB = Uzbekistan, VIE = Viet Nam.

[a] ADB. 2000. *Technical Assistance for the Fifth Agriculture and Natural Resources Research at CGIAR Centers.* Manila (RETA 5945, for $5.8 million, approved on 17 October).

[b] ADB. 2001. *Technical Assistance for the Sixth Agriculture and Natural Resources Research at CGIAR Centers.* Manila (RETA 6005, for $4.0 million, approved on 6 November).

[c] ADB. 2002. *Technical Assistance for the Seventh Agriculture and Natural Resources Research at International Agricultural Research Centers.* Manila (RETA 6067, for $3.8 million, approved on 6 December).

[d] ADB. 2003. *Technical Assistance for the Eighth Agriculture and Natural Resources Research at International Agricultural Research Centers.* Manila (RETA 6136, for $3.0 million, approved on 11 November).
[e] ADB. 2004. *Technical Assistance for the Ninth Agriculture and Natural Resources Research at International Agricultural Research Centers.* Manila (RETA 6208, for $3.0 million, approved on 16 December).
[f] ADB. 2005. *Technical Assistance for the Tenth Agriculture and Natural Resources Research at International Agricultural Research Centers.* Manila (RETA 6276, for $1.0 million, approved on 2 December 2005.
[g] ADB. 2006. *Technical Assistance for the Eleventh Agriculture and Natural Resources Research at International Agricultural Research Centers.* Manila (RETA 6376, for $1.0 million, approved on 18 December).
[h] ADB. 2007. *Technical Assistance for the Twelfth Agriculture and Natural Resources Research at International Agricultural Research Centers.* Manila (RETA 6439, for $2.0 million, approved on 18 December).

Note: ANRR agendas:
(1) Sustainable and Renumerative Farming Systems for Poor Farmers
(2) Enhancing the Incomes and Living Standards of Rural Women
(3) Sustainable Management of Agricultural and Natural Resources
(4) Enhancing the Productivity of Agriculture
(5) Enhancing the Capacity of NARSs
(6) Public Policy and Socioeconomic Research

Source: Summarized from the technical assistance proposal for the various RETA projects.

ANRR PROJECTS FINANCED BY ADB AND PARTNERS, 2000–2007

Project Name	IARC	DMC Coverage	Amount Provided ($ '000) ADB	IARC	NARSs	Others	Total Project Cost
A. RETA 5945: Fifth ANRR at CGIAR Centers[a] (Oct 2000 to Dec 2007)							
1. Sustaining the Rice Wheat Production Systems of Asia	CIMMYT	BAN, IND, NEP, PAK	1,200	900	200	200	2,500
2. Strategies and Options for Increasing and Sustaining Fisheries and Aquaculture Production to Benefit Poor Households in Asia	ICLARM	BAN, PRC, IND, INO, MAL, PHI, SRI, THA, VIE	1,100	635	375	0	2,110
3. Rapid Crop Improvement for Poor Farmers in the Semiarid Tropics of Asia	ICRISAT	BAN, PRC, IND, PAK, VIE	1,200	1,310	990	0	3,500
4. Breeding for Iron-Rich Rice to Reduce Iron Deficiency Anemia in Asia	IFPRI/IRRI	BAN, INO, PHI, VIE	1,300	595	160	922	2,977
5. Pro-Poor Intervention Strategies in Irrigated Agriculture in Asia	IWMI	BAN, PRC, IND, INO, PAK, VIE	1,000	480	480	0	1,960
Subtotal			**5,800**	**3,920**	**2,205**	**1,122**	**13,047**
B. RETA 6005: Sixth ANRR at CGIAR Centers[b] (Nov 2001 to Sept 2005)							
1. Developing Sustainable Coconut-Based Income-Generating Technologies in Poor Rural Communities	IPGRI	BAN, FIJ, IND, INO, PNG, PHI, SRI, VIE	1,000	666	1,060	274	3,000
2. Improving Crop-Livestock Production Systems in Rainfed Areas of Southeast Asia	ILRI	PRC, INO, PHI, THA, VIE	1,000	795	940	780	3,515
3. Sustaining Food Security in Asia through the Development of Hybrid Rice Technology	IRRI	BAN, IND, INO, PHI, SRI, VIE, KOR, MYA	1,000	470	890	470	2,830
4. Developing New Maize Germplasm through Biotechnology for Resource-Poor Farmers in Asia	CIMMYT	PRC, IND, INO, PHI, THA, VIE	1,000	900	720	180	2,800
Subtotal			**4,000**	**2,831**	**3,610**	**1,704**	**12,145**

Project Name	IARC	DMC Coverage	Amount Provided ($ '000) ADB	IARC	NARSs	Others	Total Project Cost
C. RETA 6067: Seventh ANRR at IARCs[c] (Dec 2002 to Jun 2008)							
1. Asian Vegetable Research and Development Center	AVRDC	BAN, CAM, INO, LAO, MAL, PHI, THA, VIE	1,000	1,000	1,000	0	3,000
2. Centro Internacional de Agricultura Tropical	CIAT	CAM, PRC, INO, LAO, PHI, THA, VIE	950	300	855	0	2,105
3. International Crops Research Institute for the Semi-Arid Tropics	ICRISAT	PRC, IND, THA, VIE	1,300	700	800	0	2,800
4. International Food Policy Research Institute	IFPRI	BAN, BHU, IND, NEP, PAK, SRI	568	257	0	527	1,352
Subtotal			**3,818**	**2,257**	**2,655**	**527**	**9,257**
D. RETA 6136: Eight ANRR at IARCs[d] (Nov 2003 to Dec 2007)							
1. Improving Rural Livelihoods Through Efficient On-Farm Water and Soil Fertility Management in Central Asia	ICARDA	KAZ, KGZ, TAJ, TKM, UZB	1,000	763	322	0	2,085
2. Integrating and Mobilizing Rice Knowledge to Improve and Stabilize Crop Productivity to Achieve Food Security in Diverse and Less Favorable Rain-fed Areas of Asia	IRRI	BAN, IND, INO, LAO, PHI, THA, VIE	900	2,245	1,360	0	4,505
3. Achieving Greater Food Security and Eliminating Poverty by Dissemination of Improved Carp Species to Fish Farmers	WorldFish	BAN, PRC, IND, INO, THA, VIE	950	400	300	0	1,650
4. Regional Workshops on Agriculture and Natural Resources Research in the Central and South Asian Regions	RSAN	Central and South Asia	150	0	0	0	150
Subtotal			**3,000**	**3,408**	**1,982**	**0**	**8,390**
E. RETA 6208: Ninth ANRR at IARCs[e] (Dec 2004 to Dec 2008)							
1. Improving Rural Livelihoods Through Development of Vegetable-Based Post-Harvest Technologies	AVRDC	CAM, LAO, VIE	700	600	250		1,550

Project Name	IARC	DMC Coverage	Amount Provided ($ '000) ADB	IARC	NARSs	Others	Total Project Cost
2. Improving Farmers' Income Through Enhanced Maize Productivities in Drought-Prone Environments in East and Southeast Asia	CIMMYT	INO, PHI, PRC, THAI, VIE	750	737	400		1,887
3. Enhancing Farmers' Income and Livelihoods through Integrated Crop and Resource Management in the Rice-Wheat System in South Asia	IRRI	BAN, IND, NEP, PAK	700	760	577		2,037
4. Enabling Communities in the Aral Sea Basin to Combat Land and Water Resource Degradation Through the Creation of "Bright Spots"	IWMI	KAZ, TAJ, TKM, UZB	700	616	24		1,340
5. Workshops for Strengthening Partnerships for More Effective Planning, Research, and Development in Agriculture in Mekong and Southeast Asia	RSAN	GMS and Southeast Asia	150	0			150
Subtotal			**3,000**	**2,713**	**1,251**	**0**	**6,964**
F. RETA 6276: Tenth ANRR at IARCs[f] (Dec 2005 to Dec 2008)							
1. Development and Dissemination of Water-Saving Rice Technologies in South Asia	IRRI	BAN, IND, NEP, PAK	**1,000**	**566**	**740**		**2,306**
Percent			43	25	32	0	100
G. RETA 6376: Eleventh ANRR at IARCs[g] (Dec 2006 to Dec 2009)							
1. Supporting Pro-poor Vegetable Value Chains in Greater Mekong Subregion Couintries	AVRDC	CAM, LAO, VIE	500	155	20		675
2. Promoting a Multi-stakeholder Dialogue on New Strategies and Action for Reducing Hunger and Poverty with Focus on Agriculture and Rural Development in Asia	IFPRI	PRC	500	125	0		625
Subtotal			**1,000**	**280**	**20**	**0**	**1,300**
Percent			77	22	2	0	100
H. RETA 6439: Twelfth ANRR at IARCs[h] (Dec 2007 to Dec 2010)							
1. Enabling Policy Options for Sustainable Land Management in Central Asia	ICARDA	Central Asia, PAK, PRC	775	227	126		1,128
2. Vulnerability to Climate Change: Adaptation Strategies and Layers of Resilience	ICRISAT	IND, SRI, BAN	1,100	260	250		1,610
3. ADB ANRR Capacity Development	ADB		125	0	0		125

Project Name	IARC	DMC Coverage	Amount Provided ($ '000) ADB	IARC	NARSs	Others	Total Project Cost
Subtotal			**1,875**	**487**	**376**	**0**	**2,738**

ADB = Asian Development Bank; ANRR = agriculture and natural resources research; AVRDC = Asian Vegetable Research and Development Center (now the World Vegetable Center); BAN = Bangladesh; BHU = Bhutan; CAM = Cambodia; CGIAR = Consultative Group on International Agricultural Research, CIAT = Centro Internacional de Agrcultura Tropical; CIMMYT = Centro Internacional de Mejoramiento de Maíz y Trigo (International Maize and Wheat Improvement Center); DMC = developing member country; FIJ = Fiji Islands; GMS = Greater Mekong Subregion; IARC = international agricultural research center; ICARDA = International Center for Agricultural Research in the Dry Areas; ICLARM = International Center for Living Aquatic Resources Management (now the WorldFish Center); ICRAF = International Centre for Research on Agroforestry; ICRISAT = International Crops Research Institute for the Semi-Arid Tropics; IFPRI = International Food Policy Research Institute; ILRI = International Livestock Research Institute; IND = India; INO = Indonesia; IPGRI = International Plant Genetic Resources Institute; IRRI = International Rice Research Institute; IWMI = International Water Management Institute; KAZ = Kazakhstan; KGZ = Kyrgyz Republic; KOR = Republic of Korea; LAO = Lao People's Democratic Republic; MAL = Malaysia; MYA = Myanmar; NARS = national agriculture research system; NEP = Nepal; PAK = Pakistan; PHI = Philippines; PNG = Papua New Guinea; PRC = People's Republic of China; RETA = regional technical assistance; RSAN = Agriculture, Natural Resources, and Social Sectors Division, Regional and Sustainable Development Department; SRI = Sri Lanka; TAJ = Tajikistan; THA = Thailand; TKM = Turkmenistan; UZB = Uzbekistan; VIE = Viet Nam; WorldFish = WorldFish Center (originally International Center for Living Aquatic Resources Management [ICLARM]).

[a] ADB. 2000. *Technical Assistance for the Fifth Agriculture and Natural Resources Research at CGIAR Centers.* Manila (RETA 5945, for $5.8 million, approved on 17 October).

[b] ADB. 2001. *Technical Assistance for the Sixth Agriculture and Natural Resources Research at CGIAR Centers.* Manila (RETA 6005, for $4.0 million, approved on 6 November).

[c] ADB. 2002. *Technical Assistance for the Seventh Agriculture and Natural Resources Research at International Agricultural Research Centers.* Manila (RETA 6067, for $3.8 million, approved on 6 December).

[d] ADB. 2003. *Technical Assistance for the Eighth Agriculture and Natural Resources Research at International Agricultural Research Centers.* Manila (RETA 6136, for $3.0 million, approved on 11 November).

[e] ADB. 2004. *Technical Assistance for the Ninth Agriculture and Natural Resources Research at International Agricultural Research Centers.* Manila (RETA 6208, for $3.0 million, approved on 16 December).

[f] ADB. 2005. *Technical Assistance for the Tenth Agriculture and Natural Resources Research at International Agricultural Research Centers.* Manila (RETA 6276, for $1.0 million, approved on 2 December 2005.

[g] ADB. 2006. *Technical Assistance for the Eleventh Agriculture and Natural Resources Research at International Agricultural Research Centers.* Manila (RETA 6376, for $1.0 million, approved on 18 December).

[h] ADB. 2007. *Technical Assistance for the Twelfth Agriculture and Natural Resources Research at International Agricultural Research Centers.* Manila (RETA 6439, for $2.0 million, approved on 18 December).

Source: Asian Development Bank project files.

RETA MANAGEMENT

RETA	TA No.	ADB Department/Division Responsible
5th RETA[a]	RETA 5945	EARD/EAAE
6th RETA[b]	RETA 6005	CWRD/CWAE
7th RETA[c]	RETA 6067	EARD/EAAE
8th RETA[d]	RETA 6136	SERD/SEAE
9th RETA[e]	RETA 6208	SARD/SANS
10th RETA[f]	RETA 6276	SARD/SANS
11th RETA[g]	RETA 6376	EARD/EAAE
12th RETA[h]	RETA 6439	EARD/EAAE

ADB = Asian Development Bank; CWAE = Agriculture, Environment, and Natural Resources Division (CWRD); CWRD = Central and West Asia Department; EAAE = Agriculture, Environment, and Natural Resources Division (EARD); EARD = East Asia Department; RETA = regional technical assistance; SANS = Agriculture, Natural Resources, and Social Services Division; SARD = South Asia Department; SEAE = Agriculture, Environment, and Natural Resources Division (SERD); SERD = Southeast Asia Department.

[a] ADB. 2000. *Technical Assistance for the Fifth Agriculture and Natural Resources Research at CGIAR Centers.* Manila (RETA 5945, for $5.8 million, approved on 17 October).

[b] ADB. 2001. *Technical Assistance for the Sixth Agriculture and Natural Resources Research at CGIAR Centers.* Manila (RETA 6005, for $4.0 million, approved on 6 November).

[c] ADB. 2002. *Technical Assistance for the Seventh Agriculture and Natural Resources Research at International Agricultural Research Centers.* Manila (RETA 6067, for $3.8 million, approved on 6 December).

[d] ADB. 2003. *Technical Assistance for the Eighth Agriculture and Natural Resources Research at International Agricultural Research Centers.* Manila (RETA 6136, for $3.0 million, approved on 11 November).

[e] ADB. 2004. *Technical Assistance for the Ninth Agriculture and Natural Resources Research at International Agricultural Research Centers.* Manila (RETA 6208, for $3.0 million, approved on 16 December).

[f] ADB. 2005. *Technical Assistance for the Tenth Agriculture and Natural Resources Research at International Agricultural Research Centers.* Manila (RETA 6276, for $1.0 million, approved on 2 December 2005.

[g] ADB. 2006. *Technical Assistance for the Eleventh Agriculture and Natural Resources Research at International Agricultural Research Centers.* Manila (RETA 6376, for $1.0 million, approved on 18 December).

[h] ADB. 2007. *Technical Assistance for the Twelfth Agriculture and Natural Resources Research at International Agricultural Research Centers.* Manila (RETA 6439, for $2.0 million, approved on 18 December).

Source: Technical assistance proposal for the various RETA.

RECOMMENDATIONS MADE BY SES-2000 AND ASSESSMENT OF IMPLEMENTATION

SES-2000 Recommendations	Extent of Adoption
1. ANRR Research Agenda. The ANRR Policy agenda should be refined and closely focus on sustainable farming systems for poor farmers; sustainable management of agricultural and natural resources; enhancement of agricultural productivity; strengthening of NARSs; and promoting public policy and socioeconomic research.	• A guideline paper was issued in 2003 in response to these concerns. These guidelines for project proposal submissions clarified ADB's requirements in research proposals and provided structure to the project selection process. The purpose was also to help ensure relevance of priority research areas (ADB ANRR Policy) for ADB support. • The specific objectives of the guidelines are to provide clarity in terms of what is required in IARC research project proposals, outline how ADB will evaluate and select the proposals to be funded, and describe how projects are expected to be implemented and monitored.
2. ANRR Implementation Strategies. ADB should adopt a two-pronged approach to ANRR: (i) RETA projects (for IARCs) should focus on cutting-edge research with the objective of bringing about another quantum jump in yield and productivity in agricultural production; (ii) IARCs should receive continuous support for networking projects for effective dissemination of results to NARSs. ADB should provide loans and TA funding for NARSs, universities, and NGOs, to focus adaptive research based on local needs and production factors.	• This has not been done. Instead there has been some use of ADB trust funds to accomplish this, often not associated directly with a loan but to provide information of use to ADB for future operations. • A positive step in the implementation was made, however. Since 2002 (7th RETA), following the recommendation made in the SES, funding for both CGIAR and non-CGIAR centers has been integrated into a single RETA. • IARCs have not received continuous support from ADB for networking projects for effective dissemination once the project has concluded. ADB has also failed to provide loan or TA funding for NARSs, universities, and NGOs to focus on adaptive research and dissemination of proven agricultural technologies developed from IARCs.
3. Funding Modality. ADB should continue the current restrictive funding modality but adopt a cluster TA project processing approach, providing TA funding of about $20 million in real terms once every 3 years to IARCs and NARSs.	• This has not been followed; in fact, funding for ANRR declined precipitously from $5.8 million in 2000 to $1 million in 2005 and 2006 and $2 million in 2007. • ADB RETA funding did not follow the recommended $20 million (in real terms) every 3 years level as suggested by the SES.

2000 ANRR SES Recommendations	Extent of Adoption
4. Geographic Focus. Focus of research should be in agro-ecological areas characterized by a high incidence of poverty. Research should continue to target crops and livestock grown under less-favorable environments within these geographic regions.	• This was done through the ADB Guidelines paper and proposals quickly emphasized theses priority areas. • Since 2000, ADB has supported research on (i) crop varietal improvement; (ii) crop management systems; (iii) germplasm research, etc. targeted to less-favorable areas with high incidence of poverty.
5. Strengthening of ADB's Institutional Capacity to Administer, Supervise, Monitor, and Promote ANRR. ADB has no line staff position designated as the point person for ANRR. It is recommended that AED and AWD jointly create a lead ANRR specialist position to formally oversee, supervise, and act as focal person for all ANRR activities.	• This has not been done in terms of staffing, funding, or revised incentive structure within ADB to encourage internal development of this capacity. • With the dissolution of RSAN, project implementation of the ANRR RETA projects was spread over the regional departments. ADB has not appointed a line staff or a focal person to formally oversee and manage all ANRR activities.
6. Adequate Government Funding for NARSs. ADB's agriculture and programs departments should undertake active policy dialogue with DMCs during ADB's annual country programming mission and other policy dialogue missions to ensure that DMC governments give significant emphasis to ANRR and to provide adequate staff and financial resources for ANRR activities.	• No direct evidence was found that this was an ADB priority area during these dialogues. DMC and ADB funding for ANRR is now on a downward trend, as is funding for ANRR development.

ADB = Asian Development Bank; AED = Agriculture East Department; ANRR = agriculture and natural resources research; AWD = Agriculture West Department; CGIAR = Consultative Group on International Agricultural Research; DMC = developing member country; IARC = international agricultural research center; NARS = national agricultural research system; NGO = nongovernment organization; RETA = regional technical assistance; RSAN = Agriculture, Natural Resources, and Social Sectors Division; SES = special evaluation study; SES-2000 = Special Evaluation Study in 2000; TA = technical assistance.

SUMMARY OF TECHNICAL EVALUATION OF SOME COMPLETED RETA PROJECTS

RETA No./Project Name and IARC	Objectives	Ratings	Reasons for the Rating	ADB Recommendation
A. RETA 6005: Sixth ANRR[a]		**Overall: Successful**		
1. Developing New Maize Germplasm through Biotechnology for Resource-Poor Farmers in Asia (CIMMYT)	Increase farm income of poor farmers in rainfed environments across Asia through assistance to nine national agricultural research systems (NARSs) in six DMCs by intensifying the application of biotechnology tools for developing locally adapted, high-yielding maize varieties resistant to major diseases, tolerant against soil-related stresses, and with improved nutritional values.	Successful	Good performance of the TA generated interest beyond the partner countries, as many new countries have expressed strong interest in joining the AMBIONET including Bangladesh, Iran, Malaysia, and Nepal. The TA strengthened the capacities of its NARS partners and supported an effective regional network that served as a regional platform for exchange of information and research collaboration on maize hybrid for the benefit of the poor farmers. However, the long-term sustainability of maintaining the regional networks on maize biotechnology is not clear. Overall, the TA was assessed as relevant, effective, and efficient in delivering its key results. However, the long-term sustainability of some activities of the TA, in particular continued support for regional networks, is not clear.	• CIMMYT needs to continue supporting the AMBIONET network and other key programs implemented under the TA through its regular program. • The participating DMCs need to maintain and further enhance their research capacities in maize biotechnology to fully benefit from these promising new technologies. • ADB to carry out an impact study on of the TA in 3-4 years time to determine the ultimate impacts of the TA on enhancing maize yields and improving rural income.
2. Improving Crop-Livestock Production Systems in Rainfed Areas of Southeast Asia (ILRI)	Empower farmers by developing capacities of stakeholders and development agents, improve rainfed farm productivity, and promote conducive policy and market environments in the five participating countries.	Successful	Farm household incomes increased by more than 30%, and more importantly, the contribution of livestock to total income ranged from 38% to 205%. In this sense, the project has exceeded its targets. The capacity-building activities have contributed to retooling of a large number of extension workers, farmers, and researchers. The project has enabled the evolution of various activities into a vehicle for development in the project sites. It has	• Crop-Animal Systems Network should be continuously supported with a combination of internal (from country partners) and external (from international aid agencies). • Some seed funds can be provided by ADB to jumpstart the process that will allow the members to continue to conduct yearly meetings and also maintain the interactive website

RETA No./Project Name and IARC	Objectives	Ratings	Reasons for the Rating	ADB Recommendation
			also enabled the consolidation of local programs on livestock and promoted the recognition of the role of livestock in poverty reduction and development into the mainstream.	as a platform for continued interaction and knowledge dissemination. This modality will also provide the avenue for monitoring the developments to learn how the project has continued to have an impact, if any. • The seed fund can be phased out gradually over 5 years with the expectation that the network itself will have generated its own funds to sustain its operations. • Undertake an independent impact assessment of the project 3 years after its completion to determine if indeed the observed trends in the likelihood of impact will have been realized and if not, determine the constraining factors.
3. Developing Sustainable Coconut-Based Income-Generating Technologies in Poor Rural Communities (IPIGRI)	Develop sustainable coconut-based industries in poor rural communities through the production and marketing of high-value coconut products, intercropping, and livestock/fodder production and multiplication of planting materials in 8 participating countries.	Successful	The project successfully developed and tested income-generating technologies and showed that household incomes could be increased between three and five times. The effect of the project on women was particularly significant, with formerly destitute and underemployed women now earning up to $3 a day. Families are working together, which contributes to social cohesiveness, social recognition, and self- esteem, especially for women. Nutrition and food security have significantly improved at the village level.	• IPGRI and its implementing agencies to continue monitoring the status of project assets transferred to the 24 community-based organizations (CBOs) including their use of the project machinery and revolving funds for income-generating activities. • International Coconut Genetics Research Network (COGENT) to continue to work with the 24 CBOs under the ADB-funded project and the 30 participating CBOs in the IFAD-funded follow-up project.

RETA No./Project Name and IARC	Objectives	Ratings	Reasons for the Rating	ADB Recommendation
				• For the IFAD component: institutionalization of income-generating technologies by linking the communities and research organizations with support groups in the public and private sector. • For the IPGRI component: convince and support all participating countries to institutionalize poverty reduction research into their coconut research agenda.
4. Sustaining Food Security in Asia Through the Development of Hybrid Rice Technology (IRRI)	Enhance rural income and food security in Asia through promotion of hybrid rice technology. Strengthen the capacities of national research organizations in hybrid rice technology; improve the capacities of public and private enterprises in producing hybrid rice seed; and enhance government commitments in hybrid rice research and development.	Successful	The hybrid rice technology promoted under the TA produced 15-20% higher yields than the traditional high-yielding varieties. The TA strengthened the hybrid rice research capacities of national research institutes, advanced the frontiers of hybrid rice research, and facilitated policy dialogue and exchanges of germplasm among participating DMCs. According to IRRI, during 2001-2004, the area under hybrid rice cultivation in the participating DMCs increased from 0.7 million ha to 1.5 million ha, producing an estimated 1.5 million tons of additional rice (worth $255 million). Hybrid rice technology still faces formidable challenges. It needs strong policy support in some countries, greater understanding of factors for effective public-private partnerships, enhanced training and extension in seed production, and improved agronomic practices for use by farmers.	• Regional hybrid rice network established under ADB-supported TA should continue to be supported by IRRI and NARSs through their regular programs. • Governments of participating DMCs step up their investments in hybrid rice research and extension and promote greater involvement of the private sector. • ADB should commission a special study to better understand the issues related to public-private partnership development and dissemination of hybrid rice technology.

RETA No./Project Name and IARC	Objectives	Ratings	Reasons for the Rating	ADB Recommendation
B. RETA 6067: Seventh ANRR[b]		**Overall: Successful**		
1. Participatory Watershed Management for Reducing Poverty and Land Degradation in the Semiarid Tropics (ICRISAT)	Strengthen and consolidate the promising results and gains achieved in natural resource management (NRM) under its predecessor project (RETA 5812) in India, Thailand, and Viet Nam.	Successful	Scaled up the benefits of IWM to 25 demonstration watersheds in India, Thailand, Viet Nam, and People's Republic of China. Its achievements include • development of agronomic management approaches using micronutrient fertilization, which increased crop yields from 50% to 145% • establishment of seed banks, which provided high-quality seeds to farmers • establishment of cattle breeding centers to increase milk production • improved income diversification among farmers through development of new income-generating activities • improvements in income, household food security, and family health through introduction of contour cultivation and fruit-tree-based farming to combat soil erosion • construction of 200 water harvesting pits and water tanks • enhanced incomes through application of balanced fertilizers and higher productivity.	• More work is required to quantify the monetary benefits of environmental services generated from community watershed management (particularly with respect to carbon sequestration benefits). This will increase uptake of technologies developed. • ICRISAT or country partners to put up good model of watersheds to sensitize policy makers and facilitate scaling-up. • Watershed programs of country governments to be developed based on livelihoods approach to enhance value adding activities and greater linkage to markets.
2. Poverty reduction Through Advisory Network, Policy Research, and	Support a broader initiative of IFPRI in establishing a policy analysis and advisory network of South Asia (PAANSA). This network	Partly successful	Project helped create centers of excellence for agriculture policy research, and memoranda of understanding outlining future cooperation in agricultural policy research and capacity building were	• Need for ADB to allocate greater resources for identifying, monitoring, and supervising RETA. • ADB needs to ensure that staff

RETA No./Project Name and IARC	Objectives	Ratings	Reasons for the Rating	ADB Recommendation
Capacity Strengthening in South Asia (IFPRI)	undertook applied research on critical agricultural policy issues and conducted collaborative research, training, and exchange programs with local institutions, government agencies, non-government organizations (NGOs), and the private sector.		signed. The subproject initiated various capacity-building activities, covering themes such as agricultural diversification, agroprocessing, domestic market reforms, market interactions, and trade liberalization. Project was tempered by a 7-month delay in the subproject commencement and the limited ADB contribution. Continuing leadership either by IFPRI or by participating national institutions is needed for sustaining the accomplishments of the subproject.	have sufficient technical expertise. • Greater ADB staff involvement is vital for fostering policy relevance of the research, coordinating follow-on studies, and applying results in future operations. • Closer review of research results by concerned country teams and other relevant staff to better assess opportunities for incorporating the TA research results into country strategies and plans.
3. Promoting Utilization of Indigenous Vegetables for Improved Nutrition of Resource-poor Households in Asia (AVRDC)	Promote cultivation, preservation, and utilization of indigenous vegetables (IVs) in eight countries, namely Bangladesh, Cambodia, Indonesia, Lao People's Democratic Republic (Lao PDR), Malaysia, Philippines, Thailand, and Viet Nam	Successful	The subproject produced expected outputs, and results surpassed targets in several subproject activities. One simple measure of the subproject's success is the number of new IVs identified, developed, and disseminated in the 8 countries covered by the subproject. In all there were about 50 such IVs.	• IV seed production, commercialization of IVs, and linking IVs to market could be developed into ADB loan projects to ensure the continued conservation and utilization of IVs. • AVRDC and country partners to emphasize the production of published outputs as well as the distribution of IV seed kits, IV information in CD-ROM, and via the internet.
4. Improving Livelihoods of Upland Farmers Using Participatory Approaches to Develop more Efficient Livestock Systems" Implemented by	Develop improved forage systems that could be integrated with indigenous fodders and crop residues in Cambodia, Indonesia, Lao PDR, People's Republic of China (PRC), Philippines, Thailand, and Viet Nam	Successful	Successfully developed improved feeding systems based on planted forage, which significantly increased returns to labor and farm livestock income, thus improving the livelihoods of participating farmers. The subproject also developed improved extension methods and scaled up improved feeding systems to areas beyond the original project area, which were subsequently incorporated into	• Livestock development deserves closer consideration as a pathway to assist poor rural households out of poverty. Capacity development of national staff in livestock development and linking them through a loose knowledge network offers an opportunity for these

RETA No./Project Name and IARC	Objectives	Ratings	Reasons for the Rating	ADB Recommendation
the International Tropical Agriculture Center (CIAT)			government programs. Project was carried out in a timely manner and exceeded the original targets and milestones. Improved feeding systems were developed using participatory approaches at project sites, and these were adopted by more than 7,500 households, improving returns to labor and increasing their incomes from livestock.	individuals to contribute to the design and implementation of ADB development projects.

[a] ADB. 2001. *Technical Assistance for the Sixth Agriculture and Natural Resources Research at CGIAR Centers.* Manila (RETA 6005, for $4.0 million, approved on 6 November).

[b] ADB. 2002. *Technical Assistance for the Seventh Agriculture and Natural Resources Research at International Agricultural Research Centers.* Manila (RETA 6067, for $3.8 million, approved on 6 December).

Source: Asian Development Bank project files.

NEPAL'S NATIONAL AGRICULTURE RESEARCH SYSTEM: KEY ACHIEVEMENTS AND CHALLENGES

1. The main purpose of this appendix is to assess the linkages of regional technical assistance (RETA) projects with the Asian Development Bank's (ADB) country operations in Nepal. The discussion is focused primarily on the appropriateness of technologies promoted under the RETA projects.

2. The report also highlights the key achievements and challenges of the national agricultural research system (NARS).[1] This report also includes a discussion of the potential contribution of ADB's RETA for addressing food insecurity. The overall aim is to provide insights on (i) the linkages between ADB RETA and the overall performance of NARS in terms of technology development and utilization toward improvements in the productivity of staple crops—rice, wheat, and legumes—managing water, and addressing food policy issues; and (ii) the way forward to improve the performance of NARSs.

3. The report has been prepared based on a desk review of the RETA project reports; interactions and discussions with RETA site leaders/coordinators, relevant scientists, and peer groups; and observation visits to a few RETA project sites.

A. Agricultural Research and Technology Development Institutes

4. Two public sector organizations, the Nepal Agricultural Research Council (NARC), established in 1991, and the National Agricultural Research and Development Fund (NARDF), established in 2002, dominate agricultural research in Nepal.[2] Some limited agricultural research is also conducted by universities and the private sector, and nongovernment organizations (NGOs).

5. NARC comprises two institutions (National Agriculture Research Institute and National Animal Sciences Research Institute); 13 disciplinary divisions; 14 commodity research programs; six cross-cutting divisions and units; four regional agricultural research stations (RARSs); and 18 Agricultural Research Stations (ARS), which serve as collaborative sites for multilocation trials of new technologies developed at RARS, by commodity programs, and by disciplinary divisions.

6. NARDF was created to carry out agricultural research and development (R&D) programs on the basis of a competitive grant system by involving research providers in the public, private, and NGO sectors, and to provide full or partial grants to priority programs. NARDF was established with ADB's assistance.[3]

7. Over the past few years, a number of private academic institutions have sprung up, one of them specializing in agriculture.[4] Involvement of the private sector in agricultural research is limited. Unlike other countries where private business enterprises spend a portion of their earnings R&D, Nepalese businesses have yet to develop this culture. They depend largely on

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[1] NARS in this report refers to research carried out by the Nepal Agriculture Research Council and stations/programs under it.

[2] The Nepal Academy of Science and Technology (RONAST) also conducts research. However, its mandate is quite broad, embracing all kinds of research. It does have a small agriculture portfolio.

[3] ADB. 2000. *Report and Recommendation of the President to the Board of Directors on the Crop Diversification Project*. Manila (Loan 1778-NEP, for $11 million, approved on 9 November).

[4] The Himalayan College of Agricultural Science and Technology.

foreign sources for technology such as hybrid seeds. Recently, a few private organizations, for example Dabur/Nepal, have initiated some adaptive research and crop trials to transfer technology directly to contract farmers.

8. Several NGOs have now emerged to carry out agricultural research and service delivery as a result of the adoption of favorable market-oriented policy and NGO-friendly strategies by the government since 1990.

9. Of all the above research establishments, the most important is NARC, established by Act of Parliament. Its objectives are to

(i) conduct studies and research on various aspects of agriculture,
(ii) identify the existing problems in agriculture and find out the solutions, and
(iii) assist the Government in the formulation of agricultural policies and strategies.

B. Agricultural Research and Technology Development Programs and Strategies

10. The Agriculture Perspective Plan (APP) recognizes technology as one of the key factors for bringing dynamism to Nepal's agriculture. There is general consistency and coherence between the APP and *NARC Vision 2020*.[5] Both have underlined the need for setting priority on the basis of national strategies and policies, output value, employment generation, nutritional importance, cash income potential, availability of research outputs, and the potential for increasing output through research. Current research strategies are guided by the APP goals and objectives.

11. Having emphasized a small number of high-priority research areas, APP's priority list includes four basic food crops essential to food security, namely rice, maize, wheat, and potato; one livestock priority (i.e., buffalo/dairy); a high-value crop (citrus); followed by vegetables, sericulture, and honey. Three key areas identified for enhancing resource productivity are soil fertility enhancement, intensive farming in irrigated areas, and integrated pest management.

12. The promotion of a pluralistic agricultural and natural resources innovation system was a major theme during the evaluation period. A central theme of NARC's new vision is the promotion of broad-based partnerships in research and technology development.[6] This fits in well with ADB's RETA projects' key concerns.

13. Collaboration among government, nongovernment, community-based, and private-sector organizations for planning, implementing, monitoring, and evaluating R&D initiatives is gaining ground in Nepal. This shift has been recognized in NARC's "Vision for 20 Years" document: *"Technology generation and dissemination was considered the sole domain of the public sector. The potential roles of the NGO and private sectors were not taken seriously…The context has changed drastically in recent years….the role of government is being redefined as a promoter, facilitator and regulator, rather than an implementer."*

C. Agricultural Research and Development Issues

[5] Approved by NARC on 5 February 2002, *NARC Vision 2021* can be viewed as its institutional response to changing national and international policies and to evolving context in which agricultural research takes place. However, its status is gloomy and is said to remain pending, as it is not yet approved by the Government.

[6] NARC. 2003. *Recent Spread and Impact of Agricultural Technologies in Nepal.* Outreach Research Division (ORD). Khumaltar.

14. **Production and Productivity Increase.** Available statistics show that agricultural productivity has increased slowly despite more than three decades of commodity research programs in Nepal. Yield gaps between research stations (potential) and farmers' fields (actual) have not decreased significantly, and average yields of all crops have continued to remain low by regional standards (Table A7).

Table A7: Present Yield Gaps in Major Food Crops in Nepal, 2002–07
(yield in mt/ha)

Crop	Average Yield (2002-2007)	Annual Growth Rate (2002-2007)	Potential Yield	Yield Gap (%)	Number of Varieties Released in SAPE Period (1997-2007)	Number of Varieties Released (1960 to 2007)	Area Coverage Under Improved Varieties, (%)
Rice	2.72	(1.4)	3-10.00 (Av 5.0)	46	13	42	85
Maize	1.98	2.8	2.2-10.6 (Av 4.0)	51	5	12	86
Wheat	2.09	1.3	4.0-6.7 (Av. 4.5)	54	7	17	96
Potato	12.00	4.2	18.0 to 38.7 (Av. 25)	52	3	6	45

SAPE = sector assistance program evaluation.
Source: NARC. 2008. NARC Research Highlights: Released and Registered Crop Varieties in Nepal, 1960 to 2007. Khumaltar.

15. According to NARC, it has released 213 improved varieties together with packages of cultivation practices for 45 different crops, and the area coverage of improved seeds/varieties of the three main crops: rice, maize, and wheat are 85%, 86%, and 96%, respectively.[7] However, the slow annual growth rates in productivity and production of these crops suggest a serious challenge in research, extension, and inputs-supplying subsystems (Table A7).[8]

16. Although the table shows substantial area coverage under improved varieties, in case of rice, many of the improved varieties originated in India.[9] Box A7.1 presents a case for rice.

Box A7.1: Performance of Rice Research in Nepal

Rice is Nepal's main staple food crop. Grown on more than 1.44 million hectares (over 54% of the total arable land of the country), it contributes more than 20% to agricultural gross domestic product and provides more than 50% of the total calorie requirement.

According to Nepal Agriculture Research Council (NARC), about 85% of the rice area is under "modern" varieties, but most of the 'modern' rice varieties grown in Nepal are quite old and have

[7] NARC. 2002. NARC Research Highlights, 2002/03-06/7: Nepal Agricultural Research Council. Khumaltar.
[8] Personnel communication, Mr Bhola Man Singh Basnet, Agronomist (Principle Scientist, S-5), Communication and Information Division, NARC.
[9] According to a study on Review of Research Impact, Responsiveness and Future Priorities in the Agriculture Sector in Nepal, Final Report. ITAD in association with NewEra, 2005, this owe little or nothing to the Nepalese agricultural research system.

degenerated. Studies show that the majority of rice farmers in the Terai, which accounts more than 70% of the total rice area, are growing Indian rice varieties like Pankaj, Sarju 52, and hybrid rice. The high dependency of Terai farmers on Indian varieties suggests limited suitability and/or access of varieties developed by NARC. Evidence indicates that varieties from the Nepalese research system have not impacted markedly on Nepalese rice production. This situation is due to several factors including the following:

(a) a very slow varietal release process: it can take as long as 15 years from the time of crossing to the time of release; this explains the fairly widespread use of Indian varieties and varieties that have not been officially released;
(b) a poor seed supply situation: the production of foundation seeds in sufficient quantity has been a major bottleneck for a long time; and
(c) inadequate exposure of farmers to such new cultivars as do emerge from the system.

Source: A Review of Research Impact, Responsiveness and Future Priorities in the Agriculture Sector in Nepal, Final Report. ITAD in association with NewEra, 2005.

17. While the performance of NARS has been mixed, some scientists argue that their achievements are often undermined and not credited appropriately. According to them, maize research has made a substantial impact, as maize production has increased considerably in spring and winter.

18. Traditionally, maize was grown in the summer season, but it is now grown in spring and winter also (although not on the same land).[10] The introduction of new maize varieties facilitated such seasonal shifts. Likewise, wheat varieties released/recommended by NARC now cover almost all of the area under improved varieties. Besides this, the contribution of research has gone beyond varietal improvement into lowering the production costs and improving the timeliness of operations through zero- and minimum-tillage techniques.

19. From 1997, NARC's emphasis has gone towards capacity building and demand-driven technology generation with a focus on decentralization and promoting a pluralistic approach for research and extension support.[11] However, the dominance of the top-down approach within the NARC system is an important constraint.[12] The overall problem has been aggravated by low priority for agricultural research and shrinking investments of both the government and external agencies.[13]

[10] A Review of Research Impact, Responsiveness and Future Priorities in the Agriculture Sector in Nepal, Final Report. ITAD in association with NewEra, 2005.

[11] External support to agricultural research and extension in Nepal is divided into three phases. While the first period (1980-87) emphasized the national commodity programs, the second (1986–1997) focused on institutional strengthening activities for technology dissemination and verification. The third phase (from 1997 to date), has laid emphasis on capacity building and demand-driven technology generation with a focus on decentralization and a pluralistic approach. Credit for fostering a pluralistic approach and partnerships within NARS goes to the UK Department for International Development-funded Hill Agriculture Research Project. This wasfurther expedited by the ADB-funded Crop Diversification Project (2002–2007).

[12] The midterm review of the World Bank funded Agriculture Research and Extension Project (1997–2002) noted mixed performance of research and extension system despite the project introduced bottom-up planning and pluralistic approach, and encouraged private and non-government agencies in technology generation and extension. The project could not make substantial gains in terms of improving the productivity of major crops, livestock, and horticulture.

[13] Evidence shows Nepal's research system is underfunded (0.2% of the adjusted gross domestic product) and infrastructures are poorly maintained. The international investment norm accepted by Food and Agriculture Organization and the World Bank is about 2%of AGDP.

20. **Dependency of Nepalese Farmers on Informal Flow of Technologies from India.** Both the development and utilization of technology in Nepal have been slow. The unavailability of locally adapted varieties in a timely manner increases the dependency on varieties coming from across the border in India. As a result, farmers are increasingly utilizing technologies from India, especially improved varieties of cereals and vegetables, particularly in the Terai region. Many international and local NGOs including public sector extension organizations are often seen providing financial and technical assistance to farmers to bring seeds and technologies from neighboring cities and universities of India, particularly Govind Ballabh Pant University of Agriculture and Technology, Pantnagar. However, such transfers of improved varieties of cereal crop seeds appropriate to the hill region of Nepal are constrained. Climatic and environmental conditions in the hills are highly diverse, and poorly developed transport and communication facilities limit such transfers. Often technologies that have not been adequately evaluated for their suitability are transferred, with farmers having to bear the consequences.

21. **Targeting the Poor and Disadvantaged.** NARC has had difficulties clearly targeting thepoor. Without proper targeting, poor farmers are unlikely to benefit much from improved technologies. Its limited financial resource base and low capacity of current staff severely constrain the ability of NARC to develop a flexible, productive, and well-targeted program.

22. **Enhancing Capacity to Work with the Commercial Private Sector.** A review of collaborative research projects carried out by NARC over the period 2002/03–2006/07 shows that it has not developed partnerships with the private sector for resource generation. Public-private partnerships can play an important role in financing research while making the product of research available to farmers in a timely manner.

23. **Competitiveness of Agricultural Products.** Research is focused mostly on increasing yield, but this does not always mean to be the major source of potential increase in farmers' incomes. Technologies that promote value chain development and are market oriented are needed to increase farmers' incomes.

24. **Strengthening Research Extension Linkages.** A review of contemporary reports and discussions with NARC scientists and Ministry of Agriculture and Cooperatives (MOAC) senior officials (Department of Agriculture, Department of Livestock Services, Department of Food Technology and Quality Control) revealed that linkages among research, extension, and farmers are weak.[14]

25. Research and extension agencies usually work in isolation and almost independently of each other. This constrains the utilization of synergistic effects. Institutional mechanisms and processes established for promoting better linkages have not been effective for several reasons. Different priorities for research and extension, shrinking financial resources, weak leadership, structural constraints (extension service under MOAC and autonomy for the NARS), and lack of accountability within the system are some of the key reasons.[15]

26. In brief, a review of contemporary studies and reports reveals that factors such as diffused organizational structure, underfunding, inadequate remuneration and incentives for scientists, and poor retention of scientists have put NARC in a difficult position to focus on key priority issues. It operates in too much of a vacuum; the mechanisms that would allow the

[14] Joshi, Dhruba, 2003. Technology System Management, Nepal Agriculture Sector Field Program Review and Development Mission (Annex 1).
[15] NARC 2007. ATWG Guidelines (Nirdesika).

organization to respond in a dynamic manner are not fully in place.[16]

D. Collaboration with International Agricultural Research Institutes

27. NARC has been collaborating with the international agricultural research centers (IARCs), particularly the International Rice Research Institute (IRRI), the International Maize and Wheat Improvement Center (CIMMYT), the International Plant Genetic Resources Institute (IPGRI), and International Crops Research Institute for Semi-Arid Tropics,[17] for more than four decades. The contribution of this international research on the performance of NARC appears immense. The collaboration with IARCs has enabled NARC to undertake basic and adaptive research in high priority areas. NARC and commodity programs acknowledge the role of this international support. NARC scientists generally quote the following four benefits of collaboration with IARCs:

(i) improved access to IARC's germplasm and technologies;
(ii) international exposures, training, and capacity building;
(iii) shared local experiences and technologies; and
(iv) confidence building.

28. ADB's RETA projects have further helped strengthen such relationships of NARC with IARCs. Seven RETA projects have provided support for research and technology development in Nepal from 2000–2007. Five institutes of the Consultative Group on International Agricultural Research (CGIAR)—CIMMYT, IPGRI, the International Food Policy Research Institute, IRRI, and the International Water Management Institute were the executing agencies and NARC was the national counterpart implementing agency most of the RETA projects. The objectives of these RETAs project were mainly to (i) improve food security, and (ii) contribute towards increased productivity of the agriculture sector. The RETA projects supported the development of technologies for raising the productivity of staple crops—rice and wheat through (i) varietal enhancement and improved management practices, (ii) development of effective water management institutions, (c) conservation of native fruits species, and (d) socioeconomic and policy research. One of the RETA projects has the technical assistance completion report, which rated the project *successful*.

2. Assessment of Regional Technical Assistance Projects

29. This section assesses the performance of NARC over the last 11 years (1997 to 2007). The information is based on a review of research projects carried out by NARC with the support of different agencies, including research carried out by NARC (i) in collaboration with CGIAR as part of RETA-supported research, (ii) as per contract with NARDF, and (iii) as part of the government's direct funding to NARC (government source).

3. Relevance

30. Most of the research carried out by NARC is relevant when assessed in terms of consistency with national polices and programs. Although the proposals for RETA originated at IARCs, the research projects implemented in Nepal were clearly aimed at addressing major constraints to productivity growth. Research programs have been appropriately designed to

[16] ITAD in association with NewEra. 2005. A Review of Research Impact, Responsiveness and Future Priorities in the Agriculture Sector in Nepal, Final Report.
[17] IARCs either use their core funding or receive support of agencies like ADB under its RETA.

respond to Nepal's key agricultural production and productivity problems and opportunities such as the following:

(i) delayed sowing of wheat in the Tarai due to excessive moisture conditions,
(ii) depletion of groundwater table and lack of year-round irrigation facilities,
(iii) poor agricultural mechanization,
(iv) shortage of labor,
(v) increased cost of production, and
(vi) promotion of commercialization of the agriculture sector.

31. In the past, agricultural research in Nepal was dominated mostly by crop varietal improvement and livestock breeding. However, NARC's recent collaboration with IARCs through RETA enabled it to work on adaptive issues related to crop, livestock and resource management and to cropping and farming systems.

2. Effectiveness

32. In terms of the effectiveness, the performance of NARC has been mixed. Irrespective of RETA-supported research, linkages with other agriculture and natural resources (ANR) subsectors such as extension were found to be poor.

33. For zero and reduced tillage, NARC introduced different types of seed drills and machines made in India, but no major efforts were made to make these tools and implements readily available to farmers at reasonable cost. The usefulness of the technology was demonstrated to policy makers of the MOAC but the Government continued with its policy of no tariff for the finished products imported from India but a tax on raw materials used to locally manufacture these machines. Private sector entrepreneurs made no attempts to manufacture the machines within Nepal as a result. A few machines were distributed to the district agriculture development offices but remained unused because of the lack of the appropriate knowledge and skills to use them. NARC appreciated the need to scale up this promising technology, but it was unable to do.

34. The aforementioned example is not typical of RETA-supported research only, but the situation is also applicable to research supported by other agencies. For improving research and extension linkages, the World Bank-supported Agricultural Research and Extension Project (1997–2002) had earlier introduced an institutional innovation embodied under regional technical working groups (RTWG) and the National Technical Working Group (NTWG). These groups (RTWGs and NTWG) were supposed to promote stronger linkages between research and extension through regular meetings and exchange of ideas. However, it is reported that these groups now meet rarely following the termination of the project in 2002.

35. Promising technologies are not adequately disseminated by providing appropriate policy and institutional support. Past experiences show that most line agencies work in isolation and almost independently of each other, reducing the synergistic effect that could have been achieved.

36. Likewise, this study could not trace any functional linkages of ADB's country operations to the RETA projects. Technologies developed through RETA projects could have been important vehicles to promote such linkages in two of ADB's projects.[18]

[18] The Crop Diversification Project and Community-Managed Irrigated Agriculture Sector Project had opportunities to scale up RETA technologies.

3. Efficiency

37. Frequent transfer of scientists (project coordinators) and delay in the release of budget from the concerned IARCs has undermined the efficiency of RETA projects. Furthermore, on the one hand, NARC was constrained by shrinking funds from the Government; on the other, it was often required to carry out RETA research initially from its internal sources and obtain reimbursement from the executing agencies later. According to NARC sources, this has reduced NARC's efficiency to some extent.

4. Sustainability

38. The sustainability of research outputs/technology products generated by the RETA projects appeared shaky, mostly because the products promoted by NARC are seldom backed up by necessary policy, institutional, extension, and financial support. The RETA funds allocated for the Nepal component are too small to scale of these products. An assessment of four research projects carried out by NARC under RETA projects clearly points to this situation. For example, a RETA research study[19] demonstrated how farmers could produce more while conserving their natural resource base by abandoning current land plowing and harrowing practices in favor of zero tillage. This is a simple technique of drilling seed into the soil with little or no prior land preparation. However, it is likely that this technology may not be fully utilized because of non-availability of zero tillage/reduced tillage machines, lack of appropriate mechanisms/processes for scalingup, and weak capacity of the agencies responsible for technology dissemination (public and private sector). The technology offers a good opportunity for developing public-private partnerships but this is yet to be achieved.

39. This assessment could not trace the linkages between research carried out with the support of RETA and ADB country operations. Likewise, policy and institutional support to scaleup the technologies promoted under the RETA projects was lacking in investment programs.

5. Problems and Constraints

40. The lead institution that is mandated for research is somewhat weak and poorly organized. Major restructuring and changes in the working environment will be required to enable it to play a key role in poverty reduction and to help achieve food security. Some problems are internal to the NARS, and others are external.

a. Internal to NARS

(i) inability to fulfill vacant positions in a timely manner (at the scientist, technical, and administrative levels);
(ii) underutilization of scientists and research infrastructure;
(iii) weakness in terms of generating location specific technologies that could solve farmers' key problems;
(iv) inadequate efforts to identify, collect, develop and promote promising indigenous technologies, knowledge, and practices;

[19] Enhancing Farmers' Income and Livelihoods through Integrated Crop and Resource Management in the Rice-Wheat System in South Asia (RETA 6208).

(v) inadequate efforts to establish effective linkages and coordination with extension and inputs delivery systems;
(vi) weak socioeconomic research to assess the adoption and impact of technologies (released varieties and other technologies) at farmers' levels (limited feedback mechanism); and
(vii) weakness in marketing the useful technology products developed/recommended (high dependency on inefficient and weak service delivery systems).

b. External to NARS

(i) Low priority given to research by the Government (policy does appear to give a high priority however the resources allocation is low);[20]
(ii) Current lack of support for research from development partners (i.e., other than RETA);
(iii) Inefficient technology transfer (extension) service;
(iv) Weak delivery of inputs and services, particularly seeds, fertilizers, and irrigation;
(v) Pseudo-autonomy to NARC followed by frequent changes in leadership as a result of political interference;
(vi) Shrinking budget and financial support; and
(vii) limited capacity of other players such as NGOs and the private sector to undertake research; lack of clear strategy/policy to involve/link different players.

E. Conclusions

41. NARC's recent shift from a focus on varietal improvement trials to other dimensions of research such as reduction in cost of cultivation, sustainability of rice-wheat cropping systems, promotion of water-saving technologies, and resource conservation technologies suggests that it is now increasingly responsive to farmers' immediate problems and concerns.

42. This has facilitated in the RETA projects carrying out some adaptive research and produce technologies that address farmers' current needs and problems. However, despite the appropriateness of these technologies, farmers including the poor, women, and the disadvantaged have not been able to benefit from them as a result of weak scaling-up programs.

43. Promising technologies promoted as a part of RETA have not been substantially backed through policy and institutional measures/processes. Linkage of RETA research with other ANR subsector almost non-existent.

44. As a result, RETA's effectiveness in Nepal is mixed. Its contribution to poverty reduction cannot be substantiated. Reasons include the following:

(i) NARC's involvement in highly promising technologies like zero tillage and reduced tillage for more than a decade has not brought about a substantial impact at the farmers' level.
(ii) Adoption of the technology at the farmers level is limited.

[20] Nepal's research system is underfunded (0.2% of the AGDP) and infrastructures are poorly maintained. The ratio of NARC budget to national budget is very low (less than 0.6% of the total). In addition, the ratio of NARC's budget to the national budget has been declining since 2002/03.

(iii) Technologies have not been linked with country operations. Other projects implemented with ADB assistance are not aware of RETA research products.
(iv) RETA is not linked with the ANR sector. RETA's linkages with extension, service delivery and other ANR subsectors are limited. Sectoral focus of the implementing agency continues to be a problem.
(v) NARC's has concerns about the RETA implementation modality, particularly with respect to the lack of transparency of IARC, on sharing of financial resources, selection of participating countries and to the extent of involvement.

F. Way Forward

1. General (Specific to NARS)

45. There is need to increase the contribution of research in solving Nepal's current food crisis and attaining food security in the long run. Carefully planned research strategies involving measures to enhance economic growth and productivity with appropriate scaling-up mechanisms for promising technologies are urgent. The APP's visualization of an effective agricultural research system as one of the prerequisites realizing higher growth rates in the agriculture sector is still valid today, and in fact its importance has further increased.

46. Based on the performance assessment of RETA-assisted research, contemporary research, studies carried out by NARC, the review of literature and reports, and discussions with key stakeholders, this report recommends the following:

(i) Follow a small country research model where most of the research will be adaptive and applied, and maintain a competitive edge in research output with cost effectiveness.
(ii) Considering the resource constraints and limitation of professional and managerial ability, Limit the number of research area. As all research is not of equal importance, follow strict screening criteria to determine priorities. The capacity to identify and respond to a demand-driven and client-oriented research agenda will need to be improved.
(iii) Strengthen socioeconomic research to identify and develop demand-driven research priorities based on current and future projections. Studies on constraints for adoption and impact of technical changes are crucial for enhancing technology-led growth. Analysis of issues such as the trade-offs between growth and other objectives such as sustainability, employment generation, poverty alleviation, commercialization and regional balance should be an important agenda for socio- economic research. Likewise, linkages and partnership will be more rewarding and meaningful if NARC addresses policy agenda such as breeders' rights, farmers' rights, bio-safety, and phytosanitory issues. in the light of the World Trade Organization to promote rational sharing of technologies, products, and knowledge with international communities.[21]

[21] Berry Pound and Padma B. Shakya, February 2004. Uptake Pathways and Scaling-up mechanisms for Agricultural technologies in Nepal, Natural Resources Institute, UK.

2. Specific to RETA

(i) Continue to support IARCs through RETA. However, let the RETA competitive bidding be opened also to the NARS with the condition that it will partner with the IARCs, rather than opening up funds only to the 14 IARCs under CGIAR.

(ii) Ensure the involvement of the NARS from the start to the end—right from the project proposal development stage to the project design, and later in the evaluation of the project, too. According to NARC, it is currently informed or its participation is sought after the approval of RETA. NARC is hardly involved in the project design stage.

(iii) Include a socioeconomic component in the project, and follow up from the start of the project so that the mechanisms for appropriately backing up technology with requisite policy and institutional support for facilitating its scaling up can be put in place. For this, a tripartite steering committee is suggested. Cochaired by the NARC Executive Director and the director general of the concerned department, the committee will consist of representatives from policy (MOAC and the Nepal Planning Commission), practice (beneficiaries and implementing agency) and the private sector (Agroenterprise Centre, traders, and finance sector).

(iv) Develop a mechanism to link RETA outputs/technologies with country operations and delegate authority to the ADB resident mission to periodically monitor the performance of the projects, keep concerned authorities in the Government updated about the performance of the RETA projects, and take necessary actions for their scaling up.

(v) Avoid transfer/change of the country project coordinator/leader over the life of the project except in exceptional cases.

(vi) Prior to project termination, assist the implanting agency, (NARC) preparing a reentry plan so that successful technology products can be scaled up appropriately.

ASSESSMENT OF RETA PROJECTS IN NEPAL

A. Project Code	:	**RETA 5812**
Title of Project	:	Development of Effective Water Management Institutions
Implementation Period	:	1998–2003
Executing Agency	:	IWMI
Participating Countries		Indonesia, Nepal, Philippines, People's Republic of China, and Sri Lanka
Implementing Agency in Nepal	:	Department of Irrigation/Government of Nepal, Institute of Agriculture and Animal Sciences/Tribhuban University, International Water Management Institute (IWMI)/Nepal
Objectives	:	• To carry out a detail analysis of existing institutional arrangements for water resources management in selected river basins with a view to identifying constraints and opportunities relating to agricultural water management, particularly in the context of intersectoral competition for water. • To apply and validate a conceptual framework for analyzing the institutional arrangements for water resource management. • To develop and initiate the implementation of policies and institutional strengthening programs that will lead to improved management of water available for agriculture.
Current Status	:	Completed/technical assistance completion report: Successful
Outputs (6 studies):	:	• Identification of Physical Characteristics of East Rapti River Basin • Water Accounting in the East Rapti River Basin • Socioeconomic Survey and Stakeholder Analysis for East Rapti River Basin. • Performance Assessment of Irrigation Systems in East Rapti River Basin • Institutional Analysis for Water Resources Management in East Rapti River Basin, Nepal • Institutional Analysis of Integrated Water Resource Management.
Technology	:	Introduction of Integrated water resource management (IWRM) concept in Nepal and water accounting technology
Relevancy	:	**Relevant.** Focused on Nepal's development challenges and issues which include efficient and integrated use of water, improvements in the coordination among key stakeholders, capacity enhancement.
Appropriateness of the technology	:	**Substantially appropriate.** Probably introduced these concepts when the country was not fully prepared, early
Appropriateness of the CGIAR Collaboration	:	**Highly appropriate.** Collaboration with IWMI especially important because it is the only international center within the Consultative Group on International Agricultural Research which has been assisting developing countries to identify and address water and land management challenges and issues, provided an opportunity for intergovernmental and

		intercountry experiences sharing, and is the most appropriate institution to facilitate policy dialogue at different levels
Dissemination and adoption of technology	:	Ministry of Water Resources/Department of Irrigation in the process of institutionalizing IWRM framework. The framework has been acknowledged at the highest policy-making level as a new paradigm for development, and is incorporated in the National Water Plan 2005. This plan has been prepared to operationalize the Water Sector Strategy, approved by the Government of Nepal in January 2002.
Linkage with ANR sector	:	Contemporary studies reveal sectoral focus of the IWRM and the lack of a coordinated effort to integrate water with other components of natural resources such as the forest.[87]
Linkage with country operation	:	None
Situation after the completion of RETA projects	:	• Importance of intergovernmental and intercountry experiences sharing and awareness created about IWRM • Adoption of the IWRM concept in the Water Resource Strategy, 2002 • Convinced of the need to visualize the skills development of researchers from a wholistic perspective
Recommendations Suggestions/	:	• Involve country partners from the stage of the development of the proposal to the development of research methodology and final evaluation of the project • Assist the implementing agency to prepare reentry plan so that the successful technology products can be scaled up appropriately
B. Project Code	:	**RETA 5866**
Title of Project	:	Conservation and Use of Native Tropical Fruit Species Biodiversity in Asia
Implementation Period	:	2000-2003
Executing Agency	:	International Plant Genetic Resources Institute
Participating countries		
Implementation Agency	:	Nepal Agriculture Research Council/Horticulture Research Station, Kirtipur, Nepal
Objectives	:	Conduct eco-geographic surveys; locate, collect, evaluate, and characterize the diversities and traits of citrus and mangos
Collaborating Agencies		
Current Status	:	Completed, TCR not available
Technology		• Methodology for collection, characterization, and evaluation of mango and citrus germplasm (characters: total soluble sugar, yield and fruit weight, juice content, pulp color and fruit skin color, fruit surface texture, average number of seeds and number of segments/ fruits, fruit maturity and spine density, etc.)

[87] Pant Dhruba, Thapa Sabita, Singh Ashok, Bhattarai Madhusudhan, and David Molden. 2005. Integrated Management of Water, Forest and Land Resources in Nepal: *Opportunities for Improved Livelihood*, International Water Management Institute, University of Leeds, Water Energy Commission Secretariat, HMG/Nepal.

Outputs	:	• Mango germplasm collected:109 from Terai and 30—Inner Terai. Some of the best performing germplasms has been identified and used for the production of seedlings • Citrus-88 genotypes collected • Ecogeographic study reports • Identification of elite lines with valuable traits.
Key Conclusions of Project	:	• Exploration, collection, utilization, and conservation of genetic diversity are very necessary for different crops, as there exist valuable genetic diversity areas. • In the absence of external funding, NARC alone is unable to carry out this task. • Fruit growers were enthusiastic to identify diversity villages and diversity orchards and also to identify and evaluate elite lines and germplasm. • The 3-year project period for a fruit crop program is inadequate to show the impact of the project on farmers.
Relevance	:	**Relevant.** Both mango and citrus are economically important, widely grown fruits in Nepal. The role of fruit crops in improving livelihoods of farm families is obvious. Both fruit crops have received high priority in Nepal's national research system. Likewise, citrus and mango are among the priority high-value crops identified by the Agriculture Perspective Plan.
Appropriateness of Technology	:	**Highly appropriate** in transferring knowledge and skills on conservation and wise use of mango and citrus genetic diversities, Methodology of identification, collection and conservation through the establishment of ex-situ and in-situ germplasm was appropriate in the country context. It created awareness on the need for exploration, collection, utilization,and conservation of existing and elite germplasm.
Appropriateness of CGIAR Collaboration	:	**Highly appropriate** • International Plant Genetic Resources Institute (IPGRI) support was of high professional caliber, timely supported, oriented towards output. • Provided substantial support to identify, collect and conserve important mango and citrus germplasm • IPGRI's collaboration enhanced NARC's capacity through both in-country and outside country training • Possible to obtain well performing elite germplasm • IPGRI training quite useful for undertaking sites survey, collection, evaluation, and characterization of genotypes. • Elite accessions of mango and citrus with valuable traits identified • Good contribution in the present situation of NARC's budgetary resource constraints despite the support was modest/minimal. • Project duration very short, not commensurate with the nature of output/outcome envisaged.
Dissemination and Adoption of Technology	:	**Modest** • Made aware of national commodity programs for

conservation and use of tropical fruit diversity.
- Government allocated budget to establish gene bank in Khumaltar (NARC) in 2008/09.
- Selection of Tarahara Agricultural Research Station, Sunsari District as site for in-situ conservation of mango germplasm was not appropriate.

Linkage with ANR Sector :
- **Modest**
- Involved a wide range of partners (research and extension), carried out in different ecological settings.
- Partnership with farmers, and private nurseries provided better understanding about the importance, uses, and value of fruit germplasm conservation.

Linkage with Country Operation : **Poor**
- Despite the output the research could have been linked with ongoing ADB-funded Crop Diversification Project (CDP). While the District Agriculture Development Office (DADO), Dadeldhura which is one of the CDP districts, is reported as a collaborating agency, DADO is not aware of the project activities. There are no mechanisms developed to incorporate the results of the project

Situation after the completion of RETA projects :
- Project report has been published and widely circulated within national agricultural research system (NARS)
- NARC is engaged in establishing gene banks, improving laboratory facilities, and undertaking similar research

Outcome : **Modest**
- Farmers' demand for grafted seedlings produced from the elite plants selected by the project is growing
- Created awareness of the need for exploration, collection, utilization, and conservation of existing germplasm
- Speeded up exchange of elite planting materials and indigenous technology from farmers to farmers

Impact : **Not Applicable**
- Impact in terms of improvements in food security and nutrition are not available because of inadequate adoption of the technology products

Recommendations/ Suggestions :
- Ensure that the concerned international agricultural research center (IARC = executing agency [EA]) establish linkages with the participating collaborating institution (NARC) from the stage of project proposal development to resource allocation and evaluation of the project
- Maintain transparency on sharing of financial resources between the EA and IA
- Make sure of timely release of the budget
- Develop a mechanism for linking RETA outputs/outcomes to country operations
- Encourage the IA for not to change/transfer the country project coordinator during the duration of the project unless required for some unavoidable reason
- Assist the IA to prepare reentry plan for scaling up the technologies with the support of the concerned key

stakeholders

C. Project Code	:	**RETA 6208**
Title of Project	:	Enhancing Farmers' Income and Livelihoods through Integrated Crop and Resource Management in the Rice-Wheat System in South Asia
Implementation Period	:	2004–2008
Executing Agency	:	International Rice Research Institute (IRRI)
Participating Countries	:	Bangladesh, India, Nepal, and Pakistan
Implementing Agency	:	Research Station of NARC in Bhairahawa Soil Science Division, Khumal
Objectives	:	• Integrate different nutrients and crop management practices with resource conservation technology (RCT) to enhance productivity of rice-wheat system. • Increase food security and livelihood of resource poor farmers.
Current Status	:	Ongoing
Technology	:	Integrated crop management in zero-tillage and reduced-tillage wheat (zero tillage: Drilling seed into the soil with little or no prior land preparation)
Outputs	:	• Developed, tested, and disseminated resource-efficient technologies for rice-wheat systems. • Enhanced capacity of NRIP and NWRP/NARC • Improved crop quality and diversification
Key Conclusions of Project	:	• Wheat seedings can be advanced for 7-15 days with zero tillage and obtain good yield. Advance seeding reduces yield loss. • Cost of production is reduced with RCT equipment like zero tillage seed drill and power tiller • Integration of RCT with other crop and nutrient management practices improve crop yield and increases farmers' income • With provision of subsidy for resource poor farmers to buy power tiller and Zero till yields of rice and wheat can be increased
Relevance	:	**Relevant** • Rice and wheat are the most important crops in Nepal, most widely planted crop (from high mountains to Terai region). Eighty-five percent of the wheat produced in Nepal is grown after rice, and 38% of the rice is followed by wheat, making the rice–wheat system the most important cereal-producing system in Nepal.[88] Obviously, the rice-wheat system must receive a top priority in agricultural research and development if the country is to achieve food security. Nepal is no short of improved varieties (potential yield - 4.5 MT/ha), but productivity has been low due mainly to improper

[88] Hobbs and Adhikary, 1998.

crop, nutrient, and resource management. The project is relevant, for it has sought to respond to contemporary problems of the rice-wheat system; like low nutrient recycling system, poor integration of crop, nutrient and resource management technologies; poor mechanization; and high cost of production)

Appropriateness of technology : **Highly appropriate.** Technology responded to local problems such as the following appropriately:

- late planting
- high cost of production
- poor crop, nutrient and resource management
- less return to resources
- labor scarcity at peak season
- poor farm mechanization
- soil fertility degradation
- drudgery

Of the total wheat area in the country (0.7 million ha), about 50–60% is planted on time and the rest is planted late. The main causes of late planting are an excess or lack of soil moisture and the long turnaround time between rice and wheat. The technology product under this project could address 40–50% of the area under wheat.

The technology is likely to increase nontraditional wheat area, as the RCTs will bring fallow land under wheat cultivation.

Appropriateness of the CGIAR Collaboration : **Highly appropriate.** Excellent good quality support. NARC scientists highly acknowledged IRRI's support. It has provided them an opportunity for international exposure and to learn from international experiences and share experiences about new technologies with international communities. Not only has NARC's access to exotic genotypes been increased but also the project helped NARS to acquire some equipment and other material

Dissemination and adoption of technology : **Poor.** Constrained due to unavailability of zero-tillage/reduced-tillage machines. Farmers' demand for the technology has been very encouraging but constrained by the supply of the machines.

Manufacturing of the machines in Nepal is not cost effective due to the high customs tariff imposed by the Government on raw materials besides inadequate technical knowledge and skills. Importing the finished product (machines) is cheaper, as there is no tariff on them. Yet, the machines are so costly that very few farmers can afford to buy the machine

In the hills, the technology is poorly adopted for the following reasons:

- moisture stress in direct-seeded rice (DSR) due to uncertainty of rainfall
- difficulty of operation of power tiller in narrow terraces

		and poor farmers and smallholders cannot own power tillers • Disease such as blast in DSR • Weed management in DSR • Lack of varietal diversity for DSR
Linkage with ANR Sector	:	**None.** Lack of policy and institutional support to promote the technology, particularly to promote zero- and reduced-tillage technologies
Linkage with Country Operation	:	**Poor.** Despite the output, the research could have been linked with the ongoing ADB funded CDP and Community Ground Water Irrigation System Project. There have been no efforts to link the technology with these projects.
Outcome	:	**Modest.** Nevertheless, the technology contributed to • changing the cropping systems • convertring rice-fallow fields to rice-wheat fields • increase yields of wheat from 500 kilograms (kg)/ha to 3,000kg/ha and some spillover effects of the technology are seen in nearby villages • Helping overcome a major cause of low wheat yields—the late planting of wheat seed.
Impact	:	It has been difficult to realize the impact due to • unavailability of the proper machines at the local level • unavailability of herbicides for DSR, and when available these are too expensive for farmers • unavailability of fertilizer • lack of assured irrigation
Key lessons learned	:	• Farmers will not benefit even from the promising/highly appropriate technologies like zero- /reduced-tillage if the technology dissemination/upscaling activities are not appropriately backed and supported by policy and institutional mechanisms/processes. • Zero tillage systems provide higher yields at less cost and also save on fuel use and tractor wear and tear. • When the technology is about already proven and widely adopted, it is better to focus on both availability and field testing simultaneously. • Changing farmers' mindset/perceptions on new technology such as zero tillage is a time-taking activity. Facilitation and efforts of both the research and extension agencies together with timely availability of the proper machines are required. • Zero-tillage/direct-seeding technology needs perfection.
Recommendations	:	• Maintain transparency on sharing of financial resources between the EA and IA. • Back up the technology adoption process with necessary policy and institutional support. • Define research and extension outputs clearly. • Encourage local importer/manufacturers to import/ fabricate RCT equipments and machineries through

		appropriate policy and institutional measures for sustainability of resource conserving technologies. • Develop mechanisms to scale up technology through extension.
D. Project Code	**:**	**RETA 6276**
Title of Project	:	Development and Dissemination of Water-Saving Rice Technologies in South Asia
Implementation Period	:	2005–2008
Executing Agency	:	IRRI
Implementation Agency	:	NRIP RARS Tarahara
Objectives	:	• Enhanced food and income security of rural and urban population. • Improved environmental sustainability of rice production system in drought-prone and water-scarce areas of Nepal
Project Coordinator	:	Mr. Devendra K. Chaudhary
Current Status	:	Ongoing
Technology		Identification of rice genotypes adapted to aerobic and alternate wetting and drying (AWD) water-saving irrigated systems, based on improved rice varieties, developed.
Outputs:	:	Several genotypes identified and selected.
Relevance	:	High, well addressed the issues of rice wheat system.
Appropriateness of the technology	:	Highly appropriate
Appropriateness of the CGIARS collaboration	:	Highly appropriate
Dissemination and adoption of technology	:	Several genotypes included in coordinated varietal trails
Linkage with ANR sector	:	None
Linkage with country operation	:	None
Impact	:	• New water-saving technologies tested and disseminated to farming communities • Strengthened national capacity to develop and disseminate water-saving rice production technologies. • A regional network to trade information and know-how to cope with water shortage in rice production systems.
Key Lessons Learned	:	• Promising technologies require policy and institutional support for scaling up
Recommendations	:	• Involve NARS from proposal development to project evaluation stages • Maintain transparency between NARC and IARC with regard to the sharing of financial resources • Ensure timely release of the budget for the project • Strengthen research on these water-saving technologies so they can be adapted and promoted to farmers

E. Project Code	:	**Project 5945**
Title of Project	:	Sustaining the Rice Wheat Production Systems of Asia
Implementation Period	:	2000–2007
Executing Agency	:	International Maize and Wheat Improvement Center
Implementation Agency	:	NWRP, Bhairahawa
Participating countries		Bangladesh, Nepal, India and Pakistan
Objectives	:	Develop farming systems solutions for site-specific productivity and sustainability problems of rice-wheat rotation systems in the Indo-Gangetic Plains.
Current Status	:	Completed. No schedule for the TCR yet.
Technology	:	RCT.
Outputs:	:	Increased yield and cost savings due to adoption of zero-tillage wheat production technology.
Relevancy	:	**Relevant.** Addressed key production constraints such as resource degradation (soil and water resources), poor crop diversification, and sustainability issues of rice–whean Systems; addressed the issues with of rice-wheat systems appropriately
Appropriateness of the technology	:	**Highly appropriate.** Technology responsive to farmers' key problems such as • high cost of cultivation • poor farm resources (land, labor, water, capital) • improve return to resources • decline in yield due to late planting • labor scarcity at peak season • poor crop and soil management practices • buildup of weeds, diseases & pests • soil fertility degradation
Appropriateness of the CGIAR collaboration	:	**Highly appropriate, Project implementation and support were very effective:** • knowledge sharing and training support provided • international exposure through participation in workshops and seminars available. • opportunity to update with new research methodologies and findings in various aspects of agriculture development.
Dissemination and adoption of Technology	:	• poor adoption as the machines were under development therefore some machines worked some did not work properly.
Linkage with ANR Sector	:	None
Linkage with Country Operations	:	None
Key Lessons Learned	:	• For scaling up programs, a larger unit should be taken as a site, like the Western Terai, Central Tarai, Central hills. • Coordination with national extension network and other local collaborators must be made at the planning stage, and thereby responsibilities and resources should be shared accordingly. • Small funding (e.g., $10,000/year) does not help in

scaling up technology to a large scale.

Recommendations :
- Provide necessary policy and institutional support for scaling up successful technologies.
- Encourage the IA for not to transfer/change the country project coordinator/leader over the life of the project except under unavoidable circumstances.
- Consider the NARS to lead the RETA in partnership with the IARCs.

Summary and Conclusions

Technologies promoted under RETA are relevant to the country context. CGIAR support is highly appropriate to food insecurity, as it is generally focused on rice-wheat systems. Eighty-five percent of the wheat produced in Nepal is grown after rice and 38% of the rice is followed by wheat, making the rice-wheat system the most important cereal-producing system in Nepal. NARS requires RETA for not only enhancing their capacities but also to test and scale up technologies. NARC appreciates the support available to it through the IARCs as a part of RETA, which tends to be the only link to the international scientific community in some cases. However, the RETA's impact in terms of its contribution to poverty reduction could not be substantiated. Reasons include the following:

(i) NARC's involvement in highly promising technologies like zero tillage and reduced tillage for more than a decade has not brought about a substantial impact at the farmer level. Adoption of the technology has been poor, due mainly to lack of policy and other necessary support. This implies NARC's limited influence in the sector's development.

The appropriate RETA-generated technologies could have been linked to ADB country operations resulting, in some degree of scaling up.

(i) RETA has not been appropriately linked with other subsectors in the agriculture an natural resources sector. Linkages with extension and the service delivery aspect are almost missing. The sectoral focus of the IAis problematic.
(ii) As a result of lack of necessary policy and institutional support on the part of the Government, farmers have not been able to benefit from the promising technologies.

Recommendations for ADB

(i) Continue to support IARCs through RETA. However, open opportunities for the NARS to lead RETA in partnership with the IARCs.
(ii) Ensure the involvement of the NARS in the development of the project proposal and the project design, and later in the evaluation of the project.
(iii) Develop a mechanism to link RETA output/technologies with ADB country operations.

Recommendations for IARCs and NARC (IA)

(i) Include a policy advocacy component in the project, and follow up from the start of the project so that the technology will be appropriately backed by requisite policy and institutional support.

(ii) Encourage NARC not to transfer/change the country project coordinator/leader in middle of the project implementation except under unavoidable situations.

(iii) Prior to the termination of a project, work together to formulate a reentry plan (or follow-up project) for scaling up the technology products.

(iv) Identify key stakeholders of the project and keep them updated about project activities, constraints, and opportunities for sustainability of project outputs and outcomes.

MAJOR OUTPUTS GENERATED (OR TO BE GENERATED) FROM ADB RETA FUNDED ANRR AND THEIR RELEVANCE: FIFTH TO TWELFTH RETA

Type of Output	Relevance/Expected Relevance
1. Crop/genetic characterization using DNA markers and other associated advanced technologies	• Full understanding of crop/genetic characteristics is the key to the development of promising improved varieties/cultivars—high yielding, disease/virus resistant, tolerance to fragile environments (drought-prone, flood-prone, saline areas) • Improved varieties can help reduce cost of production from more efficient use of fertilizer and pesticides • Improved varieties can be of better quality and hence can command higher prices • Many of varieties were exchanged among NARSs partners for further field evaluation and improvement • DNA markers/germplasm characterization/molecular breeding and other associated technologies were made available to partners for application in their local breeding activities to improve varieties
2.1. Improved crop/input management technologies, resource conservation technologies, and postharvest technologies • alternate wetting and drying/aerobic rice • water-harvesting technologies • zero-tillage technology • laser levelling • leaf color chart • direct seeding • raised-bed planting • various irrigation management technology like drip irrigation, microfurrow irrigation, microsprinkler irrigation. • integrated nutrient management • integrated pest management • integrated crop management	• Cost-saving technologies without affecting production performance— e.g., more efficient use of natural resources such as water, inputs like fertilizer, use of organic manures, reduced use of pesticides, low-cost animal feed alternatives like rice straw • Improved productivity in land and water in degraded areas through cultivation of licorice and other salt-tolerant crops, phosphogypsum application for magnesium-rich soils, forage cultivation and shrubs establishment in sloping areas, etc. • Enhanced crop production performance especially in adverse ecosystems/fragile environments including sloping and upland areas • Reduced losses from postharvest activities • Product quality improvement

Type of Output	Relevance/Expected Relevance
• residue management • crop diversification in both rainfed and irrigated areas • risk mitigation practices related to climate change • postharvest technology for vegetables • management technologies to combat land and water degradation	• Technologies consistent with farmers' own resources and indigenous knowledge
2.2. Animal production management technologies • crop/livestock integration/food-feed system • crop-based (sweet potato and cassava rice straw) feeding technology • sustainable parasite control technology • artificial insemination • animal stall/housing improvement • improved animal feed mixtures (e.g., urea treated rice straw, use of premixes to enrich animal feeds, urea/molasses/mineral licks, etc.) • embryo transfer	• Enhanced animal production performance • Use of crops and crop residues for value adding • Reduced production cost in animal raising from alternative feeding systems based on crops and crop residues
2.3. Value adding technologies in coconut farms • intercropping in coconut farms • coconut-livestock farming • coconut processing • coconut seedling technology	• Improved livelihood among coconut farmers from knowledge of high-value coconut products
3. Biodiversity protection through *in situ* genetic conservation • conservation agriculture • collection of indigenous vegetables • indigenous vegetable accessions • on farm conservation of coconut genetic coconut resources	• Promote sustained food production increases from protection and conservation of water and other resources including crop/animal and fish species • Safeguard indigenous varieties to preserve biodiversity for varietal breeding as well as farmers' economic base
4. Capacity building/ networking/knowledge exchange • training on various aspects of crop and animal production and postharvest technology including those on breeding development • capacity building on resource conservation technologies • establishment of small-scale enterprise models • training in home gardening/vegetable seed production/promotion of school gardens • enhancement of farmer organizations	• Strengthened capacities of NARSs on various aspects of crop, animal, and fish production from varietal development to postharvest and processing activities • Strengthened capacities to analyze data and information using models • Improved capacities for impact assessment • Organization of farmers to take advantage of market potentials and economies of scale • Networking across countries for exchange of knowledge,

Type of Output	Relevance/Expected Relevance
• promoting farmer alliances/community-based organizations • farmer participation in implementing programs • consortium/network development such as the AMBIONET, CURE, etc. • capacity to do modeling and analytical work, vulnerability mapping and social indexing	experiences, and technologies • Capacity built via farmer field schools to improved farmer knowledge contributed to the effective application of these technologies • Empowerment of women and building of social capital for decision making • Greater understanding of climate variability and impact on the poor • Farmers are trained to lead the planning, management, and implementation of income-generating projects/activities
5. Information generation, model development, and policy advocacy 5.1. Information generation and model development • GIS maps/vulnerability maps/irrigation-poverty profiles • survey methodologies • econometric models • projection/simulation models • impact assessment techniques 5.2. Information dissemination • conferences and workshops • research publications and other materials, journal articles • public awareness materials 5.3. Policy Advocacy	• Databases were used in models and other analytical tools. • Tools to analyze/assess interlinkages/relationships and provide a more scientific basis for technology/policy recommendations • Models are used to identify appropriate strategies to increase and sustain production (e.g., fish production in the poor in DMCs) • Significant impact on (re-)designing policies to more effectively target and reduce ultrapoverty • Publication to facilitate dissemination of new findings/technologies • Stakeholders have shown significant interest in replicating the study in other locations of the region • Adoption and application within the national development programs of the recommended policies that promote sustainable land management practices • Policy recommendations to serve policy advisors, policymakers, and researchers in their long-term agenda planning • Findings and recommendations for pro-poor policies and for facilitating the achievement of inclusive and sustainable growth in Asia

ADB = Asian Development Bank, AMBIONET = Asian Maize Biotechnology Network ANRR = agriculture and natural resources research, CURE = Consortium for Unfavorable Rice Environments, DNA = Deoxyribonucleic acid, NARS = national agricultural research system, RETA = regional technical assistance.
Source: Summarized from IARCs responses to survey questionnaire.

IMPACT OF IMPROVED POSTHARVEST TECHNOLOGIES IN VEGETABLES: CASE STUDIES FROM TWO GREATER MEKONG SUBREGION COUNTRIES[1]

1. The two case studies described below indicate the expected impact of the RETA 6208[2] project on Improving Rural Livelihoods through Development of Vegetable-Based Postharvest Technologies in Cambodia and Lao People's Democratic Republic (Lao PDR). The project aims to reduce poverty, enhance rural economic development, and improve food security in Cambodia, and Lao PDR by (i) promoting the vegetable postharvest sector; (ii) reducing postharvest losses of high-volume, high-value commodities; and (iii) developing and promoting low-cost, postharvest technologies in collaboration with both the public and private sectors. It was funded in 2004, and activities are still in progress.

2. **Cambodia:** Mr. Popich is a vegetable farmer from the vegetable-growing village of Bantheydek, Bantheydek Commune, Kiensvay District, Kandal Province, Cambodia. He has a 1.2 hectare vegetable farm with tomato as the major crop. His farm was an experimental showcase for tomato varieties from the World Vegetable Center—CLN1462A and CLV1461i cherry tomatoes. The farm also showcased interventions in the entire production chain, from choice of variety (CLV Net and RETA 6208 projects), cultural management techniques, to harvesting and postharvest handling operations. The farmer started growing CLV1462A after attending training on postharvest technology of tomato and chili held at Kbal Koh Agricultural Research Center, Phnom Penh in early 2007.

3. His shift to the new tomato technology enabled Mr. Popich to increase income due to reduced losses in production and postharvest operations, greater demand from collectors and traders, and higher product price. "*Life is now easier than before because there is enough food and money for everything, including the purchase of a new motorcycle and improvement of residential land near the national road*," remarked Mr. Popich.

4. **Lao PDR:** Ms. Samphong Singsathong is a vegetable farmer-collector in Khouadeng Village, Hathsayhong District, Vientiane Capital, Lao PDR. She and her family grow and sell tomato, chili, and eggplant and at the same time collect and market produce of other farmers. Ms. Samphong was one of the trainees of RETA 6208—Laos Mobile Training on Postharvest Technology of Tomato and Chili—held in Hathsayfong District on 26 January 2007. Her participation in this training enabled her to overcome problems in handling and marketing tomato. She has also gone into providing credit to other farmers with the condition that they sell the produce to her. The family is now being looked up to in the village and serves as a model for other farmers on how to increase incomes.

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[1] Source: Initial Impact Document on Improving Rural Livelihoods through Development of Vegetable-Based Postharvest Technologies in Cambodia and Lao PDR submitted by AVRDC to ADB.

[2] ADB. 2004. *Technical Assistance to the Ninth Agriculture and Natural Resources Research at International Agricultural Research Centers*. Manila (RETA-6208, for $3 million, approved on 16 December).

STAR TECHNOLOGIES DEVELOPED FROM THE CONSORTIUM FOR UNFAVORABLE ENVIRONMENTS PROJECT SUPPORT

1. The Consortium for Unfavorable Rice Environments (CURE) funded by ADB under RETA 6136, comprises 10 countries in South and Southeast Asia with unfavorable rice areas characterized by drought, submergence, salinity, and other soil problems. The purpose of CURE is to address the problems of farmers in such unfavorable rice areas through research and development. Participating countries are Bangladesh, Cambodia, India, Indonesia, Lao People's Democratic Republic (Lao PDR), Myanmar, Nepal, Philippines, Thailand, and Viet Nam.

2. Star technologies or practices developed through CURE research and development activities during the last 5 years are listed below for upscaling in the next few years. RETA 6136 is completed, but activities under CURE are continued by the International Rice Research Institute with support from the national governments of the participating countries.

A. Working Group 1 for Drought-Prone Lowlands

1. Raipur, India

3. Crop management options integrate direct-seeded establishment methods with improved weed control and nutrient management practices.

4. Suitable postemergence herbicides are identified for effective weed control in direct-seeded rice.

5. Intensification of rice-based systems with new establishment practices allows for early rice harvest and improved chances for a postharvest nonrice crop such as chickpea.

6. Through farmer participatory trials, the genotypes ARB6, ARB8, and IR74371-46 were identified for their high drought tolerance and were nominated to India's national varietal testing and release program.

2. Ubon Ratchathani, Thailand

7. Participatory development of a decision-support tool for site-specific nutrient management for farmers in northeastern Thailand was pursued, along with accompanying training materials to teach researchers and extensionists working in this ecosystem.

8. Through farmer participatory methods, the first KDML backcross derivative, RD33, was developed and officially released to farmers on 6 March 2007. This variety has high blast tolerance and matures approximately 1–2 weeks earlier than KDML 105, reducing its exposure to late-season drought in northeastern Thailand, and it is indistinguishable in quality from KDML 105.

B. Working Group 2 for Submergence-Prone Lowlands

9. The Sub1 gene for flash-flood tolerance has been introgressed into the varieties popular with farmers—Swarna-Sub1, Sambha-Sub1, and IR64-Sub1—and was tested in farmers' fields at CURE key sites in Faizabad, India, and Rangpur, Bangladesh.

1. Faizabad, India

10. A package of improved nursery management practices, that is, nutrient management, lower seedling density, and immediate transplanting (vs. a 24-hour delay) after uprooting seedlings from a nursery, can produce quality seedlings better able to withstand flash-flood conditions in the main field, that have better recovery after water recession, and that give higher yield for both submergence-tolerant and nontolerant varieties.

11. Through farmer participatory trials, NDR8002, a genotype with moderate drought tolerance and high yield (5.0–6.5 ton per hectare [t/ha]) was released by India's national varietal testing and release program. In addition, 14 and 8 new genotypes are undergoing testing by the national and state varietal release programs, respectively. All these varieties are characterized by higher yields than farmers' usual varieties, good to excellent submergence tolerance, and resistance to the important biotic stresses of this ecosystem, and one each is suitable for deepwater cultivation or delayed transplanting.

2. Rangpur, Bangladesh

12. New rice establishment methods were developed using either a drum seeder for wet-direct seeding or a lithao for dry-direct seeding that can sow the crop earlier and with less labor, resulting in higher yield and an earlier rice harvest so farmers can get a more timely seeding of a postrice crop, potato, which can be followed by a third crop, all on the same piece of ground. This system provides rice during the hungry months (monga) and provides wage-labor opportunities for agricultural workers in an otherwise slack employment period. The use of the short-duration variety BRRI Dhan 33 with either new or usual establishment practices can also advance the rice harvest for hunger mitigation and diversification/intensification with nonrice crops.

13. Landrace Jati Balam was identified as a potential donor source for breeding tolerance of rice for medium stagnant water conditions, in addition to identifiying 18 IRRI advanced lines with good survival and tolerance of flash-flood conditions.

14. Nursery management was improved to involve a low seeding rate and fertilizer anagement for producing quality seedlings that have a better chance of survival under flooded conditions.

15. New double-transplanting (bolon) practices have improved plant survival in flash-flood onditions; these practices include transplanting 30-day-old seedlings at closer spacing, and new nutrient management in the main field.

C. Working Group 3 for Salt-Affected Lowlands—Cuttack, India

16. A package of integrated crop and natural resource management practices, when used with newly identified improved salt-tolerant varieties (specific to wet- and dry-season conditions), can improve overall system productivity. This package not only can improve wet-season main crop productivity, but also allows farmers to expand their limited dry-season cropping area, when seasonal salinity levels are usually high, to buffer against any crop losses that might occur in the wet season. The package involves the following components:

(i) early transplanting to improve dry season rice productivity by avoiding the risk of high salinity at a sensitive growth stage such as flowering;

(ii) improved nursery nutrient management for robust seedlings and seedling handling (older seedlings transplanted at closer spacings) to increase rice productivity in the wet season; and
(iii) effective main field nutrient management practices involving *Sesbania* for green manuring and the aquatic fern *Azolla* as biofertilizer for sustained nutrient availability, which resource-poor farmers can adopt at very little cost.

17. Salt-tolerant nonrice crops were identified to diversify rice-based systems for enhancing the livelihoods of rural resource-poor households. These crops are sunflower, which farmers value as a source of cooking oil; chilli; watermelon; and okra.

18. Six CRRI lines were identified and nominated to the national varietal testing and release program that can yield at least 4.0 t/ha in the coastal saline ecosystem: CR 2069-16-1 (IET 19680); CR 2092-141-2 (IET 19471); CR 2093-7-1 (IET 19468); CR 2094-46-3 (IET 18696); CR 2070-52-2 (IET 18692); and one line nominated for sodic soils, CR 2096-71-2 (IET 18697).

19. Many salt-tolerant landraces were also identified that can be used as donors for breeding rice for salt-affected ecosystems for future backstopping of the breeding program.

D. Working Group 4 for Sloping Rotational Uplands—Luang Prabang, Lao PDR

20. Through Participatory Variety Selection trials across the northern Lao PDR provinces, suitable traditional varieties have been identified for short-fallow and intensely cropped upland areas, as well as improved materials for more favorable uplands, which can provide better yields than farmers' usual cultivars.

21. Suitable varieties, Mak Nge and Meuang Nga, were identified for gall midge resistance in lowland fields of upland areas.

22. Cold-tolerant varieties were identified for lowland fields of upland areas, such as IR62445-2B-12-12 (3.10 t/ha), IR6244-2B-73-2-2-1 (2.86 t/ha), and K39-96-1-1-1-2.

23. Crop diversification was developed for short-fallow upland fields through a rice-pigeonpea/sticklac intercropping system that can enrich soils and thus contribute to better rice productivity, and allows farmers to earn income by harvesting and selling sticklac, which is a raw material for industrial products.

24. Management practices were improved to control the invasive weed species *Imperata cylindrica* fallow rotational upland fields.

25. Rice–rice bean was developed as a suitable rotation that could improve soil conditions for better rice productivity and rice yield.

E. Working Group 5 for Drought-Prone Plateau Uplands—Hazaribag, India

26. A short-duration (90 days) variety, Anjali, with moderate drought tolerance and good blast resistance has been identified for improved rice production in bunded and unbunded uplands; and the high-yielding elite line RR345-2 was nominated to the national varietal testing and release program. Farmers gave this line a favorable evaluation in the PVS; it is phenotypically similar to Brown Gora, but better yielding.

27. Improved crop establishment methods are now available for unbunded uplands, such as the broadcast seeding in furrows + plow pass establishment system to mitigate drought effects and reduce the labor requirements for establishing the crop. Another new practice, seeding behind the plow, is an effective option.

28. New crop diversification/intensification practices were developed that allow farmers to harvest rice 1 month earlier, and allow the sowing of a nonrice crop, pigeonpea, which can be consumed by the household or sold in the market. If there is sufficient residual soil moisture or late rains, farmers may also consider sowing a postrice chickpea crop.

F. Working Group 6 for Intensive Upland Systems with Long Growing Season

1. Arakan Valley, Philippines

29. An effective model for a community seed bank was developed for *in situ* rice germplasm conservation of local varieties and as a reliable source for healthy, quality seed. It has reduced seed scarcity.

30. Modern upland varieties were identified such as UPLRi5, which can raise rice productivity, allowing farmers to save their traditional varieties for marketing to niche markets.

31. Mixed cropping practices for intensifying the rice-based system with nonrice crops, such as peanut, mungbean, and/or maize, were developed to improve food security and enhance household livelihood.

32. Rice genetic diversification, that is, planting two different rice varieties in specified row ratios, was developed to control disease and improve yield.

2. Lampung, Indonesia

33. A community seed bank has been established for *in situ* rice germplasm conservation of local varieties and as a reliable source for healthy, quality seed.

34. Promising upland rice varieties and farmers' preferred varieties/lines were identified, which are being developed into a seed package with broad-spectrum blast resistance that is being validated in farmers' fields.

Source: IRRI submission as part of the Updated SES-2000 Survey conducted with IARCs.

KEY POLICY RECOMMENDATIONS FROM RETA PROJECTS AND THEIR IMPACT

Center	RETA No.	Title	Key Policy Recommendations	Countries	Adoption/Impact
ICRISAT	RETA 5945[a]	Rapid Crop Improvement for Poor Farmers in the Semiarid Tropics of Asia	• Partnership with local research institute to sustain project outputs	India	• Indian NARS has been able to bring out its own sorghum shoot fly-resistant products from marker-assisted backcrossing in a millet network project supported by a local donor. This has reinforced the capacity-building efforts of RETA 5945 and will soon lead to applied marker-assisted breeding products that can be used by farmers. ICRISAT scientists served to monitor/mentor this nationally funded R&D project.
ICRISAT	RETA 6067[b]	Participatory Watershed Management for Reducing Poverty and Land Degradation in the Semiarid Tropics	• Farmer participatory approach for implementing watershed programs • Multidisciplinary and multi-institutional consortium and convergence approach in watershed management. • Establishment of benchmark watersheds for training and technology dissemination • Knowledge-based rather than money or material-based entry point to encourage community participation • Capacity building and technical backstopping to more successful watershed programs • Empowerment of women and building social capital for proper decision making • Backward and forward linkages with markets and value addition • Encourage diversified livelihood options • Reduce subsidies, and the beneficiaries pay for the costs of the technologies	India	• Farmers' Commission constituted by the Government of India, and ministries of agriculture and rural development in India have incorporated farmer participatory, consortium, and convergence approaches in their watershed and rural development project implementation guidelines. • Need to assess micronutrient deficiencies in dryland areas and correction of such deficiencies and enabling policies are incorporated by various states and central Government in India.

Center	RETA No.	Title	Key Policy Recommendations	Countries	Adoption/Impact
IPGRI	RETA 6005[c]	Developing Coconut-Based Income-Generating Technologies in Poor Rural Communities	• Replication in other coconut growing communities as a strategy for poverty reduction	Philippines	• Facilitated support by local governments
CIMMYT	RETA 5945[a]	Sustaining the Rice-Wheat Production Systems in Asia	• State government support for zero-tillage wheat (Haryana, Bihar, UP)	India	• Further support to disseminate uptake; provision of subsidy on zero-tillage drills
ICARDA	RETA 6136[d]	Improving Rural Livelihoods through Efficient On-Farm Water and Soil Fertility Management in Central Asia	• Several specific recommendations focused on creating enabling environments for wide-scale adoption of conservation agriculture, crop diversification, and water-saving technologies	Uzbekistan, Kazakhstan, Tajikistan, Azerbaijan, Turkmenistan, Kyrgyz Republic	• Awareness of policymakers has been raised, and several of the recommendations are now being considered and integrated into national agricultural policies (e.g., subsidizing phosphor-gypsum application at initial market development stages in Kazakhstan; use of polyethylene and hay mulching; and other water-saving technologies in Uzbekistan).
IFPRI	RETA 6067[e]	Poverty Reduction through Advisory Network, Policy Research, and Capacity Strengthening in South Asia	• Trade liberalization adopted in the rice markets but government procurement and distribution of food products still there. Trade reforms in internal agricultural markets have been there, but in 2008 many of these (like export control) got reversed.	Bangladesh, Nepal, Sri Lanka, Pakistan, and India	• Trade liberalization in rice has helped the poor and improved their food security. • Trade liberalization seems to have benefited the rich while the poor have lost out. • Trade liberalization has helped the poor because of cheap availability of rice, while the losers are relatively richer producers. • Trade liberalization led to gain for producers and slight loss for consumers due to rise in prices. • Trade liberalization was harmful for many sections of society, as it caused the prices to rise.

Center	RETA No.	Title	Key Policy Recommendations	Countries	Adoption/Impact
ILRI	RETA 6005[c]	Improving Crop-Livestock Production Systems in Rainfed Areas of Southeast Asia	• Institutionalization through creation of a Crop-Livestock Unit within the Provincial Government Office of Umingan, Northen Luzon	Philippines	• No ex-post assessment of benefits has been made yet.
			• Influencing the drafting of a new Cooperative Law that was subsequently approved by the Government of Viet Nam, e.g., some aspects of cooperatives that were advocated by national partners in this RETA were integrated in some provisions, e.g., supporting the development of specialized cooperatives as an improvement over the traditional concept of cooperatives in Viet Nam	Viet Nam	• No ex-post assessment of benefits has been made yet.
IWMI	RETA 5945[a]	Pro-Poor Intervention Strategies in Irrigated Agriculture in Asia	• Reorient interventions in irrigated agriculture with a pro-poor focus. • Target poor locations and socioeconomic groups for new investments. • Design investment strategies according to poverty types, as no single intervention suits all types. • Make irrigation agriculture investment packages more comprehensive, including addressing issues related to resource distribution and access to support services, as irrigation alone is not sufficient for achieving the desired level of improvements in productivity for poverty reduction • Provide support services necessary for increasing agricultural productivity through an integrated approach with public-private sector partnerships, and establish clear linkages between irrigation policies, agricultural policies,	Pakistan	• The study team in Pakistan informed the project leader that, based on the project outputs and discussions, a national level NGO implementing poverty reduction interventions has broadened its scope of operations to include water/irrigation as one of its core areas, and has developed new initiatives, including developing separate models for irrigated and rainfed areas, initiatives for strengthening upstream-downstream linkages, and active dissemination of small-scale resource conserving technologies. • The new concept of integrated services delivery in agriculture that emerged from the project findings is being widely discussed in higher-level policy circles. • In addition, the study team leader in Pakistan also reported receiving informal information that the interventions proposed by the project and presented in Islamabad might be further reviewed for consideration for inclusion in Pakistan's next five-year development plan.

Center	RETA No.	Title	Key Policy Recommendations	Countries	Adoption/Impact
			and poverty alleviation strategies Integrate the management of surface and groundwater, particularly in those situations where groundwater is of variable quality and canal water distribution is inequitable across upstream and downstream areas. • These resources cannot be managed in a sustainable way separately. • Develop mechanisms for improving the sustainability of canal irrigation systems. • Implement institutional reform with an explicit pro-poor focus. • Develop and strengthen the disaggregated knowledge, information, and database on poverty.		• Recently, the Punjab Irrigation Minister has expressed interest in initiating pilot projects on some of these new ideas/concepts, particularly those related to integrated services delivery and multifunctionality of water user groups for the development of smallholder economies at the Lower Jehlum Canal, and explored the possibility for IWMI taking the lead in initiating such interventions. Also, it is quite encouraging to note that the project reports/papers are now being used as reference material at the University of Agriculture, Faisalabad, Pakistan.
				Indonesia, Bangladesh	• The project has strategically involved national experts who are directly or indirectly engaged in developing country poverty reduction strategy papers and those involved in developing new national water/irrigation policies with a view to not only cross-fertilize the ideas but to get the key messages across for reflection in both poverty reduction strategies and water/irrigation policies(e.g., the project team leader in Indonesia is one of the experts involved in developing the national irrigation policy for Indonesia, and the team leader in Bangladesh is involved in the development of the national poverty reduction strategy and national water policy for Bangladesh).

Center	RETA No.	Title	Key Policy Recommendations	Countries	Adoption/Impact
				Pakistan	• The project raised significant awareness among communities and farmers about (i) institutional reforms for improved irrigation management and their potential benefits; (ii) irrigation water rights with a focus on those living in poor communities and disadvantaged locations; and (iii) promoting, in some cases, better irrigation, cultivation, and resource conserving practices and technologies. For example, in Chaj area in Pakistan, the project disseminated information and created mass awareness about the benefits of using the bed and furrow method, zero-tillage technology, precision land leveling, and land improvement measures.
IWMI	RETA 6208[f]	Enabling Communities in the Aral Sea Basin to Combat Land and Water Resource Degradation through the Creation of "Bright Spots"	• Growing of licorice on abandoned soils in Uzbekistan • Remediation of Mg-dominant soils in Kazakhstan • Promotion of salt-tolerant alfalfa lines		
World Fish Center	RETA 5945[a]	Strategies and Options for Increasing and Sustaining Fisheries and Aquaculture Production to Benefit Poor Households in Asia	• Rationalize policies to reduce dependence on capture fisheries and sustain them • Reduce poverty through community-based fisheries management to develop inland capture fisheries • Develop aquaculture to meet the growing demand for fish • Focus on freshwater aquaculture for poverty reduction. • Manage brackish and marine aquaculture to spread benefits and protect the environment.		

Center	RETA No.	Title	Key Policy Recommendations	Countries	Adoption/Impact
			• Facilitate the supply of high quality aquaculture inputs. • Improve postharvest processing and marketing services. • Build the necessary institutions.		
World Fish Center	RETA 6136[d]	Achieving Greater Food Security and Eliminating Poverty By Dissemination of Improved Carp Strains to Fish Farmers	• Selective breeding strategies like family selection would improve stock permanently. • Countries engaged in selective breeding program must continue until an economically optimal level of genetic gain is achieved.		
IRRI	RETA 6005[c]	Sustaining Food Security in Asia Through the Development of Hybrid Rice Technology	• Technology generation and dissemination	India, Viet Nam, Philippines	• The governments of these countries have continued to support the development of hybrid rice technology as a tool for improving national rice production.
			• Public-private partnership	Hybrid Rice Development Consortium (HRDC) member countries	• HRDC envisions harnessing the complementary advantages of the public and private sectors to their mutual benefit. This is through establishment of effective collaboration between public research institutions and the private sector in research, seed production, and technology dissemination.
			• Trade on hybrid rice seed across countries	Indonesia, Bangladesh	• The bulk of the hybrid rice seed requirements of these two countries are mainly supplied by other project member countries.

Center	RETA No.	Title	Key Policy Recommendations	Countries	Adoption/Impact
IRRI	RETA 6208[f]	Enhancing Farmer's Income and Livelihoods Through Integrated Crop and Resource Management in the Rice-Wheat System in Asia	• The Government of India is providing 25% subsidy towards purchasing zero-tillage drills and other implements used in conservation agriculture • The Government of Pakistan has taken a special initiative for popularizing laser land leveling, zero tillage, and residue management • The Government of Bangladesh is promoting the use of the leaf color chart on a large scale • Greater willingness to integrate the International Center for Agricultural Research, universities, private sector, extension, farmer groups	India Pakistan Bangladesh	• Larger areas have been brought under the resource conservation technologies. • More and more research projects are being developed with public-private partnerships; many private companies are being involved for agricultural extension.

AVRDC = Asian Vegetable Research and Development Center (now the World Vegetable Center), CIMMYT = International Maize and Wheat Improvement Center, HRDC = Hybrid Rice Development Consortium, ICARDA = International Center for Agricultural Research in Dry Areas, ICRISAT = International Crop Research Institute for Semi-Arid Tropics, IFPRI = International Food Policy Research Institute, ILRI = International Livestock Research Institute, IPGRI = International Plant Genetic Research Institute, IRRI = International Rice Research Institute, IWMI = International Water Management Institute, NARS = national agricultural research station, NGO = nongovernment organization, R&D = Research and Development, RETA = regional technical assistance.

[a] ADB. 2000. *Technical Assistance for the Fifth Agriculture and Natural Resources Research at CGIAR Centers.* Manila (RETA 5945, for $5.8 million, approved on 17 October).

[b] ADB. 2002. *Technical Assistance for the Seventh Agriculture and Natural Resources Research at International Agricultural Research Centers.* Manila (RETA 6067, for $3.8 million, approved on 6 December).

[c] ADB. 2001. *Technical Assistance for the Sixth Agriculture and Natural Resources Research at CGIAR Centers.* Manila (RETA 6005, for $4.0 million, approved on 6 November).

[d] ADB. 2003. *Technical Assistance for the Eighth Agriculture and Natural Resources Research at International Agricultural Research Centers.* Manila (RETA 6136, for $3.0 million, approved on 11 November).

[e] ADB. 2002. *Technical Assistance for the Seventh Agriculture and Natural Resources Research at International Agricultural Research Centers.* Manila (RETA 6067, for $3.8 million, approved on 6 December 2005.

[f] ADB. 2004. *Technical Assistance for the Ninth Agriculture and Natural Resources Research at International Agricultural Research Centers.* Manila (RETA 6208, for $3.0 million, approved on 16 December).

Source: Summarized from IARCs' responses to survey questionnaire.

RETA LINKAGES WITH DMC RESEARCH AND DEVELOPMENT INITIATIVES

Center	RETA No.	Title	Project Linkage/Follow-Up Research Activities: RETA and Non-RETA	Possible Funding
ICRISAT	RETA 5945[a]	Rapid Crop Improvement for Poor Farmers in the Semiarid Tropics of Asia	• India's "Millets Network Project" includes a component of marker-assisted backcross breeding to enhance shoot fly resistance of sorghum hybrid parental lines for the post rainy season. • ICRISAT's project "Exploiting gene synteny to improve stem borer resistance mapping in sorghum" is carrying forward sorghum stem borer resistance quantitative trait locus mapping activities that were initiated in RETA 5945	• Government of India's Department of Biotechnology (DBT) • Sehgal Family Foundation
ICRISAT	RETA 6067[b]	Participatory Watershed Management for Reducing Poverty and Land Degradation in the Semiarid Tropics	• Scaling-up of consortium approach for community watershed management in India • Scaling up of consortium approach for community watershed management in the Philippines • Common property resources (CPRs) development in India	• World Bank through Sujala Watershed Project in Karnataka, India • Sir Dorabji Tata Trust (Mumbai) in Rajasthan and Madhya Pradesh, India • Sir Ratana Tata Trust (Mumbai) in Madhya Pradesh and Jharkhand, India • Bureau of Agricultural Research (BAR), Government of Philippines • National Oilseed and Vegetable Oil Development Board, Government of India
ICRISAT	RETA 6439[c]	Vulnerability to Climate Change: Adaptation Strategies and Layers of Resilience	• Improving management of natural resources for sustainable rainfed agriculture (RETA 5812) • Participatory watershed management for reducing poverty and land degradation in Semi-Arid Tropics in Asia (RETA 6067) • Innovative policy and institutional alternatives for drought management and improving productivity in the rainfed regions	• ADB • ADB • ICRISAT-IFPRI project, a component of the CGIAR Challenge Program on Water and Food.
AVRDC	RETA 6011[d]	Strengthening the Collaborative Vegetable Research Network in Cambodia, Lao PDR, and Viet Nam (Phase II)	• Integrating Safe and Off-season vegetable production with marketing through information, education, and training in Ha Tinh and Tra Vinh provinces, Viet Nam	• IFAD

Center	RETA No.	Title	Project Linkage/Follow-Up Research Activities: RETA and Non-RETA	Possible Funding
			• Proposal submitted to ADB-RETA: Enhancing utilization and conservation of indigenous vegetables by rural farmers in ASEAN countries – a partnership program with ASEAN-AVRDC Regional Network for Vegetable Research and Development (AARNET)	• For possible RETA funding
			• Proposal with Department of Agriculture (DA), Philippines and private seed companies: Public-private partnership program to overcome the food crisis through home gardens	• For possible RETA funding
AVRDC	RETA 5839[e]	Outcome of RETA 6067	• RETA 6067: Promoting Utilization of Indigenous Vegetables for Improved Nutrition of Resource-Poor Households in Asia	• ADB
AVRDC	RETA 6067[b]	Promoting Utilization of Indigenous Vegetables for Improved Nutrition of Resource-Poor Households in Asia	• DA- BAR Philippines project on indigenous vegetables supported by Philippine government	• DA-BAR, Philippines
			• Integration of and indigenous vegetable component in the Agroforestry project of the Sustainable Agriculture and Natural Resource Management Collaborative Research Support Program	• USAID
AVRDC	RETA 6208[f] and RETA 6376[g]	RETA 6208: Improving Rural Livelihoods through Development of Vegetable-Based Post-Harvest Technologies in Cambodia, Lao People's Democratic Republic, and Viet Nam; and RETA 6376: Supporting Pro-Poor Vegetable Value Chains in Greater Mekong Subregion Countries	• Joint training, joint surveys on improvement of vegetable production and postharvest management systems in Cambodia and Australia	• ACIAR
IPGRI	RETA 6005[h]	Developing Coconut-Based Income-Generating Technologies in Poor Rural Communities	• Program for Overcoming Poverty in Coconut-Growing Communities: Coconut Genetic Resources for Sustainable Livelihoods (2005–2008)	• IFAD
			• This project supports the wider scale testing of coconut-based livelihood strategies in other communities in Asia, Latin America, and Africa	
			• Coconut-Based Product Diversification to Reduce Poverty in Coconut-growing Communities (2005-2008)	• Government of the Philippines

Center	RETA No.	Title	Project Linkage/Follow-Up Research Activities: RETA and Non-RETA	Possible Funding
			• This project supports the wider scale testing of coconut-based livelihood strategies in four communities in the Philippines	
CIMMYT	RETA 5945[a]	Sustaining the Rice-Wheat Production Systems in Asia	• Ongoing (until Dec 2008): RETA 6208 IRRI-led (Enhancing farmers' income and livelihoods through integrated crop and resource management in the rice-wheat system in South Asia)	• ADB RETA 6208
CIMMYT	RETA 6208[f]	Improving Farmer's Income Through Enhanced Maize Productivities in Drought-Prone Environments in East and Southeast Asia	• Indonesia, Philippines, PRC, and Thailand partners have used the success of the RETA 6208 to leverage funds from their governments to continue some of the activities	• Various sources
CIMMYT	RETA 6005[h] and RETA 6208[f]	RETA 6005 (Developing New Maize Germplasm Through Biotechnology for Resource-Poor Farmers in Asia), and RETA 6208 (Improving Farmer's Income Through Enhanced Maize Productivities in Drought-Prone Environments in East and Southeast Asia)	• Molecular breeding and drought tolerance work continue with involvement of a few partners, making products widely available	• Various, but very limited and hence much reduced scope of activities
ICARDA	RETA 6136[i]	Improving Rural Livelihoods through Efficient On-Farm Water and Soil Fertility Management in Central Asia	• Several of the research activities conducted under the project have now been taken up by the national programs (Kazakhstan and Uzbekistan) and are being continued through national funding • Community Action in Integrated Market-Oriented Feed and Livestock Production in Central Asia and South Asia	• Countries themselves • IFAD-TAG:ICARDA-816
IFPRI	RETA 5945[a]	Breeding Iron-Rich Rice to Reduce Iron Deficiency Anemia in Asia	• HarvestPlus Challenge Program	• Bill and Melinda Gates Foundation (BMGF) World Bank, USAID, DFID
IFPRI	RETA 6067[b]	Poverty Reduction through Advisory Network, Policy Research, and Capacity Strengthening in South Asia	• Trade, agricultural policies, and structural changes in India's agrifood system; implications for national and global markets	• European Union
IFPRI	RETA 6376[g]	Promoting a Multi-Stakeholder Dialogue on New Strategies and Actions for Reducing Hunger and Poverty with a Focus on Agriculture and Rural	• Discussions are under way with ADB for a project on the theme of "Policies for ensuring food security in South and Southeast Asia"	• ADB

Center	RETA No.	Title	Project Linkage/Follow-Up Research Activities: RETA and Non-RETA	Possible Funding
		Development in Asia		
ILRI	RETA 6005[h]	Improving Crop-Livestock Production Systems in Rainfed Areas of Southeast Asia	• Sweet potato-pig systems livelihood project (jointly implemented by ILRI and CIP) • Contract Farming for Equitable Market-Oriented Swine Production in Northern Viet Nam (implemented by ILRI, Hanoi Agricultural University, IFPRI and FAO-Pro-Poor Livestock Policy Initiative [PPLPI]), completed in 2007	• Systemwide Livestock Program • FAO-PPLPI
ILRI	RETA 6005[h] and RETA 5812[j]	RETA 6005: Improving Crop-Livestock Production Systems in Rainfed Areas of Southeast Asia, and RETA 5812: Increasing Productivity of Crop-Livestock Systems in Asia	• Development of cassava-based feeding technologies (implemented by Khon Kaen University) • Goat enterprise development project (implemented by the Philippine Council for Agriculture and Natural Resources Research and Development (PCARRD) with local government units and ILRI, completed in 2006)	• Thailand Research Fund • Philippine contribution to the CGIAR • Philippine contribution to the CGIAR
IWMI	RETA 5945[a]	Pro-Poor Intervention Strategies in Irrigated Agriculture in Asia	• Understanding the impacts of irrigation investment in Sri Lanka	• Japan Bank for International Cooperation
		Enabling Communities in the Aral Sea Basin to Combat Land and Water Resource Degradation through the Creation of "Bright Spots"	• Understanding a broad array of agricultural water management practices and their poverty linkages for investment guidance	• Various
IRRI	RETA 6005[j]	Sustaining Food Security in Asia Through the Development of Hybrid Rice Technology	• None by IRRI but support to PHILRICE was valuable in terms of additional activities to promote widespread use of technology	• Phil Gov't Hybrid Rice Program that came at the same time as ADB support
IRRI	RETA 6136[l]	Integrating and Mobilizing Rice Knowledge to Improve and Stabilize Crop Productivity to Achieve Household Food Security in Diverse and Less Favourable Rain-Fed Areas of Asia	• RETA 6136, ongoing, with core resources and other external support	• Core and other support
IRRI	RETA 6276[k]	Development and Dissemination of Water-Saving Rice Technologies in South Asia	• RETA 6276, ongoing research	• Core and other support
IRRI	RETA 6208[f]	Enhancing Farmers' Income and Livelihoods Through Integrated Crop and Resource Management in the Rice-Wheat System in Asia	• RETA 5945 and RETA 6208 - Enhancing Farmers' Income and Livelihoods through Integrated Crop and Resource Management in the Rice-Wheat System in South Asia. • USAID - Revitalizing the Rice-Wheat Cropping	• Core and other support, USAID, BMGF

Center	RETA No.	Title	Project Linkage/Follow-Up Research Activities: RETA and Non-RETA	Possible Funding
			Systems of the Indo-Gangetic Plains: Adaptation and Adoption of Resource Conserving Technologies in India, Bangladesh and Nepal. • USAID - Revitalizing the Rice-Wheat Cropping Systems of the Indo-Gangetic	
			Plains: Adaptation and Adoption of Resource Conserving Technologies in India, Bangladesh and Nepal; • BMGF - Cereal Systems Initiative for South Asia (CSISA): Proposed.	

ACIAR = Australian Centre for International Agricultural Research, ASEAN = Association of Southeast Asian Nations, AVRDC = Asian Vegetable Research and Development Center (now the World Vegetable Center), CGIAR = Consultative Group on International Agricultural Research, CIMMYT = International Maize and Wheat Improvement Center, CIP = International Potato Centre, DFID = UK Department for International Development, EU = European Union , FAO = Food and Agriculture Organization, ICARDA = International Center for Agricultural Research in Dry Areas, ICRISAT = International Crop Research Institute for the Semi-Arid Tropics, IFAD = International Fund for Agricultural Development, IFPRI = International Food Policy Research Institute, ILRI = International Livestock Research Institute, IPGRI = International Plant Genetic Research Institute, IRRI = International Rice Research Institute, IWMI = International Water Management Institute, JBIC = Japan Bank for International Cooperation, PRC = People's Republic of China, RETA = regional technical assistance, USAID = United States Agency for International Development.

[a] ADB. 2000. *Technical Assistance for the Fifth Agriculture and Natural Resources Research at CGIAR Centers.* Manila (RETA 5945, for $5.8 million, approved on 17 October).

[b] ADB. 2002. *Technical Assistance for the Seventh Agriculture and Natural Resources Research at International Agricultural Research Centers.* Manila (RETA 6067, for $3.8 million, approved on 6 December).

[c] ADB. 2007. *Technical Assistance for the Twelfth Agriculture and Natural Resources Research at International Agricultural Research Centers.* Manila (RETA 6439, for $2.0 million, approved on 18 December).

[d] ADB. 2001. Technical Assistance for the Strengthening the Collaborative Vegetable Research Network in Cambodia, Lao PDR, and Viet Nam (Phase II). Manila (RETA 6011, for $650,000, approved on 17 December).

[e] ADB. 1999. Technical Assistance for the Collection, Conservation, and Utilization of Indigenous Vegetables. Manila (RETA 5839, for $550,000, approved on 29 March).

[f] ADB. 2004. *Technical Assistance for the Ninth Agriculture and Natural Resources Research at International Agricultural Research Centers.* Manila (RETA 6208, for $3.0 million, approved on 16 December).

[g] ADB. 2006. *Technical Assistance for the Eleventh Agriculture and Natural Resources Research at International Agricultural Research Centers.* Manila (RETA 6376, for $1.0 million, approved on 18 December).

[h] ADB. 2001. *Technical Assistance for the Sixth Agriculture and Natural Resources Research at CGIAR Centers.* Manila (RETA 6005, for $4.0 million, approved on 6 November).

[l] ADB. 2003. *Technical Assistance for the Eighth Agriculture and Natural Resources Research at International Agricultural Research Centers.* Manila (RETA 6136, for $3.0 million, approved on 11 November).

[j] ADB. 1998. *Technical Assistance for the Third Agriculture and Natural Resources Research at CGIAR Centers*. Manila (RETA 5812, for $5.6 million, approved on 22 October).

[k] ADB. 2005. *Technical Assistance for the Tenth Agriculture and Natural Resources Research at International Agricultural Research Centers.* Manila (RETA 6276, for $1.0 million, approved on 2 December 2005.

Source: Summarized from IARCs' responses to survey questionnaire.

SUPPORT PROVIDED TO THE NATIONAL AND INTERNATIONAL RESEARCH INSTITUTES IN THE PHILIPPINES

1. The RETA projects (i.e., ADB. 1992. *Technical Assistance for the Establishment of the Asian Rice Biotechnology Network*. Manila [RETA 5510, for $900,000, approved on 24 November]; ADB. 1996. *Technical Assistance for the Asian Rice Biotechnology Network - from Products to Impact*. Manila [RETA 5667, for $850,000, approved on 9 January]; ADB. 1996. *Technical Assistance for the Agriculture and Natural Resources Research at CGIAR Centers*. Manila [RETA 5711, for $5.2 million, approved on 12 December]; and ADB. 1998. *Technical Assistance for the Third Agriculture and Natural Resources Research at CGIAR Centers*. Manila [RETA 5812, for $5.6 million, approved on 22 October]) supported the development of the network. These earlier RETA projects were provided prior to this evaluation period (2000–2007).

2. RETA projects such as ADB. 1975. Technical Assistance for the International Rice Research Institute. Manila (RETA 5026, for $300, 000, approved on 20 February); ADB. 1989. *Technical Assistance for Strengthening Rice Crop Protection Research and Minimizing Environmental Damage in DMCs*. Manila (RETA 5349, for $850,000, approved on 26 September); ADB. 1992. *Technical Assistance for the Establishment of the Asian Rice Biotechnology Network*. Manila (RETA 5510, $900,000, approved on 24 November); ADB. 1996. Technical Assistance for the Asian Rice Biotechnology Network - from Products to Impact. Manila (RETA 5667, for $850,000, approved on 9 January); ADB. 1996. *Technical Assistance for the Agriculture and Natural Resources Research at CGIAR Centers*. Manila (RETA 5711, for $5.2 million, approved on 12 December); ADB. 1998. *Technical Assistance for the Third Agriculture and Natural Resources Research at CGIAR Centers*. Manila (RETA 5812, for $5.6 million, approved on 22 October); ADB. 1997. *Technical Assistance for the Second Agriculture and Natural Resources Research at CGIAR Centers*. Manila (RETA 5766, for $5.5 million, approved on 29 December); and ADB. 2001. *Technical Assistance for the Sixth Agriculture and Natural Resources Research at CGIAR Centers*. Manila (RETA 6005, for $4 million, approved on 6 November).

3. RETA projects such as ADB. 1979. *Technical Assistance for the Intensification of Rice Research for Disadvantaged Areas*. Manila (RETA 5059, for $700,000, approved on 26 July); ADB. 1985. *Technical Assistance for the International Rice Research Institute for Strengthening Research on Integrated Pest Management for Deepwater Rice Farming Systems*. Manila (RETA 5194, for $350,000, approved on 18 December); ADB. 1986. *Technical Assistance for the International Rice Research Institute for Research on Botanical Pest Control*. Manila (RETA 5208, for $250,000, approved on 7 May); ADB. *Technical Assistance to IRRI-for the Development of Rice Varieties Tolerant to Problem Soil Conditions.* Manila (RETA 5261, for $500,000, approved on 20 August); ADB. 1994. *Technical Assistance for the International Rice Research Institute for Rainfed Lowland Rice Ecosystem Research*. Manila (RETA 5606, for $1.1 million, approved on 6 December); ADB. 2003. *Technical Assistance for the Eighth Agriculture and Natural Resources Research at International Agricultural Research Centers*. Manila (RETA 6136, for $3 million, approved on 11 November); ADB. 2004. *Technical Assistance for the Ninth Agriculture and Natural Resources Research at International Agricultural Research Centers*. Manila (RETA 6208, for $3 million, approved on 16 December); and ADB. *Technical Assistance for the Development and Dissemination of Water-Saving Rice Technologies in South Asia*. Manila (RETA 6276, for $1 million, approved on 2 December).

CAPACITY BUIDLING OF THE NATIONAL AGRIUCLTURAL RESEARCH SYSTEMS

A. Afghanistan[1]

1. CGIAR Presence in Afghanistan

1. The International Maize and Wheat Improvement Center (CIMMYT) and the International Center for Agricultural Research in Dry Areas (ICARDA) both hold regional offices in Kabul.

2. The future Harvest Consortium to Rebuild Agriculture in Afghanistan (FHCRAA)—ICARDA has partnered with the United States Agency for International Development (USAID) to lead a relief consortium to help restore Afghanistan's agriculture. In January 2002, 74 experts from 34 organizations including Consultative Group on International Agricultural Research (CGIAR) centers and other research institutes, relief and development organizations, nongovernment organizations, United States (US) universities, aid agencies and the Afghanistan Ministry of Agriculture participated in a meeting that resulted in the creation of FHCRAA. The Consortium identified five key priority areas needing imrpovement:

(i) seed systems and crops,
(ii) soil and water management,
(iii) livestock,
(iv) feed and rangelands, and
(v) horticulture.

3. All programs and projects have been implemented in collaboration and cooperation with NGOs, US universities, the United Nations Food and Agriculture Organization, other CGIAR centers, and the Afghanistan Ministry of Agriculture and Livestock.

4. **Consortium Delivers in Afghanistan.** One of the first missions of the Future Harvest Consortium was to promote food security. In April 2002, just in time for the spring planting season, the Consortium provided 3,500 tons of improved CIMMYT/ICARDA wheat seed to approximately 70,000 farmers in eight provinces. In addition, ICARDA sent 53 tons of wheat, barley, lentil, chickpea, and vetch to Afghanistan for evaluation, on-station testing, and on-farm seed multiplication. For the 2003 autumn planting season, the Consortium arranged the production and delivery of more than 5,000 tons of wheat seed, which reached more than 90,000 farmers in 11 provinces.

5. **Providing Improved Wheat and Maize Seeds.** CIMMYT responded to Afghanistan’s most urgent needs by making improved, high-quality wheat and maize seed available to farmers. The following are examples of CIMMYT's activities:

(i) 300 tons of quality seed of locally adapted wheat variety MH-97 to 9,000 farmers in four provinces for the 2002 fall planting;
(ii) 2.5 tons of breeder's and foundation maize seed delivered to Afghan farmers for 2003 season;
(iii) 35 wheat variety trials at six sites, and 24 maize trials at eight sites, to identify additional farmers needs; and
(iv) 15 researchers have attended training courses at CIMMYT, Mexico.

[1] Available: http://www.cgiar.org/inaction/afghanistan.html

6. CIMMYT activities in Afghanistan operate through the FHCRAA and are funded by USAID, the Australian Agency for International Development, and the Australian Centre for International Agricultural Research.

7. **Developing Alternatives to Poppy Production.** In an effort to develop economic alternatives to poppy production, the Consortium is restoring Afghanistan's gene banks, and is supporting grape, fig, olive, pomegranate, almond, mulberry, apricot, peach, orange, lemon, and almond cultivation. The International Center for Tropical Agriculture (CIAT) and the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) have joined the effort to eradicate poppy production though the USAID-funded Rehabilitation of the Agricultural Markets Program (RAMP). RAMP is initially focusing on saffron and cumin cultivation as alternative crops.

8. **Promoting Long-Term Research Capabilities.** ICARDA has worked with the Consortium to rebuild six agricultural research stations in five Afghan provinces. The stations develop and evaluate new crop genotypes for distribution throughout the region, and also serve as centers for small business development, crop improvement, technology transfer, and educational opportunities for farmers.

9. **Fighting Sunn Pest.** *Eurygaster integriceps*, commonly known as Sunn pest, is one of the most serious threats to wheat in Afghanistan. Sunn pest infestations can cause a 50–90% loss in wheat yields. ICARDA scientists are currently exploring long-term biological control options such as *Beauvaria bassiana*, a fungus that is toxic to Sunn pest eggs and larvae. In 2002, the Central Asian Development Group was able prevent wheat losses of over $12 million by using the Sunn pest management package provided by ICARDA.

10. **Potato Seed Production and Multiplication.** The International Potato Center (CIP) has developed a farmer-based seed multiplication system that has led to increased supplies of virus-free potato seed in domestic and neighboring markets. CIP trained 725 Afghan researchers in eight provinces to test and use the new virus-free varieties in their harvests.

11. **Creating a Knowledge Base.** The Consortium has provided much needed training to Afghan researchers and agricultural faculty members in all aspects of seed systems, seed production, seed enterprise development, variety management, seed potato multiplication, integrated pest management, operation and management of experimental stations, management of water resources and improvement of water-use efficiency, advanced radio production, format development and audio-editing, agricultural journalism, digital and audio recording and editing, and computer technology. The following are examples of training activities:

(i) In 2002 ICARDA staff organized a workshop in Kabul on agricultural journalism for reporters to learn the basics of journalism and radio production techniques.
(ii) Over 70 Afghan men and women have been trained in seed technology and pest control.
(iii) Regular employment has been provided for 102 Afghans and approximately 300 widows were hired to clean seed for the fall distribution.
(iv) More than 100 Afghans have been trained in water management by ICARDA and its partners.

B. People's Republic of China[2]

1. PRC-CGIAR Partnership

12. The People's Republic of China (PRC) has been collaborating with CGIAR centers since the early 1970s, and became a CGIAR member in 1984. CGIAR works through the Chinese Academy of Agricultural Sciences (CAAS), the research arm of the Ministry of Agriculture.

13. Seven CGIAR centers CIMMYT, CIP, International Food Policy Research Institute, International Livestock Research Institute (ILRI), International Plant Genetic Resources Institute (IPGRI), International Rice Research Institute (IRRI), and International Water Management Institute—maintain regional offices in the PRC.

14. Over 50 PRC institutions have collaborated closely with CGIAR centers. More than 3,400 PRC scientists have received training at CGIAR Centers, many of whom are now occupying leadership positions throughout the CGIAR and at PRC organizations. PRC's partnership with CGIAR centers focuses on major food crops (maize, potatoes, rice, and wheat), land and water management, livestock, forestry, fisheries, and food policy. As a result of this partnership, the PRC has bred more than 260 crop varieties containing genetic material from CGIAR centers.

2. Selected CGIAR Projects in the PRC

15. Examples of the PRC-CGIAR partnership follow:

16. **Raising Rice Productivity.** Rice is the most important food crop in the PRC. High-yielding rice varieties developed by IRRI (including IR-8) were used by PRC researchers well before a formal relationship was established in 1982. Since the opening of an IRRI liaison office in Beijing in 1997, IRRI and RPC scientists have collaborated on 48 different projects, with 18 still ongoing. Overall, IRRI's impact in the PRC has been extensive:

(i) About 90% of Chinese hybrid rice varieties—which account for about half of China's rice production—have IRRI parentage.
(ii) Since 1981, 37 modern varieties shared via IRRI's breeding network have been released to PRC rice growers, providing 5.45 million tons in additional rice and $465 million in additional income to farmers.

17. **Combating Rice Pests, Naturally.** Diseases and insect pests pose serious threats to PRC rice production. In 1997, IRRI led a program in collaboration with the Yunnan Agricultural University to "interplant" different rice varieties to exploit biodiversity as a way to resist pest attacks. By 2004, the technique had spread successfully to more than 200,000 hectares (ha) in Yunnan Province, allowing farmers to enjoy increased incomes of up to $150/ha. The *New York Times* described the project as a "stunning success" and one of the "largest agricultural experiments" ever.

18. **Capacity Building and Research Collaboration.** In addition to the 98 PRC PhD and MSc holders trained at IRRI since 1984, hundreds of PRC researchers have been sponsored to

[2] Available: http://www.cgiar.org/inaction/china.html

attend important conferences and workshops overseas, including 113 training programs and courses. Research collaboration has focused on the following areas:

(i) molecular breeding: about 50 PRC scientists involved;
(ii) the Irrigated Rice Research Consortium: 8 institutes, about 16 PRC scientists;
(iii) site-specific nutrient management: 7 institutes and about 10 PRC scientists;
(iv) Integrated Pest Management and biodiversity: about 100 PRC scientists;
(v) water saving: 5 PRC institutes; and
(vi) the International Network for the Genetic Evaluation of Rice: 13 institutes and about 50 PRC scientists.

19. **Fighting Hunger through Improved Maize.** According to IFPRI projections, demand for cereal crops, especially maize, will continue to increase dramatically n the PRC over the next 20 years. Maize accounts for approximately 24% of the total harvest in the PRC, and demand is also rising rapidly all across Asia. In an attempt to address some of these challenges, CIMMYT has planted more than one million ha of its maize varieties across the PRC. CIMMYT, through the Asian Maize Biotechnology Network collaborates with CAAS in applying advanced biotechnology for maize improvement throughout the country. More than 100 PRc scientists have participated in CIMMYT knowledge exchange programs on hybrid maize technology and seed production.

20. **Reducing Disease in Roots and Tubers.** The PRC is one of the largest users of CIP germplasm worldwide, and CIP has active collaboration with PRC breeders in both crops in many regions. Since 2000, CIP and PRC scientists have collaborated through the organization of South East Asian regional courses on potato and sweet potato.

21. **Sweet Potato.** In 1987, CIP began collaborating with PRC scientists to develop new technologies to eliminate viral diseases in sweet potato. The techniques included new methods to identify viruses in sweet potato roots, and better systems for multiplying improved virus-free plant varieties. By the early 1990's, these efforts had helped boost sweet potato production by over 30% and expanding cultivated area to over 600,000 ha in Shandong Province.

22. **Potato.** In 1978, the PRC and CIP worked together to develop a disease-resistant potato (CIP-24), which is grown on approximately 70,000 ha, principally in the drought-prone northern provinces. CIP collaborates with the Root and Tuber Crop Research Institute of Yunnan Normal University and the Huize Agricultural Extension Center and has developed "Cooperation 88," a high-yielding potato variety currently grown on more than 100,000 ha in Yunnan Province alone.

23. **Winning Steps for Wheat.** Wheat is PRC's second most important food crop after rice, accounting for 25% of food production. CIMMYT is helping the country address future increases in wheat demand in several aspects. The following show CIMMYT's impacts:

(i) The PRC has provided more than 1,000 commercial wheat lines to CIMMYT. In turn, The PRC wheat program has received more than 15,000 experimental strains of wheat from CIMMYT.
(ii) CIMMYT wheats contribute high yield potential, resistance to disease, and better quality to Chinese germplasm.
(iii) CIMMYT and CAAS jointly operate an internationally recognized wheat quality program to meet the demand for quality improvement.

(iv) CIMMYT and RPC scientists have developed shuttle breeding programs for improving resistance to fusarium diseases and yellow rust.
(v) CIMMYT has trained over 100 PRC wheat scientists, who currently lead wheat breeding programs at the provincial and national levels.
(vi) CIMMYT and the PRC have established an information and germplasm exchange program with the participation of more than 60 institutes across the country.

24. **Exchanging Knowledge on Hillside Agriculture.** CIAT's experience with hillside agriculture in the Andes (Bolivia, Colombia, and Ecuador) has led to partnerships and regional exchanges with related institutions in Yunnan Province. CIAT, with funding from the Inter-American Development Bank, is facilitating joint field visits, fieldwork, workshops, and visits to communities.

25. **Buckwheat Revitalized.** IPGRI has supported work on buckwheat in the mountainous regions of southwest PRC since the early 1990s. Studies of buckwheat with the Chengdu Institute of Biology, indicated strong support for the conservation of buckwheat diversity on farms.

26. A second study, involving the Zhaojue Agricultural Research Institute in the Liangshan Autonomous Region and the Chengdu Institute of Biology, surveyed local farmers to discover how they handle and conserve the crop, and mapped buckwheat biodiversity. The most recent development is to promote tartary buckwheat as a crop to improve livelihoods. A study in Shanxi Province indicated the high potential of buckwheat as a nutritious food, conferring better health, and suggested avenues for smaller farmers to process and market buckwheat products, thereby capturing more value from their harvest. In the laboratory, work with CAAS is focused on molecular characteristics of buckwheat, which will help farmers and scientists to breed better varieties more rapidly.

27. **Partnerships to Improve Crop-Livestock Farming Systems.** Mixed farming systems that integrate crop and animal production form the backbone of small-scale Asian agriculture. From 1999 to 2004, the Africa-based ILRI collaborated with the Sichuan Animal Science Academy, the Yunnan Beef Cattle and Pasture Research Center, and national agricultural research systems in four Southeast Asian countries in the Crop-Animal System Research Network (CASREN). Funded by the Asian Development Bank, CASREN applied holistic and participatory research-for-development approaches.

28. ILRI began collaborating with PRC scientists and institutions in Yunnan in 1999 and in Sichuan in 2002. CASREN projects provided farm communities with enhanced pig-feed technologies using sweet potato in Sichuan Province and enhanced smallholder production of beef cattle and goats in the rainfed maize-and-wheat farming systems of Yunnan Province.

29. ILRI's sister Future Harvest Centre, the CIP, became a research partner in the Sichuan project, which greatly enhanced smallholder use of sweet potato as pig feed. The success of CASREN's work in Sichuan, where many farm households more than doubled their incomes by adopting CASREN potato silage technologies, has induced the CGIAR systemwide Livestock Program to fund related research within the PRC and Southeast Asia.

30. In May 2004, CAAS and ILRI established a Joint Laboratory on Livestock and Forage Genetic Resources within the CAAS Institute of Animal Sciences in Beijing. ILRI and CAAS

scientists working at this Joint Laboratory are applying state-of-the-art techniques to collect, characterize, and conserve indigenous livestock and forage genetic resources in the PRC and Southeast Asia. The Joint Laboratory serves as a research platform to build biotechnology as well as genetics research capacity in the region.

31. **Bed Planting along the Yellow River.** Serious water and soil erosion along the Yellow River has led to frequent basinwide droughts and floods. In 2000, an estimated 110 million people lived in the basin area, where food per capita was nearly 20% less than in the rest of teh country. The CGIAR Challenge Program on Water and Food (CPWF) is cooperating with the Yellow River Conservancy Commission, which acts as a basin coordination institution to develop projects aimed at improving all aspects of water management. Under this umbrella, the CPWF works with several PRC researchers and institutions on issues such as aerobic rice breeding, groundwater governance, and bed planting.

32. In one example of impact, from 1998 to 2003, CIMMYT extended bed planting in the Yellow River Basin's Shandong Province from a few test plots to more than 26,000 ha. This particular method of water management involves planting crops on raised beds and applying inputs, including irrigation water, in furrows. Bed planting improves soil fertility and structure and helps reduce erosion, water usage, and herbicide use. It facilitates mechanical and manual weeding. The technique has the potential to achieve 30-40% water savings in the river basin.

33. **Pigeonpea in Chinese Diets.** In 1998, ICRISAT researchers successfully introduced pigeonpea in Guangxi and Yunnan provinces, primarily for soil conservation. Six years later the total area planted to pigeonpea was over 60,000 ha. The pigeonpea is a hardy, drought-tolerant food legume high (20-22%) in protein and offers the added benefit of fixing nitrogen and other nutrients in the soil. CAAS is working to promote pigeonpea cultivation in three more provinces characterized by harsh, dryland farming conditions. Pigeonpea is suitable fodder for cattle, goats, and rabbits. Recently, an export market for fresh pigeonpea vegetable seed has also been established, and it has enhanced farmers' income significantly.

34. **Addressing Problems with PRC's Timber Imports.** In 1998, more than 4,000 people died in floods blamed on excessive deforestation. Subsequently, the PRC implemented a widespread ban on logging. It was feared that this ban would lead to an increase in timber imports and cause serious adverse consequences for forests in Southeast Asia and eastern Russia. In 2004, the Center for International Forestry Research (CIFOR) and Forest Trends launched a multipartner project that seeks to increase the level of information available about timber demand and trade and associated environmental impacts. The project will link with regional networks, identify leverage points where advocates can effect change, and develop policy-relevant scenarios to help make forest industries and markets more responsive to the needs of smallholders and low-income producers.

35. **Improving National Forest Policy.** Since 1978, the PRC has undergone important policy reforms affecting forest resources, creating major opportunities for promoting environmentally friendly forestry techniques. In recent years, concerns have emerged regarding rising demand for timber, adequate distribution of benefits from forestry development and protecting the rights of local people living near forest areas. CIFOR has collaborated with the China Council for International Cooperation on Environment and Development, which encompasses the influential policy-making Task Force on Forests and Grasslands that is building support for policy reform through rigorous fieldwork and by strengthening the PRC's

capacity for policy analysis. CIFOR has exchanged knowledge with policymakers of the Task Force through local seminars and major symposia involving sponsors from around the world.

36. **Regional Pesticide Use Cut.** Misuse and overuse of insecticide sprays by Asian rice farmers is dangerous to human health and damaging to the environment. In an attempt to cut pesticide use in the region, IRRI researchers have launched an innovative, basinwide public information campaign in the Mekong River Delta that is reaching 92% of the delta's 2.3 million farm households including those in the PRC. Overall, insecticide use has decreased by 72%.

37. Rice production in the delta increased to 14 million tons (up from 11 million tons). The campaign, which won Scotland's St. Andrew's Environmental Prize, is now being extended to one million rice farmers along the Red River which flows through the PRC and Viet Nam into the South China Sea.

IARCS' PERCEPTION OF THE BENEFITS OF LINKING RETA WITH ADB COUNTRY OPERATIONS

The international agriculture research centers' perception of benefits on linking RETA projects with ADB's country operations are as follows:

- Could provide technical solutions to the problems of the developing member countries. (n=2)

- Could facilitate the adoption/uptake and spread of technology/gies developed and/or livelihood opportunities (e.g., indigenous school garden component of RETA 6067[1] was linked with the Northern Crop Diversification Project of Bangladesh and the Japan Fund for Poverty Reduction Program in Cambodia; training of farmers was facilitated and distribution of indigenous vegetables was more rapidly promoted). (n=2)

- Facilitate supervision/monitoring of the adoption and spread of research results/technologies developed and thereby relieve CGIARs role in this. (n=2)

- Could lead to bilateral support for research and other development activities funded by either country governments themselves or through the Asian Development Bank's (ADB) country loan operations. (n=2)

- Could lead to the creation of an enabling policy environment for the promotion of sustainable and cost-effective agricultural technologies at the country level. ADB has much greater leverage at the political level than CGIAR. (n=4)

- Could enable countries to develop safety nets and mitigation measures well ahead of time to protect farmers and the poor from the possible adverse impacts of emerging issues/problems. (n=3)

- Could facilitate a more coordinated research and development program in the region and lead to potentially greater impact. (n=4)

ADB = Asian Development Bank, RETA = regional technical assistance.

[1] ADB. 2002. *Technical Assistance for the Seventh Agriculture and Natural Resources Research at International Agricultural Research Centers.* Manila (RETA 6067, for $3.8 million, approved on 6 December).

Note: Numbers in parentheses are number of center responses.

COMMENTS ON ADB RETA OPERATION AND MANAGEMENT

ADB Guidelines for Concept Proposal and Proposal Preparation	Project Awarding and Initiation	Project Monitoring and Frequency of Report Submission	Funding Modality Used	Others
Adequate—to remain as is. **(n=5)**	No comments. **(n=3)**	Quarterly reporting too much: suggestions were for every 6 months or yearly. **(n=5)**	Present funding modality can be continued, with scope to adjust for inflation. **(n=2)**	Constant reassignment of RETA portfolio among ADB/task managers makes monitoring complicated. **(n=1)**
Broaden research areas. **(n=3)**	Reduce time gap between awarding and initiation. **(n=4)**	Clear and appropriate—no problems encountered. **(n=3)**	No comment/no problem/appropriate. **(n=3)**	Little interest, if any, from task managers; none from country office. **(n=1)**
Unclear due to frequent changes, themes not well defined. **(n=2)**	Need sufficient time to implement a project: put in place staff, project plans with NARS in place, letters of concurrence from government partners. **(n=1)**	ADB staff participation in meetings and monitoring useful/needed for clearer understanding of project. **(n=2)**	Indirect cost is inappropriate (15% of total cost). CG uses unrestricted funds to subsidize ADB grants. Do not allow full cost recovery. **(n=1)**	Agriculture second tier priority at ADB—discourages seeking additional funds. **(n=1)**
Confusing (printed guidelines not the same as in web). **(n=1)**	Timely release of funds. **(n=1)**	Too minute details of reporting. **(n=1)**	Inflexible use of contingency fund/sometimes not enough. **(n=2)**	No deputy for task managers when they go on mission—difficult to make inquiries. **(n=1)**
Deadlines are unrealistic. **(n=1)**	More frontloading. **(n=1)**	No acknowledgement of report receipt, no comments. **(n=1)**	CG staff cost not allowed to be charged from grant. **(n=1)**	Link RETA projects with country programs. **(n=1)**
To identify themes in advance—rotated among centers (at least 2 per RETA with 6 years duration). **(n=1)**	Allocate funds as program grants rather than restricted projects. **(n=1)**	Too much micromanaging of project to the point of insisting almost on how project is implemented. **(n=1)**	Appropriate if no delays. **(n=1)**	
	Inception workshop in between enables clarification and leveraging on project objectives/ activities/etc. **(n=1)**	Should include discussions of assessment of monitoring and evaluation indicators during the reporting period. **(n=1)**	Yearly rather than semi-annual disbursement. **(n=2)**	

ADB = Asian Development Bank, IARC = international agricultural research center, NARS = national agricultural research system, RETA = regional technical assistance.

Note: Numbers in parentheses are frequency counts of projects responding.

Source: Summarized from IARCs responses to survey questionnaire.

RECENT ESTIMATES OF RATES OF ANRR BY COMMODITY

Commodity	No. of Observations	Mean		Mode	Median	Min.	Max.
Multi commodity[a]	436	80.3	*(110.7)*	58.0	47.1	-1.0	1,219.0
All agriculture	342	75.7	*(110.9)*	58.0	44.0	-1.0	1,219.0
Crops and livestock	80	106.3	*(115.5)*	45.0	59.0	17.0	562.0
Unspecified[b]	14	42.1	*(19.8)*	16.4	35.9	16.4	692.0
Field crops[c]							
Maize	170	134.5	*(271.2)*	29.0	47.3	-100.0	1,720.0
Wheat	155	50.4	*(39.4)*	23.0	40.0	-47.5	290.0
Rice	81	75	*(75.8)*	37.0	51.3	11.4	466.0
Livestock[d]	233	120.7	*(481.1)*	14.0	53.0	2.5	5,645.0
Tree crops[e]	108	87.1	*(216.4)*	20.0	33.3	1.4	1,736.0
Resources[f]	78	37.6	*(65.0)*	7.0	16.5	0.0	457.0
Forestry	60	42.1	*(73.1)*	7.0	13.6	0.0	457.0
All Studies (Total)	**1,772**	**81.2**	***(216.1)***	**46.0**	**44.0**	**-100.0**	**5,645.0**

ANRR = agriculture and natural resources research.

[a] Includes research identified as “all agriculture” or “crops and livestock” as well as “unspecified.”

[b] Includes estimates that did not explicitly identify the commodity focus of the research.

[c] Includes all crops, barley, beans, cassava, sugarcane, groundnut, maize, millets, other crops, pigeonpea or chickpea, potato, rice, sorghum, and wheat.

[d] Includes beef, swine, poultry, sheep or goats, dairy, other livestock.

[e] Includes\ “other trees” and “fruits and nuts.”

[f] Includes forestry and fishing.

Note: Standard deviations are given in parentheses. Samples exclude two outliers and include returns to research only and combined research and extension.

Source: Alston, Julian M., Connie Chan-Kang, Michelle C. Marra, Philip G. Pardey, and TJ Wyatt. 2000. *A Meta-Analysis of Rates of Return to Agricultural R&D: Ex Pede Herculum.* IFPRI. Research Report 113. Washington D.C.

IARCS ISSUES AND RESEARCH PRIORITIES

Issues and Priority Areas of Research	Description
A. Climate Change 1. Biophysical aspects of managing climate change variability 2. Impacts of climate change on water availability and use in agriculture 3. Relationship of climate change and bioenergy and their impact on sustainable agriculture 4. Science-based information and decision-support tools to assist national planners in improving their understanding of the vulnerability of producers to climate change, thus enabling the proper identification of policies and regulations to minimize its impacts and allowing better investments in adaptation and mitigation 5. Technologies to enhance efficiency in breeding as the effects of climate change become more discernible	Climate variability is threatening food security. There is a need to understand more clearly its impacts on production systems (crops, animals, and aquatic) in order to identify strategies to make them more resilient. There is a need to develop adaptation risk management measures to protect poor farmers/producers. There is a need to enhance adaptive capacities of local communities. There is a need to enhance the process of evaluating changes and having these changes integrated into the planning and investment framework.
B. Water Conservation and Enhancing Water Use Efficiency 1. Assessment of water resources, their availability, quality, costs, and productivity 2. Identification of effective water pricing, water access, and water-allocation policies 3. Technologies and practices to improve water productivity in water-scarce areas 4. Water use and enhancing water productivity in irrigated agroecosystems, rainfed, and mixed agroecosystems, and wetland agroecosystems 5. Technologies to improve water quality 6. Governance of water economy and environment by promoting and supporting water policy and reform processes	Water scarcity is going to be a problem in the near future because of population increase, competition for water, climate change, as well as policies that subsidize water prices and inefficient cropping systems. There is a need to create sustainable options for the development, use, and management of water that increase water productivity and the benefits gained from water for livelihood purposes.
C. Food Crisis, Food Security and Poverty Alleviation 1. Breeding for disease-resistant varieties (plants, animals, fish, etc.) 2. Breeding for plant varieties resistant to drought-prone, saline, and other fragile environments 3. Improved management practices to increase production in marginal/fragile environments: rainfed areas, salt affected, etc 4. Policies to help vulnerable people cope up with rising food prices and to provide them with social protection 5. Agriculture, food safety, health and nutrition	The food crisis has further endangered the attainment of food security and poverty reduction in many countries. There is a need to improve productivity; promote sustainable production systems including the intensification of cropping systems, diversify livelihood options, especially for poorer communities; develop better management technology on fragile/marginal environments; etc.

Issues and Priority Areas of Research	Description
D. Biodiversity and Germplasm Conservation and Protection 1. Maximizing the potential for utilization of the germplasm collection 2. Genetic resources as threatened by global warming 3. Germplasm diversification, exchange, and International Property Rights	Biodiversity of environment and genetic resources is increasingly being endangered because of overexploitation, climate change, etc.
E. Linking Farmers to the Changing Market 1. Value-addition to increase income and to access new markets 2. Postharvest management, enterprise development, and new market opportunities 3. Modern commodity/supply chains, diversifying markets, and small producers 4. New production systems to meet demands of globalized markets 5. Agricultural trade regulations and issues 6. Diagnostic tools and policy advice to inform and support appropriate marketing investment strategies that benefit the poor	Farmers and agriculture need to be increasingly linked to the global market to enhance food production and benefits to farmers.
F. Natural Resources and Environmental Protection 1. Land degradation, desertification, and environmental security as they are affected by various factors including land tenure arrangements 2. Pollution of water sources 3. Sustainable management of upper catchments 4. Water management, environmental and human health interactions. 5. Pesticide use, integrated pest management, and biological control agents	Immediate steps are needed to enhance and maintain the production potential of land resources. There is a need to develop a culture that renders impact assessment valuable in developing countries.
G. Promoting More Effective Communication with Farmers and Other Stakeholders 1. Knowledge systems to facilitate getting the message to farmers on how best to use the most appropriate technologies 2. Framework and tools to identify target production groups for proper implementation of technologies and other intervention measures 3. Diagnostic tools for identifying sound policy advice 4. Learning alliances and knowledge networks 5. Economic, environmental, and social indicators to fully assess the effectiveness of investment.	New technologies and information have to be transmitted/relayed to the farmers as soon as possible. Effects of emerging trends and new developments have to be immediately analyzed to identify appropriate intervention measures. At the same time, there is a need to inform other stakeholders of the credibility, accountability, and relevance of research and other development activities.

IARC = International Agricultural Research Center, IPM = Integrated Pest Management.

Source: Summary of responses by IARCs to Survey Questionnaire