Developing Institutional and Human Capacity for Agricultural Research

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Preface

As part of the Obama Administration’s Global Hunger and Food Security Initiative (GHFSI), the US Agency for International Development (USAID) seeks to increase support for agricultural research and development (R&D). Agricultural R&D is a critical policy instrument for improving agricultural productivity, and changing the patterns of investment in R&D can have key implications for food security. In a strategic effort to achieve greater impact from research investments, the Agency also expects to make investments in strengthening the human and institutional capacity for agricultural research in developing countries.¹

¹ USAID adopted a new policy in December 2008 that mandates consideration of Human and Institutional Capacity Development (HICD) to improve the impact and sustainability of development assistance programs.
The goal of these investments is to go beyond training scientists, but also to improve the effectiveness of research systems in developing and delivering new technologies and management practices to small-scale producers. USAID aims to focus greater attention on and to provide new models and scalable approaches for human and institutional development by all parties: USAID Missions, other donors, and host country governments.

Many capacities contribute to the effectiveness of research systems, spanning the individual institutions as well as linkages between them. These may include:

- Linkages between global and national researchers to harness the benefits of global public goods research (e.g. between the Consultative Group on International Agricultural Research [CGIAR] and National Agricultural Research Systems [NARS]).
- Mechanisms that link national research and extension systems to both prioritize research based on the needs of producers and to disseminate technology.
- Systems for transfer of technology from public research to the private sector (e.g. seed industry).
- Establishing strategic priorities that will guide the research agenda, human resources, training, and financial resources.
- Financial management systems to ensure alignment with priorities, timeliness, and consistency needed to support research.
- Aligning and developing human resources (faculty, managers, researchers, and students) to support strategic priorities.
- National or institutional policies that related to research or the application of technology.

**SETTING PRIORITIES FOR R&D IN THE GHFSI**

Drawing on extensive analysis of where hunger and poverty are concentrated geographically, as well as expert consultations and studies on priority setting from a wide range of partners, a set of criteria were developed to meet the goals of reducing poverty, reducing risk, and improving children’s nutrition. The criteria include: scientific feasibility/likelihood of success, cost/benefit, timeframe, spillover benefits, and environmental and institutional sustainability.

From this process, a preliminary research portfolio was developed of US government research priorities that are based on the juxtaposition of need, opportunity, and capacity across the US public and private sectors and a set of global partners. The research portfolio will target both crop-specific opportunities and cross-cutting research that together will span a “research pipeline” ranging from quick-wins at the level of technologies ready or nearly ready for dissemination, to investment in longer-term research that can ultimately lead to substantial payoffs in terms of productivity, risk-reduction, incomes, nutrition and sustainability.
A preliminary set of priorities have emerged in the following areas:

- **Advancing the productivity frontier:** A focus on breeding and genetics will shift the productivity frontier for major crops and livestock, to both increase yield potential and provide solutions for major production constraints. Leading examples include:

- **Transforming Production Systems:** In priority systems where the poor are concentrated, global research resources will come together with national and regional programming so that developing country producers can achieve productivity levels commensurate with available technology and best practices.

- **Enhanced dietary quality and food safety:** Nutrition and health outcomes will be directly targeted through both technologies and policies that promote improved diets and diet quality.

**Sustainable Intensification:** Science, knowledge, best resource management practices and improved food utilization comes together with research and non-research investments at the national and regional level to achieve “sustainable intensification.” Extension, fertilizer and seed markets, output markets and market and trade policy and information provide critical context for new technology and other innovation to act as a productivity and sustainability driver. These gains increase incomes, environmental quality and resource-use efficiency, while risk is reduced, fostering further investment.

**THE ROLE OF INSTITUTIONAL AND HUMAN CAPACITY DEVELOPMENT IN THE GHFSI**

In December 2008, USAID approved an overarching operational policy statement on human and institutional capacity development. The policy integrates a human and institutional capacity development approach in strategic planning and activity design for development assistance. Along with USAID’s sector and other strategies, the policy puts capacity development at the center of USAID’s development assistance objectives (OECD/DAC, 2009a).

Research in the priority areas mentioned above will involve human and institutional capacity building and other critical linkages with national, regional, and international partners.

**METHODOLOGY**

The “theory of change”—or “logic model”—used in this analysis is that developed capacity translates into more-effective research, which in turn leads to more-effective, sustainable responses to development challenges in the area of food insecurity and
hunger. Through capacity development efforts, key actors will have improved capability to respond to development challenges through research activities.

In the report, “effectiveness” or “success” of capacity-development programs can be understood as the extent to which programs fulfill the following two sets of criteria. First, effective capacity-development approaches will permit strengthening novel capacities in individuals and organizations in agricultural research and development that will allow them to take advantage of more opportunities in a rapidly transforming and dynamic agricultural sector. The new capacities include: greater potential to contribute to greater institutional flexibility and competence; greater responsiveness to changes in science and technology (S&T), communication, institutions, markets, and stakeholder needs; stronger emphasis on interdisciplinary, systems-level, impact-orientated research and pedagogic approaches; increased ability to successfully coordinate among different institutions; and enhanced ability to integrate women (J. Moock, personal communication). Second, effective capacity-development programs have design features that address specific conditions with particular influence on capacity outcomes. These include such features as donor acknowledgement of the importance of capacity development through a written policy or other instrument, enhancement of capacity-development skills among donor personnel, alignment of efforts with aid-effectiveness principles, careful selection of capacity-development partners to maximize likelihood of success, examination of the external environment in intervention design, parallel capacity development at multiple levels, use of monitoring and evaluation, the development of long-term, interactive relationships between donors and partners, and delivery of support in a fashion that encourages dialogue about what intervention strategies are most appropriate for achieving desired goals.

The agricultural innovation system—the generation, diffusion, and application of knowledge—was chosen as a framework for the analysis. The framework outlines critical capacities at each level, along with the interactions among levels, and could serve as a starting point for identifying gaps prior to designing interventions (Spielman et al., 2008). This framework was chosen because it involves a broader set of organizational and institutional actors than does the traditional research, education, and extension model. The higher granularity of the agricultural innovation system framework places greater emphasis on the roles of farmers, input suppliers, transporters, and processors in the innovation process and rejects the notion of a linear model of research-extension-farmer linkages (IAC, 2004a). In addition, the agricultural innovation system framework affords greater consideration for the ways in which human and institutional capacity development can position actors within the research system to best take advantage of new possibilities in a changing and more dynamic agricultural sector.

This analysis presents information about baseline capacities and key constraints of the following elements of the innovation system (Spielman et al., 2008):

- Human capacity to innovate
- Organizational capacity to support innovation
• Linkages among agents of innovation (e.g., research networks, links between the public and private sector, links among public sector institutions, and links to extension for dissemination of innovation)

Examples of promising programmatic capacity-development approaches, as measured by the degree to which they fulfill the criteria defined above, are also gathered. The programs are representative of the different elements of the agricultural innovation system—individual capacity-development programs, organizational capacity-development programs, and programs to strengthen linkages among elements of the innovation system—and are geographically representative, though examples from Africa constitute a majority because this region is a major donor focus. The examples include some efforts beyond the agricultural research sector (e.g., health research and capacity development and systemic research governance capacity development) and some efforts from developed-country contexts. In the introduction to each section, strategic issues, key decision points, and strengths and weaknesses of different approaches are highlighted. The descriptions include the findings of any evaluative activities performed, where available, and material from the program’s web site, publications, etc.

The report lastly examines key principles for the design and implementation of evaluations of capacity development programs.

The analysis draws upon the following information sources:

• Review of published and gray literature
• Information from organization web sites
• USAID workshop on R&D priority setting
• Consultations/telephone interviews/email correspondence with experts and practitioners (academics who study capacity development, individuals involved in implementation of capacity development efforts, and experts in evaluation of capacity development efforts).
• Examples of capacity-development efforts provided by USAID and USDA personnel

ORGANIZATION OF THIS REPORT

This report contains background research and analysis on human and institutional capacity development for agricultural research (Appendix A contains the original scope of work for the assignment). An Executive Summary frames key findings from the chapters. Chapter 1 includes definitions of capacity and capacity development; a description of the types of capacity assets most vital to a changing agricultural sector; and a summary of baseline capacities, challenges, and constraints across critical elements of agricultural innovation systems in developing countries. Chapter 2 summarizes the range of capacity-development interventions used and highlights conditions or factors that may positively or negatively influence capacity outcomes. Chapter 3, looking across the
agricultural innovation system, summarizes strategic decisions and/or key issues to be considered at each level of the system; the range of programmatic approaches to human and institutional development; and results of these programs. The chapter includes cost, effectiveness, and other contextual considerations, opportunities, or constraints associated with the different approaches and highlights key findings. Chapter 4 reviews literature on evaluating capacity-building initiatives and provides possible approaches for assessing or monitoring training and institutional development programs.

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Executive Summary

In a strategic effort to achieve greater impact from increased investments in agricultural research investments through the Obama Administration’s Global Hunger and Food Security Initiative (GHFSI), the US Agency for International Development (USAID) expects to increase efforts to develop human and institutional capacity for agricultural research and innovation. The goal of these investments is not only to train scientists, but also to improve the effectiveness of research and innovation systems in developing and delivering new technologies and management practices to small-scale producers. USAID aims to focus greater attention on and to provide new models and scalable approaches for human and institutional capacity development by all parties: USAID Missions, other donors, and host country governments.

UNDERSTANDING AND DEVELOPING CAPACITY

*Capacity* is defined as the ability of people, organizations, and society as a whole to manage affairs successfully, to achieve goals, and to satisfy stakeholders’ expectations. *Capacity development* refers to a process of change in which people, organizations, and society as a whole improve their potential performance and unleash, strengthen, create, adapt, and maintain capacity over time. Our current view of capacity development represents a shift in paradigm from a previous understanding of capacity as something that outsiders build for others. Today, we understand capacity development more as an endogenous process in which people, organizations, and societies learn and take ownership for change. Capacity development is driven by those undergoing the change and is highly adaptive and context specific. Capacity development involves individual and collective learning and ways of doing. Capacity of individuals can be understood in relation to the systems in which they are embedded.

The *agricultural innovation system*—the generation, diffusion, and application of knowledge—was chosen as a useful framework for considering agricultural research capacity development in this analysis and includes the following elements:

- Human capacity to innovate
- Organizational capacity to support innovation
- Linkages among agents of innovation (e.g., research networks, links between the public and private sector, links among public sector institutions, and links to extension for dissemination of innovation)

An agricultural innovation system framework involves a broader set of organizational and institutional actors than does the traditional, linear research, education, and extension model, placing greater emphasis on the roles of farmers, input suppliers, transporters, and processors in the innovation process. In addition, the agricultural innovation system framework affords greater consideration for the ways in which human and institutional capacity development can position actors within the research system to best take advantage of new possibilities in a changing and more dynamic agricultural sector.
Capitalizing on these opportunities depends on whether capacity assets can be developed among actors across the system, and it is therefore vital to identify the most effective, creative pathways to build capacity assets that can meet new needs within the sector. Moving beyond traditional capacity-development approaches will require donors and hosts to take new measures. Institutions must become more flexible and competent, emphasizing problem solving and policy relevance. Flexibility will allow greater responsiveness to changes in S&T, communication, markets, and stakeholder needs. Interdisciplinary research, coupled with recognition of feedback loops, should be pursued in tandem with more stakeholder engagement and a greater orientation to achieving results. Rather than focus on pipeline production of scientists, efforts should be made to emphasize career tracks, skill utilization, and systems analysis. Institutions must themselves improve coordination. And, because women play a major role in agricultural production across the globe, but especially in developing countries, they should be integrated into capacity development.

**SUPPORTING CAPACITY DEVELOPMENT**

Effective support for capacity development should occur through an active search for approaches that achieve a best fit with the particular circumstances of the country, sector, or organization under consideration. Core design features or conditions that influence capacity outcomes should be considered in the development of approaches.

- **Parallel Development of the Individual, Organizational, and Network Levels:** Capacity development efforts should support the process of change in parallel at the individual, organizational, and network levels. While many donors focus narrowly on changes within the research area and on individual changes, educated and capable individuals are not sufficient for capacity development because of the importance of organizational and institutional constraints. Training design should be linked to organizational capacity development.

- **Policy-Level Acknowledgement of the Importance of Capacity Development:** The importance of capacity development should be acknowledged at the policy level, e.g., through written policy statements, action plans, guidance, a common definition of capacity development, and/or establishment of an organizational unit dedicated to capacity development. USAID, for example, adopted a policy in 2008 mandating consideration of human and institutional capacity development to improve the impact and sustainability of its development assistance programs. Donors should enhance the capacity development skills (e.g., pedagogic skills, adult education skills) among its personnel, and those of its partners, through training and awareness-raising.
Alignment of Capacity Development Efforts with Aid-Effectiveness Principles: Capacity development efforts should be aligned with the aid effectiveness principles of country ownership, leadership, and participation; demand-driven development; and harmonization with partner country national strategies.

Effective Donor-Partner Relationships: Relationships between donors and partners should be long term and highly interactive. Each capacity-development effort should have a clear, agreed-upon purpose and definition of the roles and responsibilities of both donor and partner. Partners and donors should first agree on desired capacity outcomes and how they should be measured, then on what interventions are necessary to achieve those outcomes. Different interventions should be considered, with flexibility to change the approach over the course of the effort and awareness of interventions that could contribute to the problem. Donors should persevere through adverse conditions and institutional upheavals. Appropriate donor roles include: facilitating access to knowledge, brokering agreements that remove obstacles to capacity development; participating in policy dialogue or advocacy; providing resources to overcome bottlenecks, and creating spaces for learning by doing.

Strategic Selection of Partnering Organizations: Donors may wish to select organizations strategically on the basis of their potential for successful capacity development and on the basis of their potential spillover effects on other organizations or the economy as a whole as a result of enhanced capacity. Attributes of partner organizations most conducive to successful capacity development include strong, client-based pressures for improvement, high-level leadership for change, an integrated approach to change management, a willingness to test and adapt organizational innovations, and strategic management of change processes.

Consideration of the External Environment: The external environment has a significant influence on the design of capacity-development efforts. This includes not only the technical context, but also the political and social context within which capacity development occurs. Such tools as power analysis, institutional analysis, drivers of change analysis, conflict analysis, conflict assessments, country political economy studies, SWOT (strengths-weaknesses-opportunities-threats) analysis, and stakeholder analysis can be used to assess the external environment.
ASSESSING BASELINE CAPACITY

Baseline assessments give a picture of the current capacity across different elements of the agricultural research and innovation system. The basic elements include resource availability in terms of funding and personnel, upon which universities, national research systems, and scientific infrastructure are built.

- **Public Agricultural Research and Development Spending:** Public agricultural research and development (R&D) spending is concentrated in richest 5 percent of countries, accounting for about half of the spending. Low- and middle-income countries account for 11 and 36%, respectively, of total spending. Within regions, there is substantial diversity in agricultural R&D spending, with some countries exhibiting growth and others exhibiting sluggish or negative growth. Agricultural research intensity—defined as R&D spending relative to economic size of the agricultural sector—is much lower in developing countries (less than 1 percent), compared to developed countries (2.36 percent).

- **Public Agricultural R&D Professional Capacity:** Globally, there has been substantial progress in building agricultural research staff capacity, both in terms of numbers and qualification levels. Regionally, the Asia-Pacific region has reported improvements in the qualification levels of agricultural scientists, with roughly 75% having post-graduate training. In a 2006 study of Latin American and Caribbean agricultural research staff, 65% of the sample were trained at the post-graduate level, with researchers in Central America the least-well qualified compared to their counterparts in Latin America. Sub-Saharan Africa, however, struggles to maintain research staff capacity, given the retirement of well-qualified researchers, brain drain, and bans on public-sector recruitment in some countries.

Despite increases in numbers of female scientists, female participation in agricultural R&D remains low in the developing world. Currently, only one in five agricultural researchers in the developing world is female. Female researchers throughout the developing world are consistently less well qualified than their male counterparts (i.e., there are higher shares of women qualified at the BSc level in the agricultural research work force as compared to men and much lower shares of women qualified at the PhD level as compared to men).

- **Agricultural Universities:** Agricultural universities in the developing world have experienced a legacy of heavy donor investments between the 1960s and 1990s, followed by a period of neglect in which donor support stagnated. Administered by Ministries of Education in most developing countries, many universities have little control over their finances, programming, curriculum, and policies and are further weakened by the lack of strong ties to the Ministry of Agriculture.
Many developing world agricultural universities lack capacity in post-graduate education: financial support, mechanisms for attracting the best students, and practical, hands-on curricula and teaching approaches. Particular deficits are evident in such disciplines as policy analysis, macroeconomics, statistics and quantitative methods, ICTs, and negotiation skills. In many countries, undergraduate education and teaching dominate most universities, to the detriment of research capacity. What research is conducted is highly stove-piped by discipline, lacking relevance to and poorly integrated with rural livelihoods, and lacking in engagement with non-university actors, including the national agricultural research system (NARS).

The professional capacity of agricultural universities is threatened by retirement of the current generation of academics and by brain drain in many regions, particularly Africa. There is particularly poor representation of women in agricultural faculty in the African region. Incentive structures (both financial and non-financial) and the degree of mentoring, and support are closely linked to the level of staff retention at agricultural universities.

National Agricultural Research Systems and Government Research Agencies: National agricultural research systems, of which national agricultural research institutes (NARIs), comprise a substantial component, exhibit capacity gaps in the areas of scientific capacity and human resources; governance and management capacity; financial management capacity; and capacity to collaborate and to network.

Capacity gaps are particularly pronounced in the sub-Saharan African region, where NARIs tend to be very small in terms of numbers of researchers, researchers are less-well qualified, and there is a lack of critical mass for research on any given crop. It is difficult to attract and retain high-quality staff; African NARIs generally offer poor conditions of service and incentives, and the resultant small numbers of PhD-level women researchers and young researchers portend a human resources crisis when current scientists retire. Gaps exist in particular scientific disciplines, such as the social sciences, biotechnology, research design, and biosafety. There is a lack of short- and long-term planning and priority setting at most NARIs; leadership, engagement of diverse perspectives in management structures, and external reviews are also lacking. NARIs are primarily donor supported and receive very little research support from government and the private sector. They lack competitive funding mechanisms and flexibility to pursue new research areas. Most NARIs lack an entrepreneurial culture and basic systems for financial management. Public agricultural research institutes in the sub-Saharan African region have weak capacity to partner with a variety of actors, including private-sector partners, universities, Consultative Group on International Agricultural Research (CGIAR) centers, and sub-regional organizations.
• **Critical Infrastructure, Technology, and Access to Scientific Publishing:**
  Many institutions within the agricultural research system in low- and middle-income countries suffer from lack of access to rapid, low-cost information and communication technologies (ICTs), which include sufficient bandwidth, automated library management systems, peer-reviewed literature, databanks. Particularly in Africa, this lack of access has led to isolation of researchers from the international academic community. Local policies and regulations and the absence of local vendors and maintenance companies contribute to the problem. Many low- and middle-income countries, particularly those in sub-Saharan Africa, lack access to dedicated scientific institutions for the dissemination of research results (e.g., journals, publishing houses, electronic repositories, and data archives) and to training in such matters as scientific publishing, editorial practices, and peer-review procedures, to ensure high-quality publishing.

• **Linkages Among Agents of Innovation:** In spite of scattered successes, linkages among NARIs, universities, sub-regional and regional institutions, farmers, and the private sector still exhibit capacity gaps in many low- and middle-income countries, particularly in the sub-Saharan African region. Regional organizations have not fully exploited synergies among the NARS, and international organizations are somewhat disconnected from the national science systems of the countries. Competitive and/or conflictive relationships persist between many NARIs and universities. There are weak links between research organizations and extension and limited relationships with the private sector. In Africa in particular, private sector entities for agricultural inputs are still inchoate. Most developing countries have inefficient or dysfunctional technology assessment, release, and oversight systems.

**PROGRAMMING FOR CAPACITY DEVELOPMENT**

There is a wide range of programmatic options for capacity development efforts across the agricultural innovation system. These include individual, group, degree, and non-degree-based training activities; organizational capacity-development efforts for universities and national research institutes; and activities to strengthen linkages among actors within the system, including universities, national agricultural research institutes, agricultural extension, farmers organizations, the private sector, and international organizations.

For purposes of this analysis, the relative potential of capacity development can be understood as the extent to which the effort fulfills the following two sets of criteria, as described above. First, the most promising approaches strengthen novel capacities in individuals and organizations in agricultural research and development that will position those actors to take advantage of opportunities in a rapidly transforming and dynamic agricultural sector. The new capacities include: greater potential to contribute to greater institutional flexibility and competence; greater responsiveness to changes in science and technology (S&T), communication, institutions, markets, and stakeholder needs; stronger emphasis on interdisciplinary, systems-level, impact-orientated research and pedagogic
approaches; increased ability to successfully coordinate among different institutions; and enhanced ability to integrate women. Second, the most promising programs have design features that positively influence capacity outcomes. These include such features as donor acknowledgement of the importance of capacity development through a written policy or other instrument; enhancement of capacity-development skills among donor personnel; alignment of efforts with aid-effectiveness principles such as country ownership and participation; careful selection of capacity-development partners to maximize likelihood of success; consideration of the external environment in intervention design; parallel capacity development at the individual, organizational, and network or system levels; use of monitoring and evaluation; the development of long-term, interactive relationships between donors and partners; and delivery of support in a fashion that encourages dialogue about what intervention strategies are most appropriate for achieving desired goals.

When examined alongside these criteria, a number of projects were found to have a promising design—both in terms of mindfulness of principles generally considered to effectively support capacity development and the degree to which they develop novel capacity assets that will permit actors within the system to take advantage of opportunities within a changing agricultural sector. Evidence for a clear judgment on program “success” or “effectiveness”, however, is lacking because it is premature to assess program outcomes and because evaluations have not been performed to standard on all programs (see Chapter 4 for more on the importance of evaluation).

A review of common features of the collective set of capacity-development approaches gathered yields the following key findings. Many of the most promising programs appear to be commonly characterized by these attributes.

- **Targeting “Soft” Capacities:** Promising capacity-development efforts cultivate “soft” or human capacities—attitudes, behavior changes, critical thinking, relationships, and legitimacy—as well as “hard” or technical capacities. “Soft” capacities have a strong influence on staff motivation, which in turn influences the levels of staff turnover and staff retention within organizations.

- **Mentoring and Individual Support:** Mentoring and individual support—linked to strengthening organizational reward and incentives systems—constitute a substantial component of promising capacity-development efforts at all levels. For recent trainees, follow-up support and mentoring in the context of the organizations in which individuals work is very important, especially for women. At the level of facilitation of networks and partnerships, promising programs encourage mentoring and support for technology transfer and commercialization processes (e.g., providing brokers to help developing countries license proprietary technologies).

- **Staff Retention, Leadership, and Incentives:** The capacity-development approaches with greatest potential have a strong emphasis on developing global
competitiveness of organizations by developing capacities to attract and retain high-quality personnel, which include non-monetary but morale-building measures such as: linking authority with accountability; benefits such as housing, education for children, and health care; social prestige; recognition; mentoring; access to literature; freedom to network professionally; availability of competitive grants; sabbatical leave; and a merit-based, innovation-friendly working atmosphere. Promising programs also focus on strengthening leadership that can bring out the best in staff.

- **Partnerships:** The most promising capacity-development efforts facilitate partnerships that take advantage of complementary assets of participating institutions, with an openness to new types of partnering arrangements for training, organizational development, and network formation, including: South-South partnerships vs. North-South partnerships (and hybrid models such as sandwich and distance learning programs) for training and organizational development, regional vs. national models for training and organizational development, local vs. overseas sourcing for training, and engagement of private-sector actors vs. public-sector actors (e.g., for traditionally public-sector roles, such as extension). Many promising efforts establish partnerships at the highest levels (e.g., at the level of Vice Chancellor/President for partnerships involving universities), as opposed to at the individual or departmental levels. These capacity-development initiatives also engage in policy advocacy to facilitate partnerships (e.g., policies to encourage private-sector investment in universities, incentives to venture capitalists, and policies to ease intellectual property constraints to technology licensing).

The most promising capacity-development partnerships also appear to be those that take a strategic, criteria-based approach to selecting partner institutions. Before the project is initiated, these programs conduct background research and facilitate strategic planning efforts so that partners can participate in designing their own projects and developing work plans jointly with donors. In the context of training, the most promising programs develop the capacities of a critical mass of individuals within carefully selected institutions.

**Research Management, Commercialization, and Use in Policymaking:** Some of the most promising capacity-development efforts support not only the programmatic capacity to conduct research but also non-programmatic capacities to manage research, commercialize research, and apply research to decision making. Most examples reviewed fall into the category of strengthening research capacity alone; however, exclusive emphasis on research capacity development is not sufficient to strengthen institutions.
The development of research management and governance capacity includes all functions that support the conduct of research and that are key to maintaining partnerships, such as financial management, resource mobilization, endowment and reserves management, human resources management, libraries, infrastructure, dissemination and publication systems, and administration. Research management capacities are also critical for supporting the ability to borrow and adapt research done elsewhere. Programs that have invested in this area report a high level of spillover effects.

Developing entrepreneurism and innovative capacity is also important both for individuals and organizations, and the most promising programs have stressed this. Educational programs include hands-on entrepreneurial practicum in the curriculum, and organizational capacity-development programs take an active role in facilitating linkages between top-notch scientists and top-notch entrepreneurs who can effectively address the marketing, sales, financial, legal and overall managerial aspects of technology commercialization. These programs also help to advocate for and address policy constraints to commercialization, e.g., through brokering royalty-free transfers of technologies and creating incentives for private sector investment in public research.

Finally, a very few programmatic examples have included a focus on developing capacity to use research to influence policy. Although such programs carry a high risk of failure, they also have a very high potential for significant impact if successful.

- **Engaging Constituents:** Many of the most promising capacity-development programs have a strong emphasis on engaging and building diverse constituencies, including farmers’ organizations, policymakers, the private sector, and other agriculture-sector actors, as well as potential sources of future funding, such as university alumni and donors. Facilitating the capacity to build constituencies can be as simple as supporting the convening of regular meetings between the research community and other actors.

- **Sustainability:** An important attribute of the most promising capacity-development efforts is a commitment to sustainable capacity outcomes. Sustainability plans include cost sharing by the partner, cost-recovery schemes, and strengthening of resource mobilization capacities to prepare partners for when donor support ends.

- **Encouraging Women’s Participation:** The most promising programs appear to have specific, written policies to mainstream women’s increased participation, including specific policies targeting recruitment of qualified female participants. These programs have tailored specific interventions for women, many with a
strong emphasis on mentoring. Gathering data on women’s participation in capacity-development activities is another important first step towards encouraging women’s participation.

- **Assuring Quality and Scientific Integrity:** Many of the most promising programs made use of merit-based, competitive processes in the selection of candidates or awarding of grants. Peer-review systems, in which both local and external reviewers are used, are also promoted by these programs to assure quality of research proposals or research results.

**EVALUATING CAPACITY DEVELOPMENT**

Monitoring and evaluation of capacity-development efforts are key for ensuring collective learning about what is and what is not effective. Monitoring and evaluation (M&E) of capacity development efforts are of critical importance because poorly conceived or implemented initiatives can fail to improve or can worsen performance. M&E implementation should be guided by a set of principles determined on a case-by-case basis, should inform decision making for program improvement, and should be shared among partners and donors. Evaluations designed *before* projects are implemented will be encouraged, as they offer the greatest flexibility in making course corrections through the evaluation process and the greatest opportunities for shared learning. The use of methodological tools particularly well suited to evaluating capacity-development efforts should be encouraged including:

- **Self-assessment approaches:** Evaluations of capacity development efforts should themselves contribute to the development of evaluative capacities among partner organizations, and ultimately, to the organizations’ performance. Although the concept of evaluation as a capacity-development intervention in support of organizational effectiveness is controversial because it challenges the view that evaluation should be external and independent of the thing measured, participatory evaluation approaches can in fact enhance program and organizational outcomes.

- **Outcome mapping:** Outcome mapping is a special evaluative methodology that focuses on one specific type of result: behavioral change. Outcomes are defined as changes in the behavior, relationships, activities, or actions of people, groups, or organizations with which a capacity development program works directly. Outcomes can be linked to a program’s activities but not directly caused by them.

- **Organizational Assessment:** A useful approach is to develop a set of indicators to track organizational performance (across the areas of relevance, efficiency, effectiveness, and financial sustainability, e.g., quality of products, cost-benefit of programs, stakeholder satisfaction, and ratio of financial assets to liabilities) and an additional set of indicators to help understand organizational performance.
(from across the influencing areas of external environment, internal environment, and organizational capacity, e.g., employee morale, timeliness of financial information, economic indicators, employee absenteeism, and number of new funders).

Chapter 1: Critical Capacities for an Effective Agricultural Research System in the Context of a Transformed Agriculture: Challenges and Opportunities

This chapter introduces the concepts of capacity and capacity development and describes a worldwide transformation in the agricultural sector, which is creating new opportunities into which human and institutional capacity development can contribute. Attributes of capacity-development approaches that are most likely to feed most effectively into a dynamic agricultural sector are described. An analytical framework—the agricultural research and innovation system—is outlined, and efforts to understand baseline capacities across critical elements of this system are synthesized.

1.1 UNDERSTANDING CAPACITY AND CAPACITY DEVELOPMENT

Many organizations have conducted extensive analysis to understand capacity and capacity development processes, including the Organization for Economic Cooperation and Development/Development Assistance Committee (OECD/DAC), Canada’s International Development Research Center (IDRC), and the International Service for National Agricultural Research (ISNAR). Several definitions of capacity have been developed:

- The “ability of people, organizations, and society as a whole to manage affairs successfully” (OECD/DAC, 2006).
- The “ability of a collective or individual to achieve its goals” (IDRC; Deby, 2005).
- “[The] potential to perform—[the] ability to successfully apply skills and resources to accomplish...goals and satisfy...stakeholders’ expectations” (ISNAR/IDRC; Horton et al., 2003).

While there is recognition that capacity is an important principle, there is often no universal understanding of what it involves, particularly at the practical level. What capacities are important for performance? What does it take to translate capacity into performance? We still do not understand which capabilities matter the most: functional skills (e.g., managerial, technical) vs. soft skills (e.g., learning, relationship building); tangible capacities (e.g., skills) vs. intangible capacities (e.g., values and attitudes) or the role of motivation (OECD/DAC, 2009b).

Capacity development refers to:
• “A process whereby people, organizations, and society as a whole unleash, strengthen, crate, adapt, and maintain capacity over time” (OECD/DAC, 2006).
• “The ability of a collective or individual to achieve its goals; a process of change; occurring at multiple levels” (Deby, 2005).
• “[The process of improving] the potential performance of the organization as reflected in its resources and is management” (Horton et al., 2003).

Capacity development can occur at multiple levels:

• **Individual**: This level includes change in individual competencies, attitudes, motivation, and behaviors.
• **Organizational**: This level includes change in organizational functions and processes (financial and human resources management, priority setting, strategic planning, dissemination, resource mobilization); infrastructure (laboratories, libraries, information and communication technologies); external legitimacy (whether the organization is perceived to provide valuable products and services); and internal confidence (whether there is high demand for the organization’s products and services). Organizational capacity can also be understood as a combination of “hard” capacities (e.g., personnel, facilities, vehicles, equipment, and funding) and “soft” capacities (activities that create conditions under which objectives are set and achieved, such as planning, goal setting, determining responsibilities, leading, allocating resources, motivating and supervising staff members, and maintaining relations with stakeholders) (Horton et al., 2003). Organizational capacity development can further be understood as change in those capacities needed to carry out day-to-day activities, operational capacities (e.g., accounting systems, physical facilities), vs. adaptive capacities needed for the organization to learn and change in response to changing circumstances (e.g., strategic planning, management of changes) (Horton et al., 2003).
• **Network**: This level includes changes in linkages and networks among national, regional, and global organizations, farmer groups, non-governmental organizations (NGOs), the private sector, policymakers.
• **State/Societal**: This level of capacity includes changes in the ability to influence policy, innovation, and technology (e.g., extension systems, technology commercialization systems) (Neilson and Lusthaus, 2005)

Our understanding of capacity development has evolved over time. Our current view of capacity development is a shift in paradigm from a previous understanding of capacity development as something that outsiders build for others. Today, we understand it more as an endogenous process in which people, organizations, and societies learn and take ownership for change. Capacity development is driven by those undergoing the change and is highly adaptive and context specific. Capacity development involves individual and collective learning and ways of doing (OECD/DAC, 2009b; Deby, 2005). Work by IDRC also encourages understanding the capacities of individuals or groups in relation to the systems in which they are embedded (Deby, 2005). Individuals apply and develop their capacities as part of organizations, institutions, societies, networks, and many other
webs of relationships (Deby, 2005). Capacity development is further embedded in processes of change that have short- and long-term dimensions (Deby, 2005).

1.2 TRANSFORMATIONAL CHANGE IN THE AGRICULTURE SECTOR: CREATING POSSIBILITIES FOR ADVANCING HUMAN AND INSTITUTIONAL CAPACITY DEVELOPMENT

The agricultural sector is undergoing a rapid, worldwide transformation, which has changed the context in which capacity development in agricultural research can be considered. Through globalization, economic markets are liberalizing, the international division of labor is changing, competition is increasing, knowledge-intensive industries are gaining traction, and market access structure is changing its modes of operation in many contexts. Market access structure is changing to allow inputs to come in at better prices and outputs to move into new markets, often defined by new consumer preferences. New roles are being defined for government, the private sector, and civil society. The private sector is driving the creation of extensive value chains that connect smallholder farmers to new, higher-value markets. Governments are increasingly engaging in public-private partnerships, promoting competitiveness, and supporting greater inclusion of smallholder farmers. Modes of farmer productivity, organization, and information access are also changing. Farmers are boosting productivity by entering the value chain. Political change in many countries is allowing and encouraging new forms of farmer collective action, such as producer groups, which is allowing smallholders to become more competitive and to grasp new opportunities in higher-value markets. Institutional innovations, such as extension, are moving away from government and are creating new platforms of progress. Finally, breakthrough innovations in science and technology, particularly in the areas of biotechnology and information technology, are transforming productivity potential in the agricultural sector and could have huge potential benefits to developing countries in terms of driving economic growth, creating new markets and employment opportunities, and development new markets. The increased development of collective action, along with decentralized and participatory approaches, is also making possible the greater adoption of location-specific technologies, such as conservation agriculture and biological pest control. At the same time, new threats and dangers about energy, climate change, and scarce land and water resources are, along with risks such as increased inequality, growing insecurities, and conflicts, creating a dynamic playing field to which agriculture must adapt (J. Moock, personal communication; UNESCO, 2008; World Bank, 2008a).

While the changes in the agricultural sector are clearly differentiated across regions and countries, the new dynamism in the system is creating more opportunities for actors across the agricultural innovation system—agribusinesses, entrepreneurs, women, research organizations, universities, policy analysts, and farmer organizations—to capture value (J. Moock, personal communication). It is clear that human and institutional capital are now feeding into a completely changed environment. What capacity assets can best position actors in developing countries to take advantage of opportunities in the new agriculture, and what fresh approaches can best support the development of those capacities to meet new demands in this transformed context?
Specific attributes will contribute to the greater potential of capacity-development programs to expand beyond formal training and the operations of individual institutions and to feed effectively into the changing agricultural sector. These include a more creative, strategic, and innovative approach; a greater focus on building institutional competence rather than professional skills; an emphasis on problem solving and policy relevance rather than technical/analytical tools; a focus on strengthening career tracks and skill utilization instead of pipeline production of professionals; and an ability to foster coordination among multiple, differentiated institutions as opposed to strengthening individual institutions (J. Moock, in Pitcöff, 2005). Successful pathways to capacity development will be more responsive to changes in S&T, communication tools, institutions, markets, and farmers’ needs. The approaches will promote a greater flexibility to listen and to provide feedback to stakeholders, and to ensure that the right people are being reached. Successful approaches will emphasize developing researchers and students who are good consumers of other disciplines and able to understand the possibilities and the edges between the disciplines. Capacity-development approaches for research will be more market driven and will emphasize creative thinking about feedback loops, engaging with farmers using participatory methods, new testing methods, networks that allow institutions to join forces, and greater impact orientation, as opposed to a publication orientation (J. Moock, personal communication). Capacity-development approaches focused on training and curriculum reform will emphasize skill development, application of available knowledge, promotion of creativity and leadership, direct implementation of projects with producers, use of integrative, systems-level approaches, interdisciplinary approaches, policy analysis, and values (IAC, 2004a). Successful capacity-development approaches will also emphasize the integration of women professionals, not only in terms of enhancing equity, but also in terms of what women bring to the table in knowledge, contacts, and understanding of agriculture, given that women are responsible for half of the world’s food production, and in most developing countries they produce between 60 and 80 percent of the food (J. Moock, personal communication; FAO, 2010).

1.3 THE AGRICULTURAL RESEARCH AND INNOVATION SYSTEM: AN ANALYTICAL FRAMEWORK FOR CONSIDERING CAPACITY DEVELOPMENT

A useful framework for considering agricultural research capacity development—and the framework chosen for this analysis—is the agricultural research and innovation system, which includes individual and collective capacities to innovate, organizational cultures and behaviors that support such capabilities, and networks and linkages among agents of innovation (Spielman et al., 2008). The agricultural research and innovation system includes not only research capacity per se, but also those capacities that support the conduct of research and the dissemination and utilization of research results. Examples include the following:
• Linkages between global and national researchers to harness the benefits of global public goods research.
• Mechanisms that link national research and extension systems to both prioritize research based on the needs of producers and to disseminate technology.
• Systems for transfer of technology from public research to the private sector (e.g. seed industry).
• Establishing strategic priorities that will guide the research agenda, human resources, training, and financial resources.
• Financial management systems to ensure alignment with priorities, timeliness, and consistency needed to support research.
• Aligning and developing human resources (faculty, managers, researchers, students) to support strategic priorities.
• National or institutional policies that related to research or the application of technology.

1.4 BASELINE CAPACITIES IN THE AGRICULTURAL RESEARCH AND INNOVATION SYSTEM: IDENTIFYING CHALLENGES AND OPPORTUNITIES FOR CAPACITY DEVELOPMENT

A number of baseline assessments have been conducted that give a picture of the current capacity across different elements of the agricultural research and innovation system and some of the opportunities for new capacity development approaches to help the system more effectively feed into 21st century agriculture.

1.4.1 Overall Capacity in the Agricultural Research and Innovation System

Global, regional, and country-level trend data on agricultural scientist numbers and total investments in agricultural research by government, higher education, and nonprofit sectors of developing countries, along with data on numbers of scientists by degree status and gender, support-staff numbers, funding sources, categories of spending (salaries, operating costs, and capital investments), and research focus can all give a picture of the overall capacity of the agricultural research and innovation system in low- and middle-income countries.

1.4.1.1 Public Agricultural Research and Development Spending

Looking at public agricultural research and development (R&D) spending, we see that public agricultural R&D spending is concentrated in richest 5 percent of countries, accounting for about half of the spending. In 2000, the United States accounted for 20 percent of the total, China and India 14%, and all of sub-Saharan Africa accounted for 11.9 percent (Pardey and Alston, 2010). Table 1.1 shows public agricultural R&D spending by region and major country for the year 2000, which is the most recent year for which a complete overview of public agricultural R&D investment information is available. Data in the table have been revised to reflect new World Bank-recommended methodologies for calculating cross-country comparisons of the prices of goods and services, the growing diversity of developing-country economies, and newly release
estimates for several regions (Beintema and Stads, 2010). The spending shares in low- and middle-income countries (not including Eastern European and former Soviet states) actually increased over the period between 1981 and 2000 from 9 to 11 percent and 29 to 33 percent, respectively (Beintema and Stads, 2010).

Table 1.1: Public agricultural R&D spending by region and major country, 2000

<table>
<thead>
<tr>
<th>Country Category</th>
<th>Spending (Million 2005 PPP* dollars)</th>
<th>Shares (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>A. Country grouping by income class</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low-income countries (49)</td>
<td>2646</td>
<td>11</td>
</tr>
<tr>
<td>Middle-income countries (82)</td>
<td>9056</td>
<td>36</td>
</tr>
<tr>
<td>High-income countries (40)</td>
<td>13,456</td>
<td>53</td>
</tr>
<tr>
<td><strong>Total (171)</strong></td>
<td>25,158</td>
<td>100</td>
</tr>
<tr>
<td><strong>B. Low- and middle-income countries by region</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sub-Saharan Africa (45)</td>
<td>1,239</td>
<td>5</td>
</tr>
<tr>
<td>China</td>
<td>2,250</td>
<td>9</td>
</tr>
<tr>
<td>India</td>
<td>1,301</td>
<td>5</td>
</tr>
<tr>
<td>Asia-Pacific (26)</td>
<td>5,120</td>
<td>20</td>
</tr>
<tr>
<td>Brazil</td>
<td>1,247</td>
<td>5</td>
</tr>
<tr>
<td>Latin America and the Caribbean (24)</td>
<td>2,755</td>
<td>11</td>
</tr>
<tr>
<td>West Asia and North Africa (12)</td>
<td>1,412</td>
<td>6</td>
</tr>
<tr>
<td>Eastern Europe and the Former Soviet States (23)</td>
<td>1,177</td>
<td>5</td>
</tr>
<tr>
<td><strong>Sub-Total (131)</strong></td>
<td>11,702</td>
<td>47</td>
</tr>
</tbody>
</table>

* Purchasing power parity


Preliminary agricultural R&D investment data post-2000 reveal substantial diversity, even within regions. In the Asia-Pacific region, growth in public agricultural R&D spending was high given the large increases in India and China, but there was sluggish or negative growth in other countries, including Pakistan, Indonesia, and Laos. In the Latin American and Caribbean region, in general, spending in middle-income countries increased, while spending in low-income countries declined over the period 1996–2006. The bulk of increased investment occurred in Argentina, Brazil, and Mexico. In sub-Saharan Africa, countries like Ghana and Nigeria have seen substantial increases in spending by the government sector since 2000, but declining or stagnating spending levels were observed in other countries, particularly Francophone West African nations, over the period 2000–2008 (Beintema and Stads, 2010).
1.4.1.2 Agricultural Research Intensity

Agricultural research intensity—defined as R&D spending relative to economic size of the agricultural sector—is much lower in developing countries (less than 1 percent), compared to developed countries (2.36 percent). Government, as opposed to higher education and the non-profit sector, remains the main performer of public agricultural research across low- and middle-income countries in Latin America (61%), Asia (62%), and sub-Saharan Africa (77%), although the higher education sector is gaining ground in a number of countries and is even on par with government in a number of countries. Government is also the dominant funder of public agricultural research in low- and middle-income countries (84%), with donor contributions supporting 7% of research, mostly in highly donor-dependent areas. Many countries are increasingly using new funding modes, such as internal revenues and production or export levies (Beintema and Stads, 2010). Competitive funding of agricultural research is increasing in Latin America and Asia. In developing countries, only 6.4 percent of agricultural R&D spending is private. And, there are wide regional differences, with 9 percent of private agricultural R&D spending in Asia, and only 1.7 percent private agricultural R&D spending in sub-Saharan Africa (Pardey and Alston, 2010).

1.4.1.3 Public Agricultural R&D Professional Capacity

In addition to investment trends, regional trend data on public agricultural R&D professional capacity are available and indicate that most regions have made substantial progress in building research staff capacity, both in terms of numbers and qualification levels. The participation of female scientists has also increased in a large number of countries. However, there is high variation in the magnitude, growth, and distribution and qualifications (PhD, MSc, vs. BSc) and gender. Maintaining viable agricultural capacity is a particular challenge in Africa.

Regionally, the Asia-Pacific region has reported improvements in the qualification levels of agricultural scientists, with roughly 75% having post-graduate training. The proportion of post-graduate-trained researchers was higher in South Asia than in Southeast Asian countries. In Latin America and the Caribbean, 70% of full-time equivalent (FTE) researchers in agriculture were employed in three countries—Argentina, Brazil, and Mexico. While capacity growth was positive in the middle-income countries in the region, it was negative in El Salvador, Guatemala, and Honduras. In 2006, 65% of the research staff in the sample were trained at the post-graduate level, with researchers in Central America the least-well qualified compared to their counterparts in Latin America. Sub-Saharan Africa struggles to maintain research staff capacity, given the retirement of well-qualified researchers, brain drain, and bans on public-sector recruitment in some countries (Beintema and Stads, 2010).

1.4.1.4 Women’s Participation in the Global Agricultural R&D Workforce

Women’s participation in the global agricultural R&D workforce has been tracked for many regions over the period 1996–2003. Despite increases in numbers of female scientists, female participation in agricultural R&D remains low. Currently, only one in
five agricultural researchers in the developing world is female. Table 1.2 shows the average shares of female scientists across regions for various qualification levels.

**Table 1.2 Share of women in total research staff by degree and region of the developing world, 1996–2003**

<table>
<thead>
<tr>
<th>Region</th>
<th>BSc</th>
<th>MSc</th>
<th>PhD</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Percentage</td>
</tr>
<tr>
<td>Sub-Saharan Africa (27)</td>
<td>23.1</td>
<td>18.8</td>
<td>13.5</td>
<td>18.4</td>
</tr>
<tr>
<td>Asia-Pacific (12)</td>
<td>31.1</td>
<td>19.3</td>
<td>24.7</td>
<td>20.3</td>
</tr>
<tr>
<td>Middle East and North Africa (5)</td>
<td>24.7</td>
<td>14.2</td>
<td>8.5</td>
<td>16.9</td>
</tr>
<tr>
<td>Sub-Total (44)</td>
<td>28.2</td>
<td>18.4</td>
<td>13.8</td>
<td>19.4</td>
</tr>
<tr>
<td>Latin America and the Caribbean (23)</td>
<td>Na</td>
<td>na</td>
<td>Na</td>
<td>20.1</td>
</tr>
<tr>
<td><strong>Total (67)</strong></td>
<td>Na</td>
<td>na</td>
<td>Na</td>
<td>19.5</td>
</tr>
</tbody>
</table>


*Notes:* Figures in parentheses indicate the number of countries in each category. For sample sizes, see specific country briefs. Data for Sub-Saharan Africa are for 2000/01; data Asia–Pacific (excluding China) are for 2002/03; data for the Middle East and North Africa are for 2001/03; and data for Latin America and the Caribbean are for 1996; na indicates that data are not available.

Female researchers throughout the developing world are consistently less well qualified than their male counterparts. There are higher shares of women qualified at the BSc level in the agricultural research workforce as compared to men (37% compared to 22% in the developing world on average) and much lower shares of women qualified at the PhD level as compared to men (23% vs. 35% on average in the African, Asian, and Middle Eastern Regions, with comparatively higher shares in Asia and comparatively lower shares in the Middle East, sub-Saharan Africa, and North Africa). Both female and male researchers employed in institutions of higher education tend to be more highly qualified than women employed in government and non-profit agencies (39% of women in higher-education institutions hold PhDs vs. 17% in government vs. 15% in non-profit agencies) (Beintema, 2006).

In the agricultural sciences pipeline, United Nations Educational, Scientific, and Cultural Organization (UNESCO) data surveying 57 developing countries as of 2000/2004 indicate that about 605,000 students were enrolled in agricultural sciences, and of these, 38 percent were female. These data augur well for increasing shares of women entering the workforce, though perhaps only at the BSc level (Beintema, 2006).
Results from a major benchmarking study performed in 2008 of 125 agricultural research agencies in 15 sub-Saharan African nations are now available (Beintema and Di Marcantonio, 2010). Major findings from the study show that over a ten-year period, the proportion of female professional staff employed at the sample agricultural research and higher education agencies increased from 18 percent to 24 percent in 2007/08, which indicates that the gender gap in agricultural sciences in Africa may be closing. Some countries exhibited extremely low levels of female participation (Ethiopia, Togo, Niger, and Burkina Faso), and proportions of female staff were much higher in other countries (South Africa, Mozambique, and Botswana). However, BSc holders comprised about 2/3 of the overall professional capacity increase in the region of about 20% (men and women), indicating that overall quality of capacity may be declining. Women are still less qualified than their male counterparts in Africa (27% women PhD holders vs. 37 % male PhD holders). In addition, women held only 14 percent of the management positions at agricultural research and higher education institutions, and the pool of female staff is much younger on average than the pool male staff. With regard the agricultural research pipeline, the proportion of females in higher education in agriculture (mostly at the BSc level) exceeds than that of professional women employed in research and higher education institutions, suggesting that increasing shares of women may be entering the work force (Beintema and Di Marcantonio, 2010).

1.4.2 Agricultural Universities

This section chronicles the history and context of agricultural universities in developing countries and summarizes some of the key capacity challenges in the areas of research, training, faculty attraction and retention, and autonomy and governance.

1.4.2.1 History and Context

Heavy donor investments in higher education in developing countries between the 1960s and 1990s have stagnated in present day, justified by the argument that investments in primary education were higher than those from tertiary education (Asenso-Okyere and Von Braun, 2007, 2009). Between 1964 and 1990, the World Bank financed 41 projects in universities (both agricultural and general) in 25 countries at a level of $713 million. The US Agency for International Development (USAID) invested $456 million in 63 agricultural universities in 40 countries between the 1950s and 1996 (Asenso-Okyere and Von Braun, 2007, 2009). The 20-year Rockefeller Foundation funded University Development Program also tried to help African universities address development programs (IAC, 2004a). Although the World Bank and other organizations have expressed renewed interest in developing country higher education (e.g., through the Science, Technology, and Innovation program) the effects of several decades of neglect are clearly evident.

In the African region, perhaps in response to the period of heavy support, many new universities were created (from 20 to nearly 160 between 1960 and 1996, with student numbers growing by 8 percent per year over the same period), but quality has fallen. Now highly under-resourced, African universities are characterized by declining standards, performance, and facilities (IAC, 2004a; Mouton, 2008a; Mouton, 2008b).
Further, the influence of regional and local political events has led to the closing of scientific institutions, including universities, in many countries, putting science back many decades (Mouton, 2008a). In a preliminary typology of African institutions, based on a survey of 17 countries, Mouton (2008a) identifies three clusters of countries: 1) those countries where a single public university producers most knowledge; 2) those countries where, in addition to a fairly strong public university, there are also some government-funded research institutes or international research institutes based in the country, and 3) countries in which there are a large array of scientific institutions.

Hansen (1990) notes that many agricultural universities—usually administered by Ministries of Education in developing countries—are weak because they lack strong ties to Ministries of Agriculture. Brazil is a typical case, where the Brazilian Corporation for Agricultural Research (EMBRAPA), was given many of the research functions of the universities when it was established in 1972, in response to the high degree of politicization of Brazilian universities. Agricultural faculties were further weakened by a decision to federalize universities, which reduced their autonomy and governance. African institutions similarly suffer because of a “lack of clarity and articulation of science governance issues (demonstrated by constant shifts in ministerial responsibility for science)” (Mouton, 2008a). The land-grant model was introduced in many African universities in the 1960s and 1970s, through ministries of education, but this came into conflict with entrenched research and extension functions in the ministries of agriculture. By the 1980s, most land grant-type universities in Africa became all-purpose universities with a focus on undergraduate teaching (IAC, 2004a). In the 1980s, several African nations tested the successful state agricultural university (SAU) model from India, but these, too, floundered in the African context (IAC, 2004a).

1.4.2.2 Training Capacity

Asenso-Okyere and von Braun (2007, 2009) note a strong lack of capacity in postgraduate education in agricultural universities. They cite a need to finance financial support mechanisms for postgraduate education, such as teaching assistantships and scholarships. In Africa, there is a heavy emphasis on undergraduate education, with little attention to graduate education (IAC, 2004a).

Universities must produce well-trained graduates to meet national needs for qualified experts, yet attracting high-quality students is a substantial capacity challenge in many developing country agricultural universities. Table 1.3 demonstrates that the need for high-quality, trained graduates outstrips the supply from universities in many developing countries both in terms of farms and farm area (Asenso-Okyere and von Braun, 2009).

<table>
<thead>
<tr>
<th>Country</th>
<th>Actual Number of Postgraduates in Developing Countries</th>
<th>Postgraduates needed in developing countries today to match the number in</th>
<th>Postgraduates needed in developing countries today to match the number in</th>
</tr>
</thead>
</table>
Agriculture is less attractive to students because of lack of jobs and low profitability of agriculture; the best students are attracted to engineering, medicine, and pharmacy (Asenso-Okyere and von Braun, 2007, 2009). At the post-graduate level, salaries are non-competitive.

Teaching approaches and curriculum that are poorly related to practical agriculture are a further capacity constraint in developing country universities. Asenso-Okyere and von Braun (2007, 2009) cite poor knowledge of practical agriculture because of the reduction of practical training in the curriculum, lack of training in policy analysis, poor training in macroeconomics, deficiencies in statistics and quantitative methods in the curriculum, poor knowledge of information and communication technologies (ICTs), and poor training in soft skills, such as negotiation, to prepare graduates for trade negotiations. Higher-education curricula need to be more aware and responsive to rural-sector needs, e.g., through farmer–scholar links. There is a dearth of learning materials, and most learning occurs in lecture format, with limited opportunities for hands-on learning (Hansen, 1990).

### 1.4.2.3 Research Capacity
Dominance of teaching, as opposed to research, is a key weakness of developing country agricultural universities. Universities are usually perceived as teaching vehicles in the narrowest sense, as opposed to research and development vehicles by the policymaking community (Hansen, 1990). In developing countries, about half of the agricultural scientists work in universities; only about 25 percent of their time is spent on research and the rest is divided among consulting, advising students, and teaching (Eicher and Alex, 2003, cited in Asenso-Okyere and Von Braun, 2009). In Africa, universities represent 18 percent of the total research capacity. This is comparable to 12 percent for OECD countries, excluding R&D in food processing, agricultural machinery, and agrochemicals. African university-based scientists also conduct a minor share of public research, though they are starting to become a more important component of agricultural research (IAC, 2004a). The practice of supplementing meager academic salaries through consultancy research, mostly for international agencies and governments, is widespread in the African region (Mouton, 2008a).

A strong ivory-tower mentality persists in many developing county agricultural universities (Asenso-Okyere and von Braun, 2009). Research needs to be improved and made a more relevant to the agricultural innovation system and to non-university actors at both the national and international levels, in particular, more effectively integrated with the national agricultural research systems (NARS). In a survey of African university stakeholder groups, university leaders articulated a very strong need for establishing such connections, particularly among communities of scholars (PHEA, 2009).

An inappropriate, discipline-based organization of agricultural universities in developing countries has also weakened universities’ rural livelihood mission. Universities lack cross-disciplinary program structures to ensure integration around common themes and agendas and application of knowledge to problem-solving situations (Hansen, 1990). Social science research and tools, in particular, have languished amidst the heavy emphasis by donors on production agriculture, technology generation, and diffusion. This has effectively weakened the universities’ political base in rural areas, the potential for research to address social and economic questions, and the potential for the university to influence policy forums (Hansen, 1990).

1.4.2.4 Incentives, Faculty Attraction, and Retention

Agricultural universities face a critical need to replenish their ranks, particularly as the current generation of academics retires (PHEA, 2009). Many agricultural universities however, particularly those in Africa, have experienced a crippling brain drain as academics lured into more attractive positions at NGOs, private sector, and international positions (IAC, 2004a; A. Johnson, personal communication). There is an urgent need to attract and retain women academics in agricultural universities, particularly in Africa. A UNESCO 1998 survey of 19 African universities showed that only 8 percent of all agricultural faculty members were women, compared to more than 50 percent in European universities. Further, African female participation in agricultural sciences is 13.8 percent compared to 25.5 percent in other fields (IAC, 2004a). Fewer than 25% of
agricultural researchers in Africa are women; most have only bachelors’ degrees, and few reach positions of leadership (AWARD, 2010).

New incentive structures beyond peer reviewed publications, such as competitive grants, contracts, and prizes, need to be designed (Asenso-Okyere and von Braun, 2009). In Uruguay, for example, universities linked effectively with the national research institute, ten percent of the research institute’s budget is devoted to competitive grants, and the universities receive about half of this. University and institute staff members meet yearly to prepare joint research programs and Institute staff spend up to 20 percent of their time teaching at universities (Hobbs et al., 1998, cited in Asenso-Okyere and von Braun, 2009). In Ecuador, a competitive grants program funded university-research institute partnerships to develop postgraduate training programs (Eicher and Alex, 2003, cited in Asenso-Okyere and von Braun, 2009).

Mentoring and financial and non-financial incentives are needed to retain staff. A survey of university stakeholders found that younger academics felt that institutional policies and mentoring needed the greatest change in African universities (PHEA, 2009). A Partnership for Higher Education in Africa (PHEA) focus group on salaries in Nigerian universities found that soft assets, rather than salaries, have major importance in staff retention in academia. If one can be comfortable on a modest university salary, the greatest retention issues at universities relate to mentoring within the faculty, the need to feel welcome in the environment, and isolation. One Foundation official gave the example of a student at Cape Town University who had transferred back to the University of the Western Cape because no one at the Cape Town psychology department was interested in his research topic: the long-term impact of apartheid. Another young academic from University of Ghana was told by the faculty that now that she had her PhD, the department could not offer her anything else. Being able to virtually “leave” the university and peruse literature in their fields through effective IT connections, being able to attend conferences, and being able to mobilize resource through effective proposal writing were cited as important factors in alleviating feelings of isolation (A. Johnson, personal communication).

1.4.2.5 Governance and Autonomy

More systemic weaknesses in agricultural universities are also cited as capacity challenges. Hansen (1990) notes that agricultural universities have little autonomy. They have little control over enrollment and admissions policies, programming and curriculum, and the structure and flexibility of their finances. All of these are regulated by an external agency. Admissions policies tend to favor urban residents instead of rural residents who have exposure to agriculture; lack of autonomy over finances means few incentives exist to foster institutional entrepreneurship. Universities also lack mechanisms for asserting accountability. They have poor governance, lack of policy guidance, lack of leadership, lack of competitive, merit-based selection approaches, poor faculty mobility, and persistent patron-client relationships. Agricultural universities have a poor capacity to learn from environment and to build effective working relationships.
with clients and constituents (Hansen, 1990). Such institutional reforms were also cited by university leaders in a survey of African university stakeholders (PHEA, 2009).

1.4.3 National Agricultural Research Systems and Government Research Agencies

This section addresses capacity challenges in the NARS, of which government research agencies, or national agricultural research institutes (NARIs), comprise a large component. Most of the literature in this section focuses on the sub-Saharan African region. Gaps can be clustered into the following areas: scientific capacity and human resources; governance and management capacity; financial management capacity; and capacity to collaborate and to network.

Government research agencies represent 81 percent of the total research capacity of NARS in sub-Saharan Africa. Universities contribute 18 percent, and private and non-profit sectors contribute 1 percent (IAC, 2004a; Pardey and Alston, 2010). In countries where there are larger numbers of full-time equivalent (FTE) researchers (500–1000), the proportion of researchers at universities is higher (22 percent) (IAC, 2004a).

1.4.3.1 Scientific and Human Resources Capacity

The current scientific capacity in sub-Saharan African NARS has some historical basis. In post-independence Africa, almost all regional agricultural research institutes were phased out or taken over by national governments; however, political instability sparked funding volatility and constant reorganization of NARS, which have had great difficulty in building domestic political support for agricultural research (Eicher, 2009). The five decades of independence have been characterized by declining research productivity of NARS and increases in the numbers of researchers. Africa has almost 30 percent more public agricultural researchers than the United States, and 50 percent more than India, but in terms of training, only 25% of those FTEs have PhDs compared to 100% in the US and 63% in India. Therefore, the quantity of effective research labor is less than that of India or the United States (Eicher, 2009; Pardey and Alston, 2010). Further, NARS expansion has been guided by domestic political interests and partially by donor pressures to increase the numbers of commodities covered (e.g., orphaned crops, women’s crops, and food crops), and the result has been that there is no critical mass of research capacity on any crop (Eicher, 2009). Sub-Saharan African public agricultural research institutes are also characterized by their very small size. Most have fewer than 100 scientists (Mukibi and Youdeowei, 2006). 75% of African public agricultural research agencies employ fewer than 20 researchers; in contrast, one-third of Indian public agricultural research agencies and all American public agricultural research agencies employ more than 100 researchers (Pardey and Alston, 2010).

Other scientific capacity challenges in sub-Saharan African public agricultural research institutes relate to the small number of PhD-level women researchers and young researchers (Mukibi and Youdeowei, 2006). Many scientists in the research institutes are approaching retirement age, but there is no plan for their replacement. In a survey of Nigerian NARS (universities, parastatals, and ministries) conducted to assess individual
and institutional capacities within several Federal ministries for designing and implementing agricultural and rural development policies and programs, a majority of individual respondents were male and a majority perceived that only a small number of women worked at the ministerial and research levels, and even at the level of rural farming communities (Adebayo et al., 2010).

Though the range of expertise in public agricultural research institutes cuts across areas relevant to agricultural and rural development policymaking, there are weaknesses in some disciplines, such as the social sciences and environmental analysis (Adebayo et al., 2010; Mukibi and Youdeowei, 2006). There is a lack of training in key areas, e.g., intellectual property management, biotechnology, research program design, and biosafety. These capacity gaps demonstrate an urgent need to identify core scientific competencies and develop strategies for hiring and recruiting human resources (Mukibi and Youdeowei, 2006).

Public agricultural research institutes offer poor conditions of service and incentives, including incentives for scientific publication (Mukibi and Youdeowei, 2006). In the Nigeria case study, a large majority of survey respondents were indifferent to their jobs, indicating a need for institutional incentives. Though human resources management and training exercises exist, survey respondents reported that they are not used (Adebayo et al., 2010).

Other major gaps in scientific capacity of NARS relate to the lack of use of research evaluation tools, including both ex ante research evaluation and evaluation of research outputs; poor generation of technology; weak ICT, library, and laboratory facilities; and the low rate of scientific publishing (Mukibi and Youdeowei, 2006).

1.4.3.2 Governance and Management

Governance and management capacity is a second key area of capacity in which there are gaps in most sub-Saharan African public agricultural research institutes. There is inadequate inter-sectoral strategic planning and priority setting for R&D nationally and regionally (IAC, 2004a). This includes lack of short- and long-term planning with a financial component (Mukibi and Youdeowei, 2006). In the Nigeria case study, survey respondents reported the existence but lack of intensive use of such planning tools as near-term strategies, financial guidelines, and reporting (Adebayo et al., 2010). Other major challenges are a lack of leadership and need for champions, the engagement of diverse perspectives (e.g., NGOs, industry, etc.) in the advisory and management structures of public research institutes, and the need for external reviews (Mukibi and Youdeowei, 2006).

1.4.3.3 Financial Status and Management

NARS face substantial challenges in funding status and financial management. Funding shortage exist because most NARS are primarily supported by donors and foundations, with little support from the government and the private sector (Mukibi and Youdeowei,
2006). Fewer than 20% of NARS in sub-Saharan Africa have competitive funding mechanisms, and therefore lack flexibility to fund new and emerging research areas. Basic business practices are also lacking. Most NARS have poor standards of financial management, which, combined with lack of an entrepreneurial institutional culture, leaves many NARIs poorly equipped to prepare research proposals (Mukibi and Youdeowei, 2006).

1.4.3.4 Collaboration and Networking Capacity

Public agricultural research institutes in the sub-Saharan African region have weak capacity to partner with a variety of actors, including private sector partners, universities, Consultative Group on International Agricultural Research (CGIAR) centers, sub-regional organizations (e.g., Southern African Development Community [SADC], Association for Strengthening Agricultural Research in Eastern and Central Africa [ASARECA], West and Central African Council for Agricultural Research and Development [CORAF/WECARD]), NGOs, farmer- and community-based organizations, research institutes from developed countries, and government (IAC, 2004a; Mukibi and Youdeowei, 2006; World Bank, 2008b). There is a need for stronger research networks to bridge the gaps among these institutions. There have been some successful partnerships, however, in cases where national agricultural research institutes were affiliated with universities, for example, those at Amadou Bello University and Obafemi Awolowo University in Nigeria (Mukibi and Youdeowei, 2006). A survey conducted of Nigerian NARS also showed that a high percentage of institutions reported collaborative programs with partner institutions and that most institutions used some form of stakeholder consultation (Adebayo et al., 2010). Technology generation by public agricultural research institutes has been generally poor, though some successes have occurred where participatory techniques were used (Mukibi and Youdeowei, 2006). Sources indicate a mixed picture regarding linkages between national agricultural research institutes and policymakers: Mukibi and Youdeowei (2006) report effective linkages between NARIs and policymakers; in contrast, in a survey conducted of NARS in Nigeria, at the institutional level, results indicated a high level of indifference to the national policymaking process, despite individual perceptions that research evidence was being used to support the development of agricultural and rural development strategies, policies, and programs (Adebayo et al., 2010). A World Bank study on institutional government action on under-nutrition in Ghana, Mozambique, Nigeria, and Uganda may shed light on constraints that may inhibit the capacity of NARIs to work with other parts of the government (World Bank, 2008b). The following barriers were identified:

- Lack of bureaucratic organization in a manner that facilitates work across sectors (e.g., agriculture, health, education)
- Resource allocation and planning processes within the bureaucracy
- Differing sector mandates and priorities
- Differing sectoral worldviews, and capacity
- Constraints for nutritional analysis within sectors
- Sector-wide Approaches (SWAps), which tend to work against cross-sectoral priorities, such as under nutrition
The study suggested the following mechanisms to enable greater cooperation among disparate ministries on cross-sectoral topics like under-nutrition:

- Multisectoral nutrition planning agencies;
- Cross-sector issues as policy priorities;
- Creation of a master plan that includes incentives to go beyond sectoral objectives
- Political champions needed
- Inclusion of nutrition objectives in agricultural activities;
- Community-driven development;
- Including nutrition topics in agricultural training.

1.4.4 Critical Infrastructure, Technology, and Access to Scientific Publishing

There is a critical need for scientists to access recent, peer-reviewed literature to keep curricula and research up to date. Data, such as genomics data, are also available in web-based databases requiring high-speed access. Rapid, low-cost access to information and communication technologies (ICTs, which include fiber optic networks, information systems development, sufficient bandwidth, and automated library management systems) is therefore essential for proper research functioning (IAC, 2004a; Mouton, 2008b). Inadequate access to ICTs, however, has led to isolation, particularly in Africa, from the international academic community. Some developing country policies and regulations contribute to digital divide (IAC, 2004a). Absence of maintenance companies and local vendors contributes to lack of replacement or repair of infrastructure (Mouton, 2008b).

In addition, many parts of the world, particularly Africa, lack access to dedicated scientific institutions for the dissemination of research results: journals, publishing houses, electronic repositories, and data archives and to training, in such matters as scientific publishing, editorial practices, and peer-review procedures, to ensure high-quality publishing (Mouton, 2008b). Bibliometric analysis has shown that since 1987, sub-Saharan African science has lost almost a third of its share in global science, as measured by papers published in ISI-indexes (Tijssen, 2007 cited in Mouton, 2008a). While there are some examples of support for local national journals (e.g., Swedish International Development Agency [SIDA] support for 26 Ethiopian scientific journals), many journals in the African region have no aspirations to become internationally recognized journals (Mouton, 2008a).

1.4.5 Linkages Among Agents of Innovation

This section describes the baseline capacity of linkages among agents of innovation, which include NARIs, universities, sub-regional and regional institutions, farmers, and the private sector.

1.4.5.1 Linkages Among National Organizations, Sub-Regional Organizations, Regional Organizations, International Organizations, and Research Networks
Large numbers of regional organizations have been created to improve coordination of agricultural research in national systems. In the African region, for example, these include:

- SACCAR: Southern African Center for Cooperation in Agricultural Research
- AARINENA: Association of Agricultural Research Institutes in the Near East and North Africa
- WECARD/CORAF: West and Central African Council for Agricultural Research and Development
- ASARECA: Association for Strengthening Agricultural Research in Central and Eastern Africa
- FARA: Forum for Agricultural Research in Africa

However, in the African context, regional organizations have not been successful in exploiting synergies and comparative advantages and economizing on scarce resources among the NARS, though they have facilitated information sharing. NARS have been reluctant to cede responsibility for priority research to other NARS. Reaching agreement on regional priorities and funding regional organizations are two challenges (IAC, 2004a).

International agricultural research organizations have an important role in shaping science at the local level, and the countries that house the headquarters of these organizations benefit from their presence. In the African region, for example, international agricultural research organizations provide continuity in research programs, conduits for R&D funding, networks of collaboration, employment to local scientists, and high-quality facilities and laboratories. In spite of the positive impacts and documented successes, research priorities and programs of international research organizations are not often closely aligned with those of the individual countries, so international organizations are somewhat disconnected from the national science systems of the countries in which they are headquartered (Mouton, 2008a).

1.4.5.2 Linkages Among Universities and National Agricultural Research Institutions

Competitive, conflictive relationships persist between NARIs and universities (IAC, 2004a). These tensions stem from the historical administration of NARIs and universities by different ministries—agriculture and education, respectively (Hansen, 1990). (Also see section on “Agricultural Universities” above).

1.4.5.3 Linkages Among Research Organizations and Farmers: Extension

Particularly in the African region, there are weak or non-existent links between research organizations and extension. There are inadequate numbers of smallholder farmer organizations to ensure participation as stakeholders in R&D priority setting (IAC, 2004a).

1.4.5.4 Linkages Among Public Research Organizations and the Private Sector
There are limited public-private partnerships in agricultural R&D, particularly in the African context. Greater investments in basic communications and transport infrastructure, as well as cultivating a climate of trust between the two sectors, could help to improve these relationships (IAC, 2004a). Further, most developing countries have inefficient or dysfunctional technology assessment, release, and oversight systems, whether for biotechnologies or for conventionally bred crops (Pardey and Alston, 2010). Local technical expertise is lacking to conduct or evaluate the pre-release trials and manage the technologies in use.

The lack of private sector entities for agricultural inputs is a particular challenge in Africa. In the area of seed supply, for example, many countries have no seed companies at all; in other countries a single seed company may have a powerful monopoly. A classic example has been the challenge of getting New Rice for Africa (NERICA) to producers in West Africa; while new seed varieties have the potential to benefit producers, the main challenge has been the establishment of seed companies (G. Toennissen, personal communication). NARIs face constraints in making improved varieties available to private sector companies. For example, in Kenya, the Kenyan Agricultural Research Institute (KARI) had an arrangement in which its varieties were made available to the Kenya Seed Company, a national parastatal; in contrast, start-up seed companies did not have access to KARI seeds. While Kenya Seed Company made seeds available in the Rift Valley, it did not produce seeds for other agro-ecosystems in Kenya; other companies were targeting those regions, and KARI had developed varieties for each of those agro-ecosystems, but the sole-source relationship between KARI and the Kenya Seed Company created bottlenecks on the commercialization side (G. Toennissen, personal communication).

The CGIAR Centers also lack a system-level strategy for facilitating public-private partnerships. Although some Centers are engaged in public-partnerships (e.g., the International Rice Research Institute [IRRI] partnership with the Rockefeller Foundation and Syngenta corporation to grant royalty free licenses to work with Golden Rice patented technologies on behalf of poor farmers in developing countries), there is no unified strategy or System-level reporting mechanism for intellectual property rights (IPR) issues in place for a system that holds a large collection of global germplasm (World Bank, 2003).

**Chapter 2: Design Considerations for Effectively Supporting Capacity Development**

Although capacity development is accepted in the abstract as an important objective of development cooperation, few donors have considered, in an analytical fashion, the practical application of capacity development at the field operations level (OECD/DAC, 2009a). This chapter discusses the most strategic investments in capacity development: an overview of approaches used to support capacity development and conditions that are important in influencing capacity development.
2.1 CAPACITY DEVELOPMENT APPROACHES

Given the highly contextual and adaptive nature of capacity development and support for it, here is no single “best” way to support capacity development; multiple approaches and perspectives are important. The wide array of interventions/approaches to develop capacity is summarized in Table 2.1.

Table 2.1: Capacity Development Approaches

<table>
<thead>
<tr>
<th>Approach</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Technical assistance</td>
<td>Long- and short-term experts imparting knowledge and skills on site through consulting, coaching, and training activities</td>
</tr>
<tr>
<td>Mentoring and “apprenticeship”</td>
<td>Linking senior and junior researchers for career counseling and capability improvement</td>
</tr>
<tr>
<td>Training programs</td>
<td>Long- and short-term learning activities, ranging from workshops to degree programs. Involves both subject-matter and management competencies (e.g., research methods and evaluation approaches)</td>
</tr>
<tr>
<td>Workshops</td>
<td>Short-term training.</td>
</tr>
<tr>
<td>Conferences</td>
<td>Topic-driven gatherings to discuss issues, research findings and to network</td>
</tr>
<tr>
<td>Study Tours</td>
<td>Experiential learning activity in which participants see in action what they want to implement in their own setting.</td>
</tr>
<tr>
<td>Institutional linkages, partnerships, and/or twinning arrangements</td>
<td>Organizational relationships aimed at improving the capabilities of the institution for mutual benefit.</td>
</tr>
<tr>
<td>E-courses and programs</td>
<td>Technology-based capacity building</td>
</tr>
<tr>
<td>Networks</td>
<td>Support to groups of individuals and organizations to engage in capacity development, usually involving e-technology and face-to-face meetings.</td>
</tr>
<tr>
<td>Infrastructure support</td>
<td>Capital infrastructure needed for research endeavors (e.g., buildings, libraries, utilities, and the internet); usually require the organization to have a maintenance budget and system.</td>
</tr>
<tr>
<td>Base budget support</td>
<td>Sustenance to recurrent costs of an organization</td>
</tr>
<tr>
<td>Awards, scholarships, fellowships, internships</td>
<td>An assortment of incentives to encourage individuals to develop capacity.</td>
</tr>
<tr>
<td>Publications and publication resource support</td>
<td>Tools to help disseminate research work</td>
</tr>
</tbody>
</table>

Source: Neilson and Lusthaus, 2005
2.2 EFFECTIVE SUPPORT OF CAPACITY DEVELOPMENT PROCESSES:
CONDITIONS THAT INFLUENCE CAPACITY OUTCOMES

Looking across capacity development programs, what factors have contributed to capacity development? What factors might have inhibited capacity development? How can donors play an effective supporting role? Effective capacity development involves an active search for approaches that achieve a best fit with the particular circumstances of the country, sector, or organization under consideration; therefore, approaches need to be tailored to country circumstances and the needs of the particular situation. While evaluation of capacity development interventions is not a matter of coming up with “best practices”, easy formulas, and quick fixes, or of assessing the relative effectiveness of different types of approaches used, we can nevertheless identify from the literature a set of core principles, or factors and conditions that influence capacity outcomes (Deby, 2005; OECD/DAC, 2006).

2.2.1 Policy-Level Acknowledgment of the Importance of Capacity Development

An Organization for Economic Cooperation and Development/Development Assistance Committee (OECD/DAC) inventory of DAC members on capacity building showed that most donors acknowledge importance of capacity development, but only a few (e.g., Canadian International Development Agency [CIDA], Swedish International Development Agency [SIDA]) have focused on it analytically (OECD/DAC, 2009a). Some donors have written policy statements and action plans. Other donors have plans in draft form or that are not used officially. 10 of 21 DAC members have some kind of guidance document on capacity development. Several donors have a capacity development unit (OECD/DAC, 2009a). Many donors use common definitions (e.g., OECD), but others have not yet adopted a formal definition. In terms of priorities, most donors are focusing on capacity development in the areas of private sector and civil society; national, sectoral, and thematic strategies; country systems; and fragile situations.

2.2.2 Alignment of Capacity Development Efforts with Aid Effectiveness Principles

Aid effectiveness principles—country ownership and leadership, demand-driven development, and donor alignment with national strategies—are increasingly included in donor approaches, and many donors are mainstreaming the concepts of capacity development at country, sector, and cross-cutting levels and anchoring their actions in overall strategies for aid effectiveness (OECD/DAC, 2009a; OECD/DAC, 2006). The 2005 Paris Declaration on Aid Effectiveness sees capacity development as an endogenous process led by a country, with donors playing a supporting role (OECD/DAC, 2006). At a practical level, aligning efforts with aid effectiveness principles means involving partner countries fully in the initiative design, jointly reviewing the organizations strategy, identifying capacity needs, and developing a plan for capacity development (Horton et al., 2003; OECD/DAC, 2009b; OECD/DAC, 2009a). Ownership can itself be considered a process (OECD/DAC, 2006).

2.2.3 Relationship Between Donors and Partner Countries
Relationships between donors and domestic actors are extremely critical to successful capacity development initiative, with potential to create either vicious or virtuous circles of change (OECD/DAC, 2006). Horton et al. (2003) identify key attributes of the relationship between donors and partner countries that contribute to effective support of capacity development efforts. Donors need to move beyond a traditional donor-recipient relationship into a relationship based on substantial interaction, mutual understanding, and common purpose. Donors and partner countries should think about how a project enhances both organizations, with mutual benefits, and decisions should be made jointly and should involve a critical mass of staff (OECD/DAC, 2006). Long-term partnerships that involve substantial face-to-face interaction tend to be most successful (Whyte, 2004). Capacity development approaches should have a clear, agreed-upon purpose; should link with the organizations’ mission, strategy, and values; and should clearly define roles and responsibilities, particularly regarding what the partner will do and invest (OECD/DAC, 2009b). Capacity development efforts should be characterized by flexibility, continuity, and persistence. Donors should obtain commitment from partners at the highest possible level (China, Chile, and Botswana are examples) (OECD/DAC, 2006).

### 2.2.4 Attributes of Partner Organizations

Specific attributes of partner organizations tend to favor successful capacity development, and these may be usefully considered by donors when deciding which organizations to target (OECD/DAC, 2006). Such organizations have strong outside (client-based) pressures for improvement; have leadership for change at top levels; approach change management in an integrated manner; try, test, and adapt organizational innovations; and manage change processes strategically (OECD/DAC, 2006). Donors may also wish to target organizations whose enhanced capacity will have the greatest spillover effects on other organizations or on the economy as a whole (OECD/DAC, 2006).

### 2.2.5 Examination of the External Environment

Every capacity-development intervention occurs not only in a technical context but in a political and social context (OECD/DAC, 2006). Understanding the external environment—the international and country context in which the capacity-development intervention will occur—is critical to the design of effective and holistic capacity development interventions (Horton et al., 2003). Both functional-rational and political perspectives on capacity and change should be recognized as a basis for understanding why things are the way they are and for identifying entry points for capacity development support (OECD/DAC, 2009b). For example, social influences (e.g., penalties for excellent performance, family loyalties) need to be considered in addition to individual capabilities and competences. The role of the private sector should also be considered (OECD/DAC, 2006). The willingness and ability of organizations to engage in change should be considered (OECD/DAC, 2009b). Most donors now accept that capacity development involves governance and political aspects, as well as organizations, institutions, networks, and systems (OECD/DAC, 2009a).
Such tools as power analysis, institutional analysis, and drivers of change analysis can be used to uncover and understand the incentive structures, power relations, norms and values, and the formal and informal “rules of the game” in a society (OECD/DAC, 2009a; OECD/DAC, 2006). Tools such as conflict analysis, conflict assessments, country political economy studies, Strengths-Weaknesses-Opportunities-Threats (SWOT) analysis and stakeholder analysis are also useful in understanding the external environment (OECD/DAC, 2006).

2.2.6 Enhancing Capacity Development Skills of Donor Personnel

Many donors now recognize that personnel may require learning new skills to effectively participate in capacity-development programs. A majority of donors have initiatives to enhance capacity development skills among staff; tools, guidelines, methodologies are under development; and libraries and online communities of practice have been established (OECD/DAC, 2009a).

2.2.7 Parallel Capacity Development at Multiple Levels

Winton Pitcoff (2005) writes that “individual skill building is of limited value if the organization they work in isn’t functioning well, and the theory that simply building human capacity will improve organizations hasn’t proven true. Human capacity development efforts must be done in parallel with organizational capacity development efforts.” Capacity development depends not only on enhancing knowledge and skills of individuals, it also depends on the quality of organizations in which individuals work, and the enabling environment (the structures of power and influence and the institutions) in which they are embedded (OECD/DAC, 2006). Capacity development, therefore, should be pursued on three interdependent and mutually influencing levels: individual, organizational, and external environment (OECD/DAC, 2006). Training design should be linked to organizational capacity development in an integrated way so that individual skills and organizational settings are created simultaneously (OECD/DAC, 2006).

Mouton (2008b) encourages a model in which governments and international funders shift their support away from individual scientists to research centers and institutes, with doctoral and post-doctoral training activities linked to the center. As demonstrated by an OECD/DAC survey, however, most donors have most experience working at the individual level and only limited experience working at the level of organizations and institutions (OECD/DAC, 2009a).

2.2.8 Monitoring, Evaluation, and Collective Learning

Building a shared understanding of what works and what doesn’t is a core principle of effective capacity development (OECD/DAC, 2006). Utilization-focused monitoring by independent assessors should be employed, capacity development efforts should be designed to maximize learning, and results should be disseminated and shared among partner organizations, countries, and donors (OECD/DAC, 2006; Horton et al., 2003; OECD/DAC, 2009a). Collective donor learning should also be assembled at the country level, involving partner countries in the process (OECD/DAC, 2009a). The degree to
which country ownership is promoted should be one of the things evaluated (OECD/DAC, 2006). Qualitative assessments may be more appropriate for evaluation of capacity-development efforts, and collecting views of intended clients or end users may be useful input. Effective evaluation includes tracking an individual’s experience back to his or her working environment, where the application of skills learned will occur (OECD/DAC, 2006). (Also see Chapter 4 for more on the design of monitoring and evaluation of capacity-development interventions.)

In spite of the near-universal recognition of the importance of monitoring and evaluation, only a few donors are evaluating the effectiveness of capacity development assistance (OECD/DAC, 2009a). It is important to note that many models outlined in this analysis have not conducted formal monitoring or evaluation exercises. Administrators of the Partnership for Higher Education in Africa—one model that conducted monitoring efforts for individual projects but no evaluation of the entire initiative—noted that the regular convening of a local body charged with monitoring was essential to ensuring the support of institutional leadership, progress, and adjustments as required (Suzanne Grant-Lewis, personal communication). Donor cooperation in sharing learning about capacity development is also acknowledged as important, but, similarly, efforts to put it into practice are limited (OECD/DAC, 2009a).

2.2.9 Delivering Support

An initial dialogue between donors and partner countries should focus on joint definition of desired capacity development outcomes. Agreement on what explicit capacity development objectives and outcomes are being pursued, and what benchmarks will be used for assessing progress along the way, should occur as part of a dialogue between donors and partner countries on programs and policies (OECD/DAC, 2009a). This process should be realistic and should also consider beyond what external support can achieve (OECD/DAC, 2009b). Capacity needs assessment or strategic planning can be useful tools for opening a dialogue on what interventions are needed. Such assessments ask the questions: “Capacity for what?” and “what might work here?” (OECD/DAC, 2006).

Different inputs and intervention strategies, and their suitability, should be considered in the design phase, as well as different roles that an external donor can best play (OECD/DAC, 2009b). Room should be left for re-strategizing along the way. Selection of a change strategy should consider the complexity of the change process in each context. More iterative approaches may be more appropriate for complex change. (OECD/DAC, 2009b). The change strategy should also include a plan for how to overcome resistance by those who stand to lose (OECD/DAC, 2009b). The approach should be designed so that quick wins are visible early in the process (OECD/DAC, 2006).

Appropriate roles donors can play in capacity development include the following (OECD/DAC, 2006):
- Facilitating access to knowledge
- Brokering agreements that remove obstacles to capacity development
- Participating in policy dialogue or advocacy
- Providing resources to overcome bottlenecks
- Creating spaces for learning by doing

Technical assistance/cooperation, training, and scholarships were traditionally the most common approaches to promote capacity development, but their effectiveness has come under scrutiny (OECD/DAC, 2009a). Many donors are reforming their approach and broadening their interventions beyond technical cooperation, recognizing “substitution”, instead of true local capacity development, usually occurs as a result (OECD/DAC, 2009a). Capacity development is also not the same as promotion of good governance (OECD/DAC, 2006). Instead of establishing implementation structures in parallel with organization line units, donors are beginning to enforce a “learning by doing” approach, using long-term expatriate technical assistance as a last resort, only when institutional twinning, South-South cooperation, and local inputs/suppliers are not available (OECD/DAC, 2009a).

Support should be delivered in a way that does not contribute to the problem (e.g., through diverting resources or bypassing existing structures rather than helping to strengthen them). Donors should be aware of the effect of perverse incentives caused by donors’ own corporate behavior/practices on local capacity (e.g., when compensation is not aligned with what local institutions offer) (OECD/DAC, 2009b; OECD/DAC, 2006).

Table 2.2 lists starting propositions for ensuring successful capacity development and is not meant to be prescriptive.

**Table 2.2: Factors Contributing to and Inhibiting Capacity Development**

<table>
<thead>
<tr>
<th>Factors that Contribute to Capacity Development</th>
<th>Factors that Inhibit Capacity Development</th>
</tr>
</thead>
<tbody>
<tr>
<td>Long-term commitment</td>
<td>Staff turnover at partner institutions</td>
</tr>
<tr>
<td>Face-to-face interactions</td>
<td>Difficult personalities within partner organizations</td>
</tr>
<tr>
<td>Persistence and engagement through difficult circumstances</td>
<td>Structures (rules/regulations) within institutions, organizations</td>
</tr>
<tr>
<td>Donor history and experience</td>
<td>Donor providing inadequate support for non-programming areas (e.g., library, accessing electronic resources, literature searches, communications, media outreach)</td>
</tr>
<tr>
<td>Local ownership and participation, translated into internal working methods</td>
<td>Donors bypassing existing structures within organizations rather than helping to strengthen them</td>
</tr>
<tr>
<td>Range of expertise</td>
<td></td>
</tr>
<tr>
<td>Mutual learning</td>
<td></td>
</tr>
<tr>
<td>Training and awareness raising of those implementing capacity development</td>
<td></td>
</tr>
<tr>
<td>Holistic: strengthening the processes, systems, and rules that shape collective and individual behavior and performance</td>
<td></td>
</tr>
<tr>
<td>Paying attention to tracking systems and</td>
<td></td>
</tr>
</tbody>
</table>
evaluation at the time when projects are being planned
Promoting sustainable capacity outcomes
Accountability to ultimate beneficiaries
Build on existing capacities instead of creating new ones
Integrate external inputs into existing priorities, processes, and systems
Establish positive incentives
Challenge mind-sets and power differentials
Respect values and foster self-esteem
Support beyond "one-off" training sessions
Flexibility of funding arrangements and programming design

Source: Adapted from Lopez and Theisohn, 2003; Lusthaus and Neilson, 2005; UN-ACC, 2000; Whyte, 2004

Chapter 3: Human and Institutional Capacity-Development Programs: Examples and Key Findings

How do human and organizational capacity-development approaches need to adapt to effectively feed into the changes in agriculture described in Chapter 1 and most effectively influence capacity outcomes, as described in Chapter 2? These questions should set the stage for our expectations of capacity development programs and the types of platforms we build from them.

This chapter provides promising examples of programmatic capacity-development approaches—drawn from across various levels of the agricultural innovation system—as measured by their fulfillment of one or more of the attributes defined in Chapters 1 and 2: first, the extent to which the approaches strengthen novel capacities in individuals and organizations in agricultural research and development that will position those actors to take advantage of opportunities in a rapidly transforming and dynamic agricultural sector; second, the extent to which the approaches have design features that positively influence capacity outcomes.

While not comprehensive, the list of programs was developed to be representative of the different elements of the agricultural innovation system. The inventory also includes some examples of capacity-development efforts beyond the agricultural research sector (e.g., health research) and capacity development efforts designed to strengthen systemic institutional functions that support the conduct of research. Examples were drawn from a variety of geographic contexts, although examples from the African context dominate the selection. The inventory considers individual capacity-development programs, organizational capacity-development programs, and programs to strengthen linkages among elements of the innovation system. In the introduction to each sub-section, strengths and weaknesses of different approaches, key issues, and strategic decisions are highlighted. The descriptions of the examples include the findings of any evaluative
activities performed, where available, and descriptive material from the project web site, publications, etc. A summary of key findings concludes the chapter.

3.1 DEVELOPING INDIVIDUAL CAPACITIES

Examples of programs for training individuals, usually in university settings, are introduced in this section. A set of strategic issues, decisions, or questions cut across the examples and should be considered when selecting the best approach for developing individual capacities in any context. These include overseas vs. local training; regional vs. national training; short-term vs. long-term training; public vs. private training; South, North, South-South, vs. South-North training; use of distance learning approaches; and strengthening entire universities vs. strengthening a limited number of disciplines (Eicher, 2009). Strengths and weaknesses of several of these alternate approaches are described in more detail below.

- **Overseas Training vs. Local Training**: Overseas experience is critically important in allowing students to see different ways of doing research than that practiced in their home countries and for expanding students’ professional networks (Eicher, 2009). At the same time, overseas-centered training programs have been criticized because of high costs, questionable relevance to immediate development problems, and low returnee rates (IAC, 2004a). Table 3.1 shows a comparison of costs of MSc and PhD programs in various universities around the world. Further, the declining role of the agricultural sector and of food production in industrialized economies, where much of the overseas training takes place, is reflected in an increasing life-sciences or biological-sciences emphasis and a decreasing prominence of tropical agriculture in the curriculum (Eicher, 2009). Plant breeding graduate programs in industrialized countries, for example, focus heavily on molecular biology instead of practical breeding (G. Toennissen, personal communication). The broadening of the curriculum in industrialized countries therefore makes training less relevant for developing country contexts. A final criticism is that those trained through overseas programs lack a local supervisor and frequently return to their home countries lacking local relationships (A. Johnson, personal communication). In fact, in some contexts, the combination of job opportunities and other incentives overseas and the lack of a supportive local institutional environment may lead many graduates of overseas training programs to not return to their home countries at all. The National Science Board, in its publication *Science and Engineering Indicators*, 2004, cites a 55% return for international Science and Engineering trainees (National Science Board, 2004). Nevertheless, overseas training may be more successful and appropriate in specific geographic contexts, like Asia, where institutions are stronger and can retain graduates (G. Toennissen, personal communication). Some more recent overseas training programs have been specifically adapted toward reducing the problem of overseas-trained students not returning home. The Agricultural Development Council (ADC) fellowships for Asian students, for example, used a combination of institutional innovations, mentoring, and incentives to assist students upon returning home. These included funding to
attend professional meetings, small research grants, and a supportive environment to build careers at home (Stevenson and Locke, 1989, cited in Eicher, 2009).

Other programs are under development for building local capacity for doctoral and other types of training. Local training is advantageous because it better prepares students for agricultural extension, there is a greater likelihood of students focusing research on local and national problems, and the increased quality of local graduate programs will provide insurance in case donors discontinue offering scholarships (IAC, 2004a). Inconsistent quality is one disadvantage of local training programs, and many developing countries are increasingly recognizing the need to make local programs more rigorous, for example, by integrating more coursework (Eicher, 2009).

Hybrid programs, known as *sandwich programs*, are low-cost alternatives to long-term training favored by some donors because the person trained benefits from an overseas experience and still has links to a home university that helps to integrate them upon their return. Programs are typically 12–18 month-long overseas experiences sandwiched between class work and research in the home country (Chicago Council on Global Affairs 2009). Sandwich programs and have been piloted by many European universities, including Wageningen University and Research Center in the Netherlands (IAC, 2004a). Since 2004, the US Agency for International Development (USAID) has piloted this experimental approach, at a cost of $30,000 per student. Successful examples of sandwich programs include the University Science, Humanities, and Engineering Partnerships in Africa (USHEPiA), a collaborative effort of nine Eastern and Southern African universities, and the University of Cape Town’s Equity Development Program (IAC, 2004b).

### Table 3.1: Comparative Cost of Graduate Degrees in Agriculture in Various Universities

<table>
<thead>
<tr>
<th>Degree</th>
<th>Years to Degree</th>
<th>University</th>
<th>Estimated total cost (US$)</th>
<th>Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>MSc</td>
<td>2</td>
<td>US universities</td>
<td>56,000</td>
<td>2003 (incl. out of state tuition)</td>
</tr>
<tr>
<td>MSc</td>
<td>2</td>
<td>Australian universities</td>
<td>32,000</td>
<td>1998</td>
</tr>
<tr>
<td>MSc</td>
<td>2</td>
<td>Southern African universities</td>
<td>31,000&lt;sup&gt;a&lt;/sup&gt;</td>
<td>1998</td>
</tr>
<tr>
<td>MSc</td>
<td>2.5</td>
<td>Makerere University, Uganda</td>
<td>25,000</td>
<td>1998</td>
</tr>
<tr>
<td>MSc</td>
<td>2</td>
<td>University of the Philippines, Los Baños, Philippines</td>
<td>24,000</td>
<td>1998</td>
</tr>
<tr>
<td>MSc</td>
<td>2</td>
<td>University of Malawi</td>
<td>18,000</td>
<td>1997</td>
</tr>
<tr>
<td>PhD</td>
<td>3</td>
<td>US universities</td>
<td>90,000</td>
<td>2003 (inc. out of state tuition)</td>
</tr>
<tr>
<td>PhD</td>
<td>3</td>
<td>Asian Institute of Technology, Bangkok</td>
<td>40,000</td>
<td>2003&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>PhD</td>
<td>3</td>
<td>University Agriculture, Bangalore (India)</td>
<td>23,000</td>
<td>2003&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>PhD</td>
<td>3</td>
<td>University of Natal</td>
<td>55,000</td>
<td>2003</td>
</tr>
<tr>
<td>PhD</td>
<td>4</td>
<td>Belgium universities&lt;sup&gt;c&lt;/sup&gt;</td>
<td>35,000</td>
<td>2003</td>
</tr>
</tbody>
</table>
Regional Training vs. National Training: Advantages of regional degree programs include achieving greater efficiency by assembling a critical mass of specialists in one location and lowering unit costs, as well as avoiding the high proportion of students who do not return to the home country following overseas training and the declining number of relevant courses in tropical agriculture in overseas universities. However, building additional layers of institutions at the regional level can be risky, expensive, and divisive. Further, there has been difficulty in obtaining local political and financial support to sustain regional education programs in the long term (IAC, 2004a). Instead of creating regional centers of excellence de novo, there is a strong case for establishing “regional specializations” in existing, strong national universities and developing networked training programs (G. Toennissen, personal communication). Because finding funding and political support for regional training and research centers is problematic, donors may wish to explore funding “invisible regional centers of excellence”, such as the Faculty of Agriculture at Katibougou, Mali, where a quarter of the students come from the surrounding six countries (Eicher, 2009).

Africa is experimenting with regional and Pan African graduate degree programs concentrated in key areas, the “silo approach” (Eicher, 2009). The African Economic Research Consortium (AERC) is offering an Africa-wide PhD in Economics. Countries in East, Central, and Southern Africa are offering collaborative MSc Degrees in agricultural and applied economics (described below). The University of Kwa Zulu Natal in South Africa is offering MS and PhD degrees in crop science. There is a PhD program in plant breeding at University of Natal, an MSc program in agricultural extension at Makerere University, and an MSc program in natural resource management at the University of Pretoria.

About 4–5 PhDs in a given discipline are a necessary “critical mass” to sustain a quality MS graduate program with research and training objectives (Finup, 1976, cited in Eicher 2009).

North-South Training vs. South-South Training: Several examples of South-South partnerships exist in which students from one developing country receive training in another developing country. Advantages include low cost and a high degree of curriculum relevance to the country sending the trainees. The Brazilian Agricultural Research Corporation (EMBRAPA) has opened an office in Accra for promoting collaboration between Brazilian and African universities and National Agricultural Research Systems (NARS) (World Bank, 2009, in Eicher...
China is also linking with African teachers and researchers and offering large numbers of graduate research scholarships (Eicher, 2009).

- **Distance Learning:** Distance education allows people to pursue university training without leaving their jobs or localities (Asenso-Okyere and von Braun, 2007). New models for online coursework, lectures, and seminars via teleconference are rapidly becoming available but are not yet a proven model for granting degrees in African countries; quality assurance will still need to be provided by human resources. Such models offer some opportunities for private industry participation (IAC, 2004a). USAID is currently piloting several new models for enhancing university-level training in agriculture. One example is a distance learning model supported through the University of Florida, offering MS degrees in soil science and entomology at the University of Nairobi in Kenya and Makerere University in Uganda. Course content and methods are team developed, ensuring a sense of ownership by local faculty. This model could be scaled up in other countries in Sub-Saharan Africa and South Asia through other participating US universities. Another promising model is a new partnership between Cornell University and the University of Ghana Legon (UGL), supported under the Alliance for a Green Revolution in Africa (AGRA) by the Bill & Melinda Gates Foundation and the Rockefeller Foundation. This partnership brings students from different countries in the region (currently from Burkina Faso, Mali, Niger, Nigeria, and Ghana) to the West Africa Center for Crop Improvement (WACCI). Students take courses taught by UGL faculty with supplemental library and distance learning support from Cornell, backed by an on-site Cornell faculty member. Over its first five years this program expects to have forty PhD students in the pipeline, all expected to graduate by the tenth year. This is the first time a single unit of the University of Ghana has ever turned out forty PhDs in just one decade. This model could be replicated at agricultural universities in East Africa and in South Asia (Eicher, 2009).

### 3.1.1 Canada’s International Development Research Centre

The International Development Research Centre (IDRC) was created by the Parliament of Canada to help developing countries use science and technology to find practical, long-term solutions to the social, economic, and environmental problems they face. IDRC’s support is directed toward creating a local research community whose work will build healthier, more equitable, and more prosperous societies (IDRC web site). Capacity development is a core element of IDRC’s mandate: “to assist the developing regions to build up the research capabilities, the innovative skills, and the institutions required to solve their problems” (Deby, 2005).

IDRC funds applied research projects resulting from direct exchanges between IDRC and developing-country institutions, provides expert advice to those researchers, and builds local capacity in developing countries to undertake research and to innovate. IDRC supports research under four broad themes:

- Environment and natural resource management
IDRC’s capacity development efforts focus on professional competencies, capabilities, and tools needed to 1) conduct research, 2) to manage research, and 3) to disseminate research results. These efforts include strengthening such areas as problem identification, project development and design, project implementation, project monitoring and evaluation, analysis, financial management, linking with other researchers, disseminating results, and incorporating participatory, gender-based, or multidisciplinary approaches. While most efforts focus on technical, functional capacities, there is also discourse on “intangible” capacities, such as confidence, credibility, recognition, and trust (Lusthaus and Neilson, 2005).

A unique aspect of IDRC’s approach is that non-programmatic organizational units at IDRC beyond the programs branch—including the evaluation unit, the partnerships and business development unit, the research information management services unit, and the grants administration division—are involved in supporting capacity development in those functions that support the conduct of research, such as monitoring and evaluation, fundraising and donor relations, negotiation skills, the production of literature reviews and research proposals, the access to information resources, financial management, and the administration and management of research projects (IDRC, 2007).

A minority of IDRC interventions focus on organizational capacities, (such as resource mobilization, financial management, networking, project administration, and reporting to donors) but for most IDRC staff, the entry point for change is at the level of individual researchers (and their teams) (Neilson and Lusthaus, 2005). Nearly half of IDRC’s capacity development interventions funded between 2000 and 2004 targeted individuals, less than 20% targeted organizations or institutions, and nearly 25% targeted policymakers (Lusthaus and Neilson, 2005). Many staff indicated that they did not have the training to manage large-scale institutional development projects.

At times, IDRC also supports capacity in terms of building necessary infrastructure or access to infrastructure (e.g., computers, libraries, and e-libraries); some IDRC staff noted that providing infrastructural support may not be systemic or sustainable (Lusthaus and Neilson, 2005).

A wide array of capacity development tools/approaches are used by IDRC, summarized in Box 3.1; the type of approach used is determined contextually. The last two approaches primarily target organizational capacity development.

### Box 3.1: Interventions Used by IDRC to Develop Capacity

- Training courses (research and evaluation methodologies and approaches)
- One-on-one exchanges
- Study exchanges, visits
Conferences, workshops, and other professional public venues or forums

Networks and networking

Award programs

Learning by doing

Linking senior researchers with junior researchers

Having recipients work with experts

Writing experiences (manuscripts, theses, articles for peer-reviewed journals)

Sustained mentoring

Small grants funding (builds partner capacity to manage research, including managing calls for proposals, selecting projects for funding and administering, managing, and monitoring the projects)

Centers of Excellence (hubs for capacity building in the region)

Source: Lusthaus and Neilson, 2005

IDRC has a “people-centered” notion of capacity building that emphasizes partnerships, local ownership, participation, and learning by doing (Neilson and Lusthaus, 2007).

An evaluation of IDRC’s capacity development efforts found that outcome types fell into six major areas: 1) improved policy influence; 2) improved partnering and networking; 3) improved research capacity, quality, and awareness; 4) improved organizational development and management; 5) improved reputation and confidence; and 6) improved capacity to seek advice. The evaluation also found a predominant focus on technical areas and on individual capacities, which effectively narrows the scope of IDRC’s capacity work. The evaluation further noted that most support focuses on conducting and managing research, with comparatively fewer results in strengthening partners’ capacities to use research results and to create or mobilize research links to policy formation or change (Lusthaus and Nielson, 2005; Adamo, 2008).

IDRC does not have a full set of numbers on people trained or sex-disaggregated data on trainees, which reflects some of the gaps in reporting systems. While there are no explicit IDRC policies beyond a general policy around mainstreaming women’s engagement, there are some specific projects that target women, such as the Women’s Rights and Citizenship Program, which has some capacity building projects on feminist methods for women researchers, and a scholarship program for Palestinian women (Colleen Duggan, personal communication).

3.1.2 USAID’s ATLAS and AFGRAD Programs
The USAID-funded African Graduate Fellowship Program (AFGRAD; 1963–1990), and its successor, the Advanced Training for Leadership and Skills Program (ATLAS; 1991–2003), trained 3,219 African professionals for PhD and MA degrees at US universities in fields critical to their country’s growth over a four-decade period (2,578 male [80.1%] and 641 female [19.9%]). The goal of the AFGRAD program in the early years was to assist young African nations with a supply of trained mid- and upper-level “human power” in key sectors needed for development. In many cases, US graduates replaced expatriates in key public-sector institutions. Later, the program emphasized assisting African institutions to build capacity. ATLAS continued this trend, introducing concepts of improving institutional performance and broadening the target institutions to include nongovernmental organizations (e.g., private companies and non-governmental organizations [NGOs]). The ATLAS program also added the element of leadership development to the program purpose (Gilboy et al., 2004).

Specific aspects of the ATLAS and AFGRAD approach may be relevant in the design of future capacity-building programs for individuals. The programs targeted institutions for capacity building in a few, key sectors—agriculture, education, health, and finance. The programs also used a “critical mass” approach, in which a cadre of US-trained scientists was placed at a small number of carefully chosen institutions. The programs also stayed in contact with program participants and provided follow-up support to returned participants, an approach that appears to be critical for leveraging investments to induce change (Gilboy et al., 2004). Such approaches all argue for the training to be tied to a larger country-level institutional capacity development project (G. Alex, personal communication).

ATLAS and AFGRAD were evaluated periodically throughout the forty years of operation. Earlier studies focused on tracing the returned participants through their careers, calculating return (“repatriation”) rates and assuming that impact was linked to promotions, salary increases and anecdotal reports. Little measurement of impact at the institutional or higher level took place. A comprehensive longitudinal study focusing on the programs’ impacts was conducted in 2004, which generated the following key findings (Gilboy et al., 2004):

The report concluded that USAID’s dollar investments in long-term training had produced significant and sustained changes that furthered development, and that long-term degree training at US institutions was critical in creating the necessary foundations for impact to occur.

Of particular interest in the evaluation, in terms of its relevance to capacity development approaches, was the impact of overseas training at the individual level. The study found that “soft” attitudes, behavior changes, and changed attitudes toward work were more frequently cited as important impacts than technical and scientific training per se. The report further cites, among other non-technical capacities developed, improvements in confidence level, critical and strategic thinking skills, management skills, and communication skills, as well as increased appreciation of others’ views, teamwork, and
greater professionalism. The evaluation posits that long-term training may be more effective than short-term training for engendering such changes.

Participants in the evaluation reported that changes in institutional performance and at levels above attributable to US training and gave concrete examples as justification. The evaluation also found some impacts at higher levels, including the institutional, national, regional, and international levels. These included an increase in the numbers of high-level positions held by locals vs. expatriates at institutions and a large number of individuals among program participants who held high-level positions (e.g., cabinet ministers, members of Parliament, directors in government, donor agencies, or NGOs, elected officers of regional organizations, and founders of organizations). Other organizational changes attributed to US-based training by the evaluation included greater and more regular publication by an organization, improvements in research quality, greater Internet connectivity at the organization, establishment of factors that created jobs, more effective rural education programs, establishment of a new laboratories, changes in university curriculum to a more flexible system, expansion of the rural banking system, increased company profits, agricultural pest control, improved learning in targeted academic departments because of improved teaching methods.

Other key findings of note were a lack of difference in impact between PhD and master’s graduates; a consistently higher impact for training in the education sector, and lower impact by participants in the financial sector, as compared to those in the other sectors; greater difficulty by women in applying their knowledge and skills in the workplace than men, but impressive examples of impact when skills and knowledge were applied; and a 49% rate of return to institutions where participants were employed prior to their program in the United States.

No major gender differences in impact of the program relating to acquisition and application of knowledge and skills were found, but at the point when women returnees tried to institute changes in their institutions, they reported more difficulty than men. Possible reasons for this include: encountering greater resistance from colleagues, less access to resources, lack of influence to implement changes. Another key gender difference relating to in career advancement and professional contributions in the study was that double the percentage of women as men reported “no achievement” when asked about discoveries or achievements made linked to the US-based training. Both sets of observations may be instructive to donors and suggest that women returnees need more targeted interventions from donors to ensure that results of long-term training are cultivated in a supportive organizational setting.

3.1.3 National Institutes of Health Fogarty International Center Training Programs
The US National Institutes of Health’s Fogarty International Center (NIH/FIC) supports a variety of US universities that provide training programs to build research capacity in low- and middle-income countries (NIH, 2010). The AIDS International Training and Research Program (AITRP), for example, supports human immunodeficiency virus/acquired immunodeficiency syndrome (HIV/AIDS)-related research training to strengthen the capacity of institutions in low- and middle-income countries (LMICs) to
conduct multi-disciplinary biomedical and behavioral research to address the AIDS epidemic in their country. Grants are awarded to US institutions with strong HIV-related research training experience and with HIV-related research collaborations with institutions in low- and middle-income countries. These institutions—in partnership with their collaborating institutions—identify health scientists, clinicians, and allied health workers from the collaborating countries to participate in their joint research training programs. Individuals from LMICs who wish to become trainees must apply to the project director of an awarded grant. Other training programs are offered in the areas of trauma and injury research, global health research, infectious disease research, population health, ethics education and curriculum development, health services research, occupational and environmental health, chronic diseases research, and medical education. Some NIH training programs have a specific emphasis on developing capacity for research administration and management in developing countries; curriculum is being developed to support individuals with expertise in managing research, including researching, writing, and implementing grants. The bioethics training, for example, trains people to organize scientific review panels.

A central focus of NIH’s training programs has been how to encourage the return of trainees to their home countries following the training. A 2002 survey analyzed strategies used by its longest-funded grantees of the AITRP program to encourage trainees to return to their home countries over three, 5-year grant cycles (15 years) (Kupfer et al., 2004). Data from 186 long-term trainees (defined as those spending 11 to 96 months studying or an average of 26 months) showed that use of these strategies was instrumental in achieving an average trainee return rate of 80%. Box 3.2 includes strategies indicated by program principal investigators that make trainee return more probable:

**Box 3.2: Strategies for Improving Trainee Return Rates, NIH AITRP Program**

**Scientific Strategies**

**Research is responsive to priorities in the home country:** Program PIs work with colleagues in developing countries to determine their priority areas of research. By working in these high-priority areas, trainees in the program are more likely to find support in their home country to continue working in the area in which they were trained.

**Training-related research is conducted at home:** By maximizing the amount of research training conducted in the home country, the program minimizes the time a trainee spends abroad. This is sometimes called “sandwich training” — the beginning and end of the training period take place in the host country institution whereas the middle third takes place at an institution in the home country. Carrying out the research at home, near family, friends and colleagues, places the trainee in a better position to find a job and funding after completion of the training.

**Strategic in-country trainee selection:** Collaborators and home-country institutions are involved in the training and selection process. In addition to selection criteria (such as test scores and proficiency in English) some PIs found trainees were more likely to return to their home countries if they were members of the institutions involved in the collaboration.

**Strong mentoring in the United States and in the home country**

Having a mentor both in the United States and in the home country is important. The mentor in the home country provides the necessary administrative, political and scientific support for a trainee. Ideally the mentor in the United States and the mentor in the home country will have a long-term scientific relationship that can provide research, training and scientific support.
Equipment support: The program provides some funds for the purchase of computers and the laboratory equipment necessary to accomplish research goals. At sites where other research supported by the National Institutes of Health is conducted, additional equipment and opportunities may be available for the trainees.

Journal and Internet access: During the training period, the AITRP trainee has access to up-to-date medical journals and the Internet. Once training is over, the program may allow the trainee to keep an email address and to have access to journals through the institution in the United States.

Professional networking support: The PIs who have established a network among their current and former fellows and mentors have found that this provides vital long-term support to trainees returning home. The AITRP network meetings are held regularly and include discussion about how to reinforce the relationships between trainees, PIs and mentors. The AITRP trainees also meet at international conferences.

Re-entry funding: Trainees have had opportunities to apply for funds (US$ 25 000) to support their “re-entry” research projects as part of the AITRP grant. These awards provided bridge funding for the trainee upon returning home and allowed them to continue their research and to begin to establish themselves as independent researchers.

Support with writing grant applications: Successfully competing for funding can provide a trainee with the resources and the foundation on which to build a research laboratory. The AITRP may hold seminars on writing grant applications and many mentors provide advice and examples for their trainees.

Political Strategies

Temporary visa: The AITRP trainees come to the United States under non-immigrant temporary visas. Most principal investigators (PIs) will not support extension or renewal of these visas, thus preventing prolongation of trainees’ stays in the United States.

Return agreements: Trainees are asked to sign a “condition of appointment” or return agreement prior to training that can be a valuable tool in encouraging them to return home.

Training for decision-makers in developing countries: Educating decision-makers about the importance of health research is an important step towards increasing the probability that such research will become a political priority. Short-term courses are the most appropriate method for training these decision-makers. This training should make administrators more aware and supportive of scientific research training, thus enhancing the environment to encourage talented people to return home.

Economic Strategies

Repayment agreements: Some ATIRP PIs require their trainees to sign repayment agreements stating that if trainees do not return to their home country, they will be responsible for repaying the cost of their training to the United States institution.

Letters of future job support: Some AITRP PIs require that trainees have positions in the field in which they were trained upon returning home. They do this by obtaining a letter of support from the sponsor in the developing country that describes potential positions that will be available after training.

Source: Kupfer et al., 2004

NIH conducts qualitative process evaluations of its training programs every five years. A framework for evaluation has been developed (see Appendix D). There is a strong interest in the longer-term impacts associated with capacity building, for example, in addition to conventional research capacity, evaluations also consider such long-term impacts as the culture of research at institutions and how capacity development can
influence policy change. NIH evaluations also consider research management and administration and how changes in those capacities can be captured.

A 2005 review of the NIH Bioethics training program, for example, drew upon interviews with program PIs, trainees, program staff, NIH partners, and outside experts to evaluate planning, management, partnerships, program re-entry rates, and program outcomes and metrics of success (FIC, 2005). In its first five years, the Bioethics program has trained 167 long-term and 1406 short-and medium-term trainees. Trainees have come from 38 developing countries and produced a total of 81 publications and 54 presentations. Almost all long-term trainees (98%) have returned to their country of origin following training. The evaluation recommended creating a more comprehensive system for tracking trainees, increasing the numbers of peer reviewers from developing nations to increase the relevance of program to developing country needs, to invest greater funding into post-training activities such as career development. Because the Bioethics program is also intended to train individuals who will help build the capacity of Institutional Review Boards and Ethics Review Committees in developing countries and who will provide training in research ethics, metrics of program evaluation need to be broadened beyond research publications to include improving institutional performance and creating new programs to teach research ethics.

3.1.4 Collaborative Research Support Programs

Collaborative Research Support Programs (CRSPs) are communities of US universities that mobilize their scientific and academic expertise to help carry out the international food and agricultural research mandate of the US Government through long-term collaboration with institutions in developing countries. Presently there are eight CRSP programs focused on a range of topics. Research methods and approaches vary among the CRSPs, but one objective they all share is to build human and institutional capacity for research-focused collaboration through graduate-degree and short-term training in science and institutional management. The graduate-degree training programs support students at US and overseas institutions, with priority given to students from developing countries. The training is integrated into the CRSP research projects, so student thesis research addresses developing country problems, students may network with an international community of scientists, and professional mentor relationships are fostered with US professors that extend beyond the degree program due to ongoing CRSP support. Instead of the traditional training programs that remove students from their countries for research and training, most of the students’ research is done in their home countries, so they maintain and build contacts with their national peers, and become familiar with the context of their national issues. Table 3.2 shows total numbers and percentages of short- and long-term trainees, male and female, between 2007 and 2009.
Table 3.2: CRSP Long- and Short-Term Trainees, 2007–2009, Disaggregated by Sex

<table>
<thead>
<tr>
<th></th>
<th>2007 (Actual)</th>
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<th>2008 (Actual)</th>
<th></th>
<th>2009 (Actual)</th>
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<tbody>
<tr>
<td></td>
<td>Short Term</td>
<td>Long Term</td>
<td>Short Term</td>
<td>Long Term</td>
<td>Short Term</td>
<td>Long Term</td>
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<tr>
<td></td>
<td>Female</td>
<td>Male</td>
<td>Female</td>
<td>Male</td>
<td>Female</td>
<td>Male</td>
</tr>
<tr>
<td>Trainees, numbers</td>
<td>8830</td>
<td>22020</td>
<td>255</td>
<td>362</td>
<td>17447</td>
<td>21062</td>
</tr>
<tr>
<td>Trainees, percentage of total</td>
<td>0.29</td>
<td>0.71</td>
<td>0.41</td>
<td>0.59</td>
<td>0.45</td>
<td>0.55</td>
</tr>
</tbody>
</table>

Includes the following CRSPs: Global Livestock (GL), Aquaculture and Fisheries (A&F), Sustainable Agriculture and Natural Resources Management (SANREM), Integrated Pest Management (IPM), Integrated Pest Management Associates Award, Sorghum, Millet and Other Grains (SMOG), Assets and Market Access (AMA), Assets and Market Access Associates Award, Aquaculture, BASIS, INTSORMIL, Peanut, Soil Management (SM), Dry Grain Pulses (DGP)

Source: USAID, CRSP FACTS Database
One study tracking the pathway of 97 MSc and PhD graduates enrolled in the CRSP programs in 15 countries over 1980–2005 found that 84% had returned home, 12% had remained overseas, and 4% were still in school. The high rate of return to the home country is attributed to the careful mentoring of students through the CRSP program, which includes observation of students in their home countries by US researchers, mentorship in US labs/classrooms, maintenance of research links to home country, and ability to secure modest grants to take research home (Jamora, 2007). A further study evaluated the impacts of students trained through the Bean/Cowpea CRSP (Jamora et al., 2008). On the basis of questionnaires by former trainees and US principal investigators, supplemented by face-to-face interviews, the study found that almost all respondents considered their graduate program and CRSP research interesting and satisfying, good preparation for and relevant to their current job responsibilities. Trainees identified the following as important knowledge, skills, and attitudes acquired during the training: scientific research design, critical thinking, scientific methods and tools, and attitude towards work. Host country respondents reported that prior to training, average salaries with a bachelor’s degree were about US$9,000 per year, compared to salaries post-training of US$21,000 a year with an MS degree and US $35,000 with a PhD (in nominal dollars). Improved financial status, greater self-confidence, greater personal and professional networks, and assistance in obtaining a desired job were cited as non-monetary impacts of the training. Significant accomplishments attributed to the training included roles in release of new varieties, awards or recognition received from research, publications, and important positions or jobs held as a result of training. 86% of host country respondents returned to their home countries following their training; 79% of country respondents returned to the same institution where they were previously working (usually a government institution or a university), and 72% continued to work in bean/cowpea-related research. Of those who stayed in the US, work opportunities or job offers were cited as the major reason for not returning. 60% of host country trainees reported collaboration with CRSP scientists following graduation. The study results suggest that the CRSP program is an effective one for developing capacity in research and teaching, particularly in host country settings.

3.1.4 EARTH University in Costa Rica

EARTH, located in Costa Rica, is a private, international, non-profit university dedicated to education in the agricultural sciences and natural resources (EARTH University, 2010). EARTH’s educational model is based on the principles of human values, entrepreneurism, social and environmental awareness, and technical and scientific knowledge. The University employs a participatory, team-orientated, development-targeted experiential learning methodology. The educational system design emphasizes the development of critical thinking skills, creativity, teamwork, reasoning and analysis, and a problem-focused approach. Experiential learning takes place through laboratory and field work, weekly visits to local communities for outreach to farmers, student entrepreneurial projects, work experience, internships, and professional experiences. The agriculture program consists of activities and coursework in agriculture and natural resources, social and economic subjects, post-harvest systems and processes, sustainable
farm management, manual and mechanical skills, professional attitudes and skills to interact positively with farmers and rural community members, and management of a farm or agricultural or agro-industrial business in a rural community.

3.1.5 Pakistan-United States Science and Technology Cooperative Program

Initiated through science and technology cooperation agreements between governments of the Pakistan (Ministry of Science and Technology and Higher Education Commission of Pakistan) and the United States (US Department of State and USAID), the Pakistan-United States Science and Technology Cooperative Program offers science and technology research grants to US and Pakistani researchers wishing to collaborate on projects that will facilitate capacity building in Pakistan by improving the quality, relevance, or capacity of education and research at Pakistani universities and institutes, improve the capacity of Pakistani research institutions to support industry competitiveness, and increase the capacity of science and technology to improve the well-being of Pakistani citizens. Both the US and the Pakistani partner contribute funds to support the program and conduct a peer review of research proposals in parallel. Projects are selected by consensus at an annual joint review panel meeting. The program has awarded a total of 46 grants of up to three years in duration in three annual competitions since 2005.

Collaborative programs engage with a variety of institutions, including universities, research institutes, and hospitals, and employ a wide array of interventions, including workshops, research infrastructure, short courses, short-term, US-based training, PhD and MS degree support, online distance learning programs, exchanges, training for industry professionals and academics, international conferences, curriculum development, and hands-on modules in remote village environments. Science and technical cooperation occurs across a range of disciplines, including construction engineering, agricultural biotechnology, plant breeding, health, water resources management, plant diseases, computational mechanics in engineering design, food science, air quality, forensic research, research ethics, and telemedicine.

While a few trainees are supported on PhD or MS programs, most participants fall into the category of short-term training (either as researchers or technicians receiving hands-on training in the lab, as students in graduate or undergraduate courses, or as attendees of workshops, seminars, or conferences). For the first four fiscal years of the program (FY2006 to FY 2009), 4,925 participants were trained, of which 3,409 were male and 1,516 were female (30.8%) (Pakistan-United States Science and Technology Cooperation Program, 2009; K. Robbins, personal communication).

3.1.6 Alliance for a Green Revolution in Africa Training Activities

Alliance for a Green Revolution in Africa (AGRA) supports multiple training activities through its Seeds and Soils Programs. The Seeds Program includes PhD training program at the University of KwaZulu Natal and at the University of Ghana, both of which are supported by Cornell University. In both cases, the training occurs at a
departmental level. The program includes deployment of Cornell faculty to African universities and use of distance learning programs at Cornell. There is a real effort to maintain quality control and a high level of supervision. At KwaZulu Natal, which previously followed a European “no coursework” model for a PhD program, PhD requirements have been modified to include 2 years of coursework and a return to home institutions to conduct dissertation research. Each student’s PhD committee includes a senior person from home university, a senior Consultative Group on International Agricultural Research (CGIAR) scientist who is working in the home country, 1–2 faculty from KwaZulu Natal, and a Cornell faculty member. The MS programs funded through the programs emphasize practical breeding and a field research project, often at a CGIAR field research station (e.g., International Maize and Wheat Improvement Center [CIMMYT] in Zimbabwe), at one of the NARIs, or at a non-governmental organization (NGO) with a significant field research operation. AGRA has developed similar training efforts through the Soils Program, including research networks coordinated by CIMMYT in Southern Africa and CIAT TSBF (Tropical Soil Biology and Fertility Institute at the International Center for Tropical Agriculture) in Eastern and Central Africa (G. Toennissen, personal communication).

3.1.7 African Women in Agricultural Research and Development (AWARD)

African Women in Agricultural Research and Development (AWARD) is a CGIAR Gender and Diversity program that offers two-year fellowships to fast track the careers of African women in delivering pro-poor research and development. AWARD fellows are at the BS, MS, and PhD levels are competitively selected (60 fellows are selected each year, with 120 serving as fellows at any given time) from the following 16 disciplines related to hunger, poverty, and environmental degradation:

- Agricultural economics
- Agronomy
- Animal and livestock sciences
- Aquatic resources and fisheries
- Biodiversity conservation
- Crop sciences
- Ecology
- Entomology
- Extension education
- Horticulture
- Food sciences and nutrition
- Forestry and agroforestry
- Molecular biology (plant/animal breeding)
- Natural resources management
- Soil sciences
- Water and irrigation management

Three cornerstones of the fellowships are establishing mentoring partnerships, strengthening scientific skills, and developing leadership capability. Each fellow is
matched with a volunteer senior professional who serves as her mentor for one or two years. They set common goals and meet twice a month. In the second year of the fellowship, more advanced fellows become mentors themselves. A portfolio of resources are also offered for strengthening scientific competence, including membership in professional associations, laptop with Internet access, plus training on accessing online science libraries, training in science writing and presentation skills, training in writing research proposals for funding, support to attend scientific conferences, and the option to compete for advanced scientific training in world-class agricultural research and development (R&D) institutions for three to nine months. Investments in fellow leadership includes training in managing successful R&D teams, navigating organizational dynamics, building alliances and taking risks, promoting gender-sensitive policies and practices, and influencing other institutions on behalf of rural women and poor farmers. Fellows engage with the next generation by organizing community events in which they discuss their work and personal journeys as well as stressing the importance of agricultural R&D and the key role of women in agriculture (AWARD, 2010).

3.1.8 CGIAR Training and Learning

NARS strengthening is a formal priority of the CGIAR, as reflected in policy documents and in the views of Center researchers, and Centers undertake a number of group and individual-level training and learning activities to strengthen NARS capacity.

Data are available on 90,000 people who have attended different types of CGIAR group training activities over the period 1990–2004 (formal group courses, conferences, meetings, field days, and study tours) (CGIAR, 2006). From 2002 to 2004, the average number of events was about 32 per year, but trends for group training have not been similar for all Centers. Group trainees included 189 nationalities, with a relatively high proportion of trainees from developed countries (12%). Eight centers have gathered sex-disaggregated data on group training activities. In the period 1990 to 2004, the proportion of women increased from 17.1% to 20.7%. Some centers had trained relatively more women than others (International Plant Genetic Resources Institute [IPGRI], CIAT, International Rice Research Institute [IRRI], and International Food Policy Research Institute [IFPRI]), and others had trained relatively fewer (International Center for Agricultural Research in the Dry Areas [ICARDA]). Long training events (>30 days) constitute a small proportion (10 to 20%) of the total group training events. Over the 1990–2004 time period, the most predominant group training themes (as measured by trainee days and numbers of participants) were crop production, breeding, and methods training. Methods training—research management/process, experimental design, statistics/data management, information technology, scientific writing, and training and education—is, interestingly, perhaps the farthest removed from the Centers’ area of comparative advantage. The most important changes over the time period were relative increases in seed, social sciences, and natural resource management, with decreases in crop production, breeding, and crop protection.
From 1990 to 2004, the CGIAR trained about 13,000 individuals, which includes long-term on-the-job training, degree training, and short-term orientation and specialization training. Trends show that long-term training (2 years or longer) has decreased over time among degree trainees. Short-term training (less than or equal to 10 days) is increasing among non-degree trainees. Sex-disaggregated data on trainees are available for 89% of the individual training programs. The proportion of women involved in individual training activities has been considerably higher than among group training participants and has increased from about 30% in 1993–1998 to about 40% in 1999-2004. Over the period 1990-2004, predominant themes (as measured by trainee days and numbers of participants) were crop protection, natural resource management, and breeding. Main changes over time were the decreasing relative importance of crop production and livestock. Methods were of only moderate importance for individual training.

In contrast to formal training activities, the CGIAR also engages in informal training (e.g., leadership, advice, and mentoring). CGIAR researchers estimated that they spent about 12% of their total time engaged in informal training activities, which is roughly the same as that spent on formal training activities. Informal training and learning have not been planned, documented, monitored, or evaluated by the CGIAR. Another significant gap in documentation is information about what types of people have been trained, e.g., policymakers, researchers from National Agricultural Research Institutes (NARIs), NGO representatives, extension workers, and farmers. There is likewise very little information on the costs of training.

Defining relevance as the extent of overlap between CGIAR priorities and NARS needs, most CGIAR training can be judged relevant. However, although most CGIAR researchers feel that NARS training and learning activities are complementary to their research, a majority of researchers feel there are few incentives to become involved in training and learning. In addition, many NARS representatives feel that the training is more project driven than needs based (CGIAR, 2006; and Youdeowei et al., 2005, cited in CGIAR, 2006). Many NARS representatives want Centers to respond to NARS needs even if they fall outside the Center research mandates. There is concern that the temptation of modest funding may lead many weaker NARS to reorient their priorities to match those of the CGIAR centers, which may in turn divert efforts from what NARS should be concentrating on. Seven out of 12 centers surveyed that they have a training strategy influenced by regular consultation with NARS; however, 17 out of 29 training officers surveyed said that regular needs analysis and priority setting did not usually occur with partners. The problem may stem both from the close-down of training units within the CGIAR and increasing dependence on project funds, as well as the inability of many weaker NARS to set priorities effectively (see Chapter 1).

The 2006 CGIAR training study assessed quality based on an examination of training quality-assurance systems and feedback from trainees and partners. A majority of ex-trainees were highly satisfied with different aspects of training quality; the minority of trainees who were not satisfied was influenced by what happened after they completed training, i.e., not being able to apply what they had learned. Quality-assurance systems for training were found to be partial in coverage and unevenly applied across centers.
Not all Centers have quality-assurance systems, and those that are in place are not always implemented. The reduction in training units and the lack of pedagogic and adult education expertise have weakened quality-assurance systems. Quality assurance systems apply mainly to courses and do not consider informal training, individual degree training, individual non-degree training, project-based training, and collaborative-research-based training. Although there examples of good practice, the lack of uniformity makes it difficult to be confident that quality issues are being monitored.

The 2006 CGIAR training study also examined training efficiency, through examination of the way resources are deployed, the level of coordination and economies of scale, and Centers’ comparative advantage. While investment in training and learning by the CGIAR is high, increases in project funding and a reduction in unrestricted funds have lowered the return on these investments, particularly in the areas of institutional strengthening, building a critical mass of scientists, building multidisciplinary teams, and financing higher-degree studies. Because pre-requisites for efficient management and delivery of training are not in place in most Centers, efficiency was difficult to assess. There are examples of good practice (e.g., moving from training to collaborative networks), but these are unevenly distributed across centers. The absence of systematic financial and monitoring data, inadequate pedagogic resources, and inadequate coordination (both within and between Centers) are the most important constraints to achieving efficiency.

The 2006 CGIAR training study also examined the effectiveness of training and learning—how well acquired skills and capacities are acquired and used, looking beyond individual advancement to organizational, network-level, and inter-organizational benefits. There is strong, consistent evidence of the effectiveness of CGIAR investments, often, but not always linked with research, in strengthening the capacity of the NARS, with impacts at the individual and institutional levels. Limitations to CGIAR training effectiveness include contextual factors outside the control of the CGIAR, such as institutional instability, weakness of NARS, and lack of resources, which influence the extent to which trainees can apply their skills.

(Also see AGROCURI below.)

3.1.9 Partnership for Higher Education in Africa: Developing and Retaining the Next Generation of Academics

The Partnership for Higher Education in Africa (PHEA), through its “Next Generation of Academics” Program, is strengthening post-graduate training, retention activities, networks, and fellowships to help ground and avoid isolation among scholarly and scientific communities. The Next Generation of Academics program focus reflects the concern voiced by many African scholars about brain drain, gender representation, and the retention of high quality faculty and researchers at African universities (PHEA, 2010a). In addition to lacking environments conducive to attracting and retaining new academics, many universities have limited capacity to provide postgraduate training. In some settings, universities lack the specialized libraries, laboratories, and comprehensive
coverage of the field needed for doctoral training. In still more settings, too few faculty are qualified to supervise doctoral training. Certain fields lack a critical mass of faculty in single institutions, particularly in science and technology (S&T). Undergraduate training predominates, and it is common to see duplication of undergraduate programs, over-ambitious course offerings instead of specialization, and a failure to evolve into centers of excellence.

Highly trained academics are needed to work within functional universities and to collaborate through networks and other kinds of academic communities. All PHEA foundations are engaged in supporting the next generation of faculty, through a range of approaches. PHEA foundations have invested over $40 million in support of faculty development. The largest proportion of support has aimed to improve the quality of postgraduate or faculty training and research. Support to university partners for postgraduate fellowships and intellectual exchange has also been significant. Experience with this grant making and several consultative meetings have yielded lessons on addressing some "push" factors within universities as well as "pull" factors operating in the external environment. PHEA has also convened consultative workshops with a small set of university leaders, young scholars, researchers, and funders, as well as focus groups with young scholars in Nigeria, to promote shared learning and stimulate action.

Strategic elements of PHEA support include the following:
- Training interventions that utilize and strengthen existing postgraduate capacity and create communities of scholars. This includes postgraduate training networks, partnerships among universities, and centers of excellence for doctoral training.
- Institutional efforts to address the "push" factors that inhibit recruitment, development, and retention of the next generation. This includes attention to policies, practices, services, infrastructure, and the scholarly environment.
- National higher education system differentiation, financing models and sector management policies. This requires engaging with governments, World Bank, African Development Bank, and the bilateral agencies.

The PHEA—and the Ford Foundation and Carnegie Corporation partners, in particular—has targeted gender inequities in African universities, such as low proportions of women in university postgraduate programs and low proportions of women among academic staff. Carnegie Corporation, for example, provided support to women’s undergraduate scholarships, strengthening institutional gender equity through gender mainstreaming programs, higher education management and leadership training for women, research and conference/workshop support, academic staff development for women, and postgraduate scholarships for women (Carnegie Corporation, forthcoming). Accomplishments include improved gender equity in enrollment and graduation rates at a number of universities. Makerere University and the University of Dar es Salaam developed selection systems to attract female students from secondary schools and remote regions. An on-campus counseling system was also created for women scholarship holders. The University of Dar es Salaam moved from 5% female enrollment in early 1990s to 30% in 2009, with particular progress in the sciences, engineering and mathematics. Female undergraduate engineering students increased from 7% to 16% over the same time horizon. The African
Gender Institute’s Associate Program has provided up to three months of protected time for writing to approximately 100 scholars of women and gender studies and supported conceptual and methodological tools for African feminist writers and researchers. Finally, hundreds of women benefited from higher education leadership training at the Higher Education Resource Services-South Africa (HERS-SA) Academy, and several model initiatives were created to strengthen gender equity by incorporating gender concerns into the university's curriculum, research, and administration (PHEA, forthcoming).

3.1.10 The Collaborative Master’s Program in Agricultural and Applied Economics

Through the AGRA Markets Program, a regional MSc training program in agricultural and applied economics is coordinated out of AERC. The Collaborative Master’s Program in Agricultural and Applied Economics (CMAAE) aims to strengthen policy research and analysis capability of postgraduate agricultural economics students in 16 public universities in 12 countries of Eastern, Central, and Southern Africa. Relevance of CMAAE students’ research and training to current issues in the agricultural sector is assured through a demand-driven process of ongoing consultation with prototypical employers, including government agencies, agricultural research institutes, businesses, and not-for-profit agencies. CMAAE runs a competitive research grant system allowing students to get funding for thesis research. The current annual cost per student is about US $12,500, while in 2004 the projected cost per student was $18,225. This means that there has been a decline in cost of about $5,725 per student, attributable to expansion in student enrollment. The increases in tuition fees at the mother universities occasioned by rise in cost of living and inflation has not facilitated further decline in the Program Cost per student (W. Kosura, personal communication; CMAAE, 2010).

A sex-disaggregated breakdown of trainees over the 5 cohorts of the program is shown in Table 3.3. The CMAAE program uses affirmative action in selection and awarding scholarships to bright and needy students. Female applicants are given priority in consideration as long as they are qualified (W. Kosura, personal communication).

Several of the universities have specialized in particular subjects or aspects of agricultural and applied economics. The strongest is the environmental economics department at the University of Pretoria. Students do a year’s training at home university and spend a year at Pretoria. A similar process is followed for applied agricultural business economics. CMAAE s draws on the strengths of collection of universities in order to offer such specialized programs. There is also a joint summer training program at the University of Pretoria where faculty from universities and outside experts from throughout the world come in for summer training. The strategy is to provide training in Africa but to make sure it is high quality. It is also aimed at strengthening all of the universities; there is funding for faculty development (G. Toennissen, personal communication).
Table 3.3: Analysis of the CMAAE Students, 2006–2010 (5 Cohorts)

<table>
<thead>
<tr>
<th>Financial Year</th>
<th>Specialization Course</th>
<th>1st Cohort(05-06)</th>
<th>2nd Cohort(06-07)</th>
<th>3rd Cohort(07-08)</th>
<th>4th Cohort(08-09)</th>
<th>5th Cohort (09-10)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total M F</td>
<td>Total M F</td>
<td>Total M F</td>
<td>Total M F</td>
<td>Total M F</td>
<td>Total M F</td>
</tr>
<tr>
<td>Agricultural and Rural Development</td>
<td>12 7 5</td>
<td>12 9 3</td>
<td>8 5 3</td>
<td>9 7 2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Agribusiness Management</td>
<td>11 8 3</td>
<td>11 9 2</td>
<td>20 9 11</td>
<td>20 10 10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Agricultural Policy and Trade</td>
<td>21 16 5</td>
<td>17 14 3</td>
<td>20 14 6</td>
<td>24 6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Environmental and Natural Resource Management</td>
<td>12 8 4</td>
<td>6 4 2</td>
<td>2 2 2</td>
<td>14 6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>56 39 17</td>
<td>46 36 10</td>
<td>52 30 22</td>
<td>79 55 24</td>
<td>67 42 25</td>
<td></td>
</tr>
<tr>
<td>Proportion of Female Students (%)</td>
<td>30.36</td>
<td>21.74</td>
<td>42.31</td>
<td>30.38</td>
<td>37.31</td>
<td></td>
</tr>
</tbody>
</table>

**Note:** The 5th Cohort students have not yet selected their specialization courses. F=female, M=male.

**Source:** CMAAE
3.1.11 Agricultural Open Curriculum and Learning Initiative

Agricultural Open Curriculum and Learning Initiative (AGROCURI; formerly the Global Open Food and Agriculture University GO-FAU) is a CGIAR Program for open distance learning and capacity strengthening that serves traditional and open universities in developing and developed countries. AGROCURI works collaboratively with partner universities to strengthen their master’s degree programs in agriculture through the provision of high-quality course content for distance and traditional education. AGROCURI, working through partner universities, strengthens existing MSc agriculture programs, short-term MSc-level agriculture courses, and new agricultural MSc distance education programs, with a focus on agroecology and agricultural economics/agribusiness. Partner universities deliver the courses, support learners, provide accreditation, and award degrees. AGROCURI trains partner faculty in using the course modules and facilitates student thesis research for those enrolled in these MSc programs.

Core principles of the AGROCURI program include: an “open” system; a participatory, transparent, demand-driven, and efficient approach; its engagement of established universities and peer review for enhancing program quality; the use of ICTs to reach students; and the use of mentoring, e-based communication, and networking to promote capacity strengthening.

The International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) leads the MSc program in Agro-ecology in South Asia, ICARDA leads the agro-ecology MSc program in North Africa, and IFPRI leads the MSc program in Agricultural Economics (AGROCURI, 2010).

3.2 DEVELOPING ORGANIZATIONAL CAPACITIES

Examples of capacity-development approaches targeting organizations are described in this section. As in the previous section, strategic questions, decisions, and issues should be addressed in the design of organizational capacity-development approaches in specific contexts:

- **National vs. Regional Organizations**: There is substantial debate concerning which institutions should be supported to avoid spreading limited resources too thin. National organizations may have greater political support but may be weak; regional institutions may be a more efficient use of resources when countries are small, but they are less easily supported—financially or politically (IAC, 2004a). In the African context, the challenge is a search for innovations to deal with the “small country problem” (Eicher, 2009). Regional research institutions during the colonial period were replaced by a rapid build-up of NARS, and there is now renewed interest in regional and global networks. African agricultural universities have also proliferated. There are more than 100 African universities with a
Faculty of Agriculture, and new universities are being added each year (Eicher, 2009).

- **Borrowing and Adapting Research vs. Basic Research**: Should countries develop their own research or borrow and adapt research done elsewhere? For example, in the case of biotechnology, since time, cost, risk, and human capital costs for research are too high for many countries in Africa, there may be a greater need for African countries to invest in training a few scientists to help science-based decision making on whether or not to borrow specific technologies, what technologies to borrow, and how to carry out field trials, applied research, and develop bio-safety regulations for those technologies that are borrowed. These scientists could also inform decisions related to the use of biotechnologies, such as patents, food aid, food safety, and environmental issues, and could engage civil society in evidence-based dialogue about the technology (Eicher, 2009).

  Pardey and Alston (2010) propose lowering the cost of access to technical information to increase local innovation and facilitate the transfer in and adaptation of technologies developed elsewhere. As the World Bank’s Science, Technology, and Innovation (STI) program points out:

  “Policy makers may be missing an important opportunity to increase employment, wages, and overall standards of living if they focus on basic research to the exclusion of the more ‘mundane’ tasks of technology upgrading—design and engineering, the ability to acquire technology developed outside the country, and the managerial, organizational and technical capacity simply to utilize more advanced technology—in those core industries which operate far below the technology frontier. It is also important to note that adopting, adapting, and applying the results of basic research requires advanced managerial and organizational capacities. When firms do not have these capacities, it will be futile for governments to finance large amounts of basic research in the hope that this will generate increased levels of innovation and enterprise productivity (World Bank STI, 2010)”

- **Public vs. Private**: Should more public research be privatized or made more entrepreneurial? The UN Millennium Task Force Report on Science, Technology, and Innovation stresses the need to combine approaches that support industry development, education, and R&D support (UNDP, 2005).

- **Retaining High-Quality Personnel**: Effective organizational capacity development efforts need to emphasize making institutions more attractive and globally competitive (IAC, 2004a). United Nations Conference on Trade and Development (UNCTAD) estimates that 30 percent of all highly trained Africans currently reside outside Africa. In contrast, in other regions (e.g., India, China, Malaysia, Chile, Brazil), successful institution building is adequate to retain high-quality personnel (BIFAD, 2003, cited in IAC, 2004a). Such efforts include post-degree networking, mentoring, access to the global scientific literature,
availability of competitive research grants, sabbatical leave, and ability to participate in national and regional workshops on development policy, management, and research topics.

3.2.1 Programs to Strengthen Higher Education

This section first outlines six attributes of more vital, innovative, socially relevant higher education capacity-development programs—those that strengthen entrepreneurial and innovative capacity, foster engagement with constituents, contribute to breaking down disciplinary barriers, strengthen research and teaching, strengthen functions that support the conduct of research, and strengthen civic roles and social responsibilities. Examples of higher education capacity development are then presented.

- **Strengthening Entrepreneurial and Innovative Capacity**: According to the UN Millennium Task Force on Science, Technology, and Innovation, universities can play an important role in creating links between knowledge generation and enterprise development—one of the greatest challenges facing developing countries (UNDP, 2005):

  “Universities can contribute to development in several ways. They can undertake entrepreneurial activities that aim to improve regional or national economic and social performance. They can conduct industrial R&D; create spin-off firms; participate in capital formation projects, such as technology parks and business incubator facilities; introduce entrepreneurial training and internships into their curricula; and encourage students to take research from the university to firms. Universities need to be transformed to play these roles. Eventually, new institutions need to be created that focus on business incubation and community development.”

Building innovative capacity in agricultural universities has the potential to accelerate growth in agriculture, which in turn will contribute to raising incomes and improving the livelihoods of the rural poor (Asenso-Okyere and von Braun, 2009). Fostering public-private partnerships and establishing agro-business parks connected to university campuses are two approaches for strengthening the entrepreneurial capacity of institutions of higher education (Roseboom, Elliott, and Minde, 2005, cited in Asenso-Okyere and von Braun, 2009). There is a need for frameworks to consider the complex ethical and value dimensions of increased public-private relationships (e.g., support from pharmaceutical companies sometimes linked with requirements for delayed publication), as noted at the South African Institute for Advancement 2009 Third Stream Income Conference² (Suzanne Grant-Lewis, personal communication).

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² The Inyathelo – South African Institute for Advancement hosted a two-day conference on Exploring Third Stream Income for South African Universities from 18-19 March 2009 in Pretoria. In recent years, South African universities have increasingly explored third stream income—advancement/fundraising, commercialization, public-private partnerships, endowment/reserves management, and long and short term financing—as an option for greater operating support. With the support of a Kresge Foundation grant, the
- **Engaging Constituents**: Universities will need to increasingly engage with their communities, gaining direct knowledge about social needs, some of which could be addressed through R&D activities (UNDP, 2005). Universities will, in particular, need a more programmatic and activist orientation in research and education efforts in rural areas (Hansen, 1990). Universities should also engage with other constituencies through offering short and executive courses for policymakers and other agriculture-sector actors (Asenso-Okyere and von Braun, 2009).

- **Breaking Down Disciplinary Barriers**: Universities can achieve greater innovation through multidisciplinary initiatives in fields such as bio- or nanotechnology, but also law, sociology, economics, philosophy, and ethics (Mbabu and Ochieng, 2006, cited in Okyere and von Braun, 2009). Universities can also move beyond crop and animal production and include a variety of social and economic issues (Hansen, 1990). Rigid departmental or disciplinary structures in universities will need to give way to an increasing structure of interconnected task groups clustered around major themes (Hansen, 1990).

- **Strengthening Teaching and Research**: Curriculum reform in agriculture needs to include more problem-solving development, policy analysis, macroeconomics, statistics, and information technology. Students should be involved in the development and reform of the curriculum (Asenso-Okyere and von Braun, 2009). A more interactive educational experience is needed in higher education institutions to help students learn how to learn (Hansen, 1990). In addition to improvements in teaching, research functions in developing countries need to be strengthened relative to teaching functions. Entrusting graduate assistants to teaching undergraduates is one approach to liberate lecturers to conduct research (Asenso-Okyere and von Braun, 2007).

- **Strengthening Functions that Support the Conduct of Research**: Beyond strengthening research, functions that support the conduct of research must also be supported. Building researchers’ capacity to conduct research cannot by itself change the whole system. These include such functions as financial management, resource mobilization, endowment and reserves management, human resources management, libraries, infrastructure, and administrative functions. In Africa, few universities outside of South Africa have well-established research management offices, although some effort has been made through Carnegie Corporation’s support of the Society of Research Administrators in Africa; research directors and managers of doctoral programs require training and support across a wide range of skills and competencies in such areas as the managing the institutional research profile, accessing funding, supervision of graduate students.

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Rhodes University Centre for Higher Education Research, Teaching and Learning is producing a comprehensive report on third stream funding in South Africa. This conference aimed to help vice-chancellors, higher education policymakers and grant makers to broaden their university’s sources of income so that they can better support their mission.
development of research plans and strategies, and the development of codes of conduct in research integrity (Mouton, 2008b). At the 2009 Third-Stream Income Conference in South Africa, for example, a focus on endowment and reserves management noted the importance of working within the university to build support for endowment development, which in turn yields greater confidence for funders. Innovative approaches such as allowing multiple schools to pool funds for common professional investment management may be options.

- **Strengthening Civic Roles and Social Responsibilities**: Social participation by students has great potential to serve and strengthen society, create social capital, and contribute positively to the creation of global public goods. Higher-education institutions can contribute to global public goods creation by fostering in faculty, staff, and students a sense of social responsibility and a commitment to social transformation and development (Talloires Network, 2005). This may include changing policies and practices, creating institutional frameworks that encourage and reward good practice in social service, ensuring that high standards are applied rigorously to community engagement, fostering partnerships between universities and communities, encouraging government policies that support civic efforts, collaborating with other sectors to magnify impacts, raising awareness within government, business, the media, not-for-profit, and international organizations about the role of higher education in social advancement, and documenting and disseminating examples of impacts.

3.2.1.1 Partnership for Higher Education in Africa

The Partnership for Higher Education in Africa (PHEA) was launched in 2000 by the Ford Foundation, the John D. and Catherine T. MacArthur Foundation, the Rockefeller Foundation and Carnegie Corporation of New York. The four foundations agreed to work together toward accelerating the processes of comprehensive modernization and strengthening of universities in selected countries. In 2000, partners pledged to invest $100 million in African higher education over five years and to support the institutional revitalization of selected universities. PHEA selected a few countries on the basis of the following criteria: trends in democratization, public policy reform, participation of civil society organizations, priority to higher education, and creative and innovative university leadership. PHEA also consulted with university leaders—vice chancellors, deans and directors, senior women, union leaders, alumni, council members—to identify their priorities. Most PHEA investments strengthened core capacities, including universities’ physical infrastructure and human and organizational capacity. PHEA invested heavily in information technologies and Internet connectivity, which included establishment of the first regional satellite bandwidth consortium in sub-Saharan Africa.

Since its inception, PHEA has expanded both the number of Partnership foundations and Partnership countries. The William and Flora Hewlett Foundation and the Andrew W. Mellon Foundation joined PHEA in 2005 and the Kresge Foundation in 2007. To date, the Partnership supports 49 universities within nine countries; 22 universities receive significant funding for systematic transformation of the university as a whole. The
Partnership countries are Egypt, Ghana, Kenya, Madagascar, Mozambique, Nigeria, South Africa, Tanzania, and Uganda.

Much of the Partnership’s work falls under four special initiatives that have the potential to impact higher education across the African continent. These are: (1) Information and Communication Technologies (ICTs), (2) Higher Education Research and Advocacy, (3) Regional Networks for research and post-graduate training, and (4) Frontiers of Knowledge University Leaders’ Forum. Gender is a crosscutting focus, receiving attention within the four major focal areas (PHEA, 2010a). Major achievements under the ICT initiative include prioritization of needs for using educational technologies for teaching and learning, the development of implementation plans, the creation of communities of practice and research and education networks about ICTs, the creation of a bandwidth consortium to enable bulk purchase of Internet bandwidth by universities, and strengthening bandwidth management skills at partner universities. Investments in higher education research and advocacy have supported research projects investigating the relationships between national policies, economic development, and higher education; university newsletters; multi-stakeholder seminars; the development of higher-education performance indicators; analysis, capacity development, and national dialogues in the area of higher education financing (PHEA, 2010b).

PHEA’s process, according to program administrators, has been very inductive and iterative. While formal baseline assessments were not conducted, case studies were conducted to look at the terrain and to identify issues. Each university was required to conduct a strategic plan prior to receiving funding. This was a long-term process, as there was some lack of willingness to look at weaknesses. Weak capacity in financial management was identified as a huge issue; most universities were set up to meet the needs of government but not to manage external funds and to report on grants. When information technology (IT) existed at a university, it did not serve the administrative functions of the university, such as the registrar’s and bursar’s offices. Personnel in those administrative functions had little familiarity with financial management tools such as spreadsheets. Challenges included a more difficult climate for indirect cost giving because of conservatism and the US Patriot Act.

PHEA administrators highlighted the importance of the PHEA approach of supporting “research governance” or “research management” capacities. If only the conduct of research is supported without concomitant support to the management of the conduct of research, researchers cannot function effectively in their environment. Research management includes such capacities as securing research funds through proposal development, managing those funds, disseminating research results, and conducting ethical reviews. Research management is quite extensive, and can involve many bureaucratic factors and institutional policies that have the potential to hold up projects, including internal funding units, internal audits, and procurement policies. PHEA administrators noted that shifting morale through such support can be a powerful force. Many positive spillovers have been documented from research management support, such as IT strengthening and training activities in resource mobilization. PHEA administrators provided anecdotal evidence of younger staff members trained through PHEA support to
research management who felt less isolated and had new energy to seek their own resources, which was possible because proposal-writing skills were enhanced. Research management and resource mobilization support has helped universities come together as institutions and make a variety of international connections, including connections within the region.

Local ownership of projects by universities was also stressed as an important finding of the PHEA approach, as universities were invited to identify their own projects. The criteria for assessing university-led projects included public acknowledgment of the strategic plan, peer review of the project, inclusiveness of gender equity themes, and financial sustainability with a fundraising plan.

Another major finding of the PHEA experience is that successful partnerships need to be established at the highest institutional levels (at the level of the university President to university Vice Chancellor), not at the individual or departmental level. PHEA administrators reported that partnerships at lower levels will never have impact at the broader institutional level at a university because subject-matter experts tend to push for activities limited to their own discipline. Many research partnerships, however, have unfortunately fallen into this trap, they cautioned. University of Pennsylvania’s partnership with the University of Botswana is an example of broad relationship, beyond a particular subject-matter area. While the partner wanted to build its medical school, it also wanted to broaden the relationship to include strengthening research management aspects.

PHEA administrators noted that US partners frequently need training in how to be effective trainers. One grantee, Stellenbosch University, has developed a code of conduct for partnerships on the Africa side in which a stronger and a weaker institution are partnering.

A further lesson learned through PHEA is that the institutions selected for strengthening need to be magnets: universities representing geographic locations where the top talent resides and where other people want to be. “Centers of Excellence” cannot be chosen on a political basis, such that they end up in countries that are in political meltdown.

PHEA is an interesting model not only in terms of its effects in Africa, but also as an example of how donors can work effectively together.

3.2.1.2 Millennium Science Initiative

The Millennium Science Initiative (MSI) is an international initiative designed to build capacity in modern science and engineering. The MSI achieves its mission through a variety of vehicles, among them competitively chosen centers or networks of excellence in scientific research and training (SIG, 2010).

While MSI projects vary in format according to the strengths and needs of the countries where they are located, they share these essential features: excellence; autonomy;
linkages to other institutions, the private sector, government and one another; leaders of major scientific stature and proven leadership ability; a training component; and opportunities for scientists to work in their home countries and to collaborate with colleagues around the world.

All MSI projects are designed by local scientists and governments, usually with the active involvement of both the Science Initiative Group (SIG) and The World Bank.

MSI efforts have been piloted in several countries, including Chile, Brazil, Venezuela, Mexico, Uganda, Bangladesh, and Vietnam, plus a regional program, the African Mathematics MSI. The Chile model is still operating after 10 years, and the Brazil MSI, established in 2002 and active until 2008, has been superseded by a locally funded program, the National Institutes of Science and Technology. In Bangladesh, a World Bank-financed “Higher Education Quality Enhancement Project” to improve teaching and research in higher education institutions was created. The MSI in Vietnam is still in the design phase. The Mexico and Venezuela MSI did not last beyond the first cycle; in Mexico, new scientific leadership lost interest in the program, and in Venezuela, the decision to use an internal selection committee resulted in poor scientific quality.

The Uganda, Chile, and African Mathematics MSIs are described in more detail below.

**Uganda MSI:** Begun in 2006, MSI-Uganda is a central component of the Ugandan Government’s strategy to strengthen the country’s scientific and technological capacity. The five-year, US$33.35 million program, co-financed by the Government of Uganda and the World Bank, is the result of several years’ planning by the Uganda National Council for Science and Technology (UNCST), Uganda's Ministry of Finance, Planning and Economic Development (MFPED), and the World Bank. MSI-Uganda’s project objective is for Ugandan universities and research institutes to produce more and better qualified science and engineering graduates; to produce higher quality and more relevant research; and for firms to utilize these outputs to improve productivity to enhance S&T-led growth (MSI Uganda, 2010). The project consists of two programs: an outreach program, with institutional strengthening, monitoring, evaluation, and policy studies; and a competitively awarded grants program for 1) high-quality scientific research led by senior researchers that is closely connected to graduate training; 2) the creation of undergraduate programs in basic science and engineering and the rehabilitation and upgrading of existing degree programs in basic science and engineering; and 3) private sector cooperation.

**Chile MSI:** The Chile MSI is a governmental entity under the auspices of the Ministry of Planning of Chile, whose main objective is to promote the development of cutting edge scientific and technological research in the country, as a key factor for sustainable, long-term economic and social development. At its inception in 1999, one-third of the Chile MSI was funded by a World Bank loan and two-thirds by country counterpart funds; it is now fully government funded (ICM, 2010).
The MSI finances the creation and development of Centers of Research—Millennium Institutes and Nuclei—which are selected through public grant competitions for their scientific merits. Projects are evaluated by a Program Committee made up entirely of distinguished foreign scientists, supported by other foreign evaluators with expertise in the thematic areas of the projects presented.

The MSI Institutes and Nuclei carry out scientific research comparable to that performed in more developed countries, in both the natural and the social sciences. They are primarily focused on developing four main components: cutting edge scientific and technological research, the training of young scientists, collaboration in networks with other centers of excellence in the region and in the world, and dissemination of their results, particularly towards the sectors of education, industry, services and society.

The MSI Program is an important actor in the National Science, Technology and Innovation System and has established agreements with the Innovation for Competitiveness Fund to finance some of the Millennium Institutes and Nuclei.

Several evaluations of the Chile MSI have been conducted. A formal evaluation of the Chile MSI, dating to when it was still being financed in part by the World Bank, reported satisfactory progress with high likely sustainability and development impact (World Bank, 2002). The evaluation found that even limited investment, distributed based on transparent and objective selection procedures, has a high impact on performance and productivity of a science and technology system. A light administrative structure, autonomy in spending resources, recognition of scientific leadership, and involvement of beneficiaries in program design and implementation were key sources of effectiveness of the program. The report provided preliminary indications that scientists and managers were increasingly collaborating and that the approach of competitively supporting the best scientists was an effective practice for increasing human capital performance among the most advanced students, including some students from countries neighboring Chile. Scientists participating in the program reported improved working conditions and career possibilities. Further, the program appears to have fostered greater links between the education and scientific ministries. Transparency in funding procedures also helped created positive perceptions of the programs, and concerns about internal tensions arising within hosting institutions where grantees worked or resistance by the S&T community to the focus on excellence did not materialize. The evaluation noted that future investments should develop specific incentives to promote private sector collaboration.

A 2005 evaluation assessed the scientific productivity of associated researchers in the first four years of the program as compared to the period before the creation of the centers (MSI, 2005). Productivity was assessed using bibliometric elements, such as publications and citation frequency, but also formation of young scientists, patent applications, and the organization of national and international events. The study showed large increases in publication number and citation frequency but decreased numbers of patent applications, revealing that technology commercialization and intellectual property protection may be features of the program that require future strengthening. Large increases in doctoral and undergraduate students were measured in participating
institutes, participation in and organization of conferences and events, and diffusion and outreach activities.

A peer evaluation of the annual reports of Chile MSI centers was conducted in 2008 to assess the performance of centers on the basis of advanced research, training, networking, and outreach (MSI, 2008). Scientific/technological research was evaluated from good to excellent at 94% of the centers, as evidenced by joint publication of scientific articles in high-impact journals. Training was also very well evaluated, with all centers obtaining superior marks. Outreach and networking had more mixed results, with 68% of centers scoring very well or excellent and more than 56% of centers obtaining the same qualifications in outreach activities.

Other evaluations are available in Spanish. Notably, one evaluation looked at sex-disaggregated data on scientific participation in MSI centers (ICM, 2008). The study found large gender gaps among principal investigators, associate investigators, and among students at the undergraduate, masters, doctorate, and post-doctoral levels, but approximately equal percentages of men and women among young investigators. Of the total number of investigators (1,437), 59% were men (844) and 41% (593) were women. The distribution of young female investigators was predominantly concentrated in the biological sciences (63%) and earth sciences (13%), with percentages under 10% in other disciplines.

**African Mathematics MSI (AMMSI):** The African Mathematics Millennium Science Initiative (AMMSI) is a distributed network of mathematics research, training and promotion throughout sub-Saharan Africa. It has five Regional Offices located in Botswana, Cameroon, Kenya, Nigeria and Senegal. Established by MSI, it is managed by a Program Committee consisting of a representative from each region. The primary goal of the MSI, established in 1999, is to create and nurture world-class science and scientific talent in the developing world by strengthening S&T capacity through integrated programs of research and training, planned and driven by local scientists. AMMSI provides small scholarships and fellowships to individual students and faculty from all over Africa to study at different African universities, and also provides some conference and travel support (SIG, 2010).

3.2.1.3 Collaborative Research Support Programs

The Collaborative Research Support Program (CRSP) model has multiple advantages, which include engaging the best universities in the United States toward the solution of agricultural problems in developing countries; building valuable research networks among American researchers and counterparts in the developing world; and leveraging resources on USAID core funding from partners at US universities and host countries (Chicago Council on Global Affairs, 2009). The CRSP model builds institutional capacity primarily through support of research activities in partner country institutions. The past achievements of this model include developing crop management techniques able to reduce the use of pesticides for insects, weeds, and diseases by 50 percent, 60 percent, and 25 percent, respectively; teaching farmers in Africa how to manage soil
resources under adverse conditions likely to increase due to climate change; developing millet cultivars and hybrids with increased yields and resistance to abiotic and biotic stresses; improving cowpea processing techniques for use by female microentrepreneurs in Niger and Ghana; and creating a Livestock Early Warning System (LEWS) to help predict forage conditions in pastoral regions in East Africa grazed by 100 million cattle, sheep, and goats (Chicago Council on Global Affairs, 2009).

3.2.1.4 India’s State Agricultural Universities

The establishment of India’s State Agricultural Universities (SAUs) is a model of institutional capacity development. From 1955 to 1972, USAID contracted with several US land-grant universities to assist the Indian Government in establishing agricultural universities. Along with the Ford and Rockefeller Foundations, USAID and the Government of India established commissions to hold meetings throughout India, visit overseas countries, and observe different agricultural institutions in practice (Goldsmith 1990, cited in Eicher, 2009). These inputs fed into agreements to establish State Agricultural Universities in India. In parallel, Indian students were trained at the MSc and/or PhD levels in US universities, and faculty members of the same universities were posted at the new state universities on multi-year assignments (Busch, 1988). Today there are 41 State Agricultural Universities in India (Goldsmith, 1990, cited in Eicher, 2009).

In spite of the fact that institution building approaches in the US in the 1960s were highly elitist and top down, strong initiative by India lessened that orientation; the effort was highly demand driven. In addition, SAUs were successful even though much of the internal and external criticisms of the land-grant model in the United States were not considered in the recommendations to those seeking to establish land-grant universities in India, and there is evidence of many erroneous understandings of the land-grant system on the Indian side (Busch, 1988). Factors contributing to the success of SAUs included strong leadership from the Indian Council for Agricultural Research (ICAR), and the strong understanding and belief in the applicability of the US concepts to India by numerous Indians in key positions. In addition, trust and confidence in the university by state governments, a high demand for agricultural graduates, commitment by SAU leadership, emphasis on farmers, the development of linkages with other institutions, and openness to internal and external evaluation were factors of success (Busch, 1988).

3.2.2 Programs to Strengthen National Agricultural Research Systems and Government Research Agencies

This section presents examples of developing the capacity of national agricultural research systems, particularly government research agencies. Strategic decisions, questions, issues to be considered in the design of capacity development interventions for NARS reform include the following:

- **Regional vs. National**: There is near-universal acknowledgment that duplicating research capacities in small countries would be an inefficient use of scarce resources (Chicago Council on Global Affairs, 2009). Particularly in the African
context, there is recognition of the need for regional coordination when investing in national agricultural research. In Eastern and Southern Africa for the past dozen years, governments have supported regional strategic planning through the Association for Strengthening Agricultural Research in Eastern and Central Africa (ASARECA). A key strategy would be to create strong national agricultural research systems in leading states that can also serve as regional centers of excellence to serve the needs of smaller neighboring states; for smaller NARS, strengthening at the sub-regional level is a higher priority (Chicago Council on Global Affairs, 2009; IAC, 2004a). Strong NARS should receive full benefit of complementary activity with international advanced research centers and advanced research institutions.

The New Partnerships for African Development (NEPAD) model of African Centers of Agricultural Research Excellence (ACARE) offers a vision of what such regional centers would look like. ACARE would be established from the existing strongest NARS and would attract the best and brightest scientists from the continent and Diaspora. The ACARE would serve as a focal point to mobilize additional resources, would exploit economies of scale and research spillovers, and would have a mandate to strengthen NARS. ACARE would be supported by African governments and governed by Africans, and they would be independent organizations with merit-based recruitment, competitive salary structure that operate in close collaboration and partnership with farmers, NARIs, universities, international agricultural research centers (IARCs), and developed countries research institutes (Chema and Roseboom, 2004, cited in IAC, 2004a; Chema et al., 2003, cited in IAC, 2004a).

- **Leadership and Staff Retention:** Capacity development approaches should be employed that help attract and retain good scientists, which includes non-monetary but morale-building measures like linking authority with accountability, and facilities like housing, education for children, and health care. Capacity development efforts that encourage social prestige, recognition, and a merit-based, innovation-friendly working atmosphere should be employed (IAC, 2004a). Capacity development efforts should focus on strengthening leadership that can bring out the best in staff and that has access to ministers and heads of government/state (IAC, 2004a).

- **Strengthening System Linkages:** Increased impact may be achieved by strengthening linkages among NARS, international agricultural research centers, advanced research institutions, credit and development agencies, local universities, private innovators, farmers’ organizations, cooperatives, nongovernmental organizations, and extension agencies (Chicago Council on Global Affairs, 2009; IAC, 2004a) (Also see next section).

- **Redefining the Role of Government in Research:** NARS may benefit from a redefinition of the role of governments in agricultural research. Research on export crops could be privatized (IAC, 2004a). Separation of funding, priority
setting, and implementation functions in government agricultural research may be considered, with farmer groups and industry groups providing more input and influence over the research budget (IAC, 2004a).

- **Centralization vs. Decentralization and Devolution of Agricultural Research**: Decentralization and devolution of agricultural research have contributed to more applied/adaptive production systems and more multidisciplinary research. Decentralization can increase the relevance of research, but it can reduce cost-effectiveness of the research, and it may be difficult to convince scientists to live in remote areas. Physical proximity to a research station is less relevant in developed country contexts (IAC, 2004a).

- **Stakeholder Participation**: Increased participation from farmers, consumers, industry, non-governmental organizations and community-based organizations in agricultural research priority setting, budget allocation, and funding may contribute to making agricultural research more relevant. However conflicts may exist between smallholders, who are peripheral to the agricultural innovation system, and large plantation owners (IAC, 2004a).

- **Development of New Forms of Research Funding**: New forms of research funding, particularly competitive research funds, may be advantageous to publicly funded agricultural research in terms of more closely aligning research with regional, national, or sub-national priorities, achieving greater technical merit through peer review, increasing cost efficiency, creating more cross-institutional and cross-national collaboration, and mobilizing underutilized capacity in environments where salaries represent the bulk of institutional funding. Disadvantages of competitive funding approaches include the lack of secure local funding base, high transaction costs, poor suitability for the entire research agenda, the requirement that institutions be able to handle research contract, and its lack of suitability for small research systems because of the lack of competition (IAC, 2004a).

3.2.2.1 National Agricultural Statistics Services Agricultural Statistics Improvement Capability

The US Department of Agriculture’s National Agricultural Statistics Service (USDA NASS) has carried out a capacity-development program to assist agricultural statistics services in other countries for over 60 years. The lack of timely, reliable agricultural statistics—which enable decision-making related to marketing, price determination, farm inputs, financial needs, etc.—is a serious constraint in many countries. Using donor funding to cover expenses, NASS provides technical assistance and training by its staff to counterpart organizations in the areas of statistical surveys, censuses, and data systems, with the goal of improving individual skills and organizational capacity. The NASS approach includes an assessment of the target country’s agricultural statistics system during a one- to two-week visit to the country, a US-based study tour by key officials from the collaborating agencies, development of detailed project plans, pilot testing of
new procedures or methodologies on a small scale with subsequent broadening, and on-the-job and workshop training opportunities for much of the staff of collaborating organizations. A major lesson learned from the project is the importance of cost-sharing by the target country, which helps to ensure sustainability of the new procedures after the collaboration has ended (USDA NASS, 2009).

3.2.3 Programs to Strengthen Critical Infrastructure and Technology

This section considers capacity-development programs for improving critical infrastructure and technology in developing countries. Two critical issues common to most models are country ownership and cost-sharing arrangements to ensure sustainability.

3.2.3.1 The Essential Electronic Agricultural Library

The Essential Electronic Agricultural Library (TEEAL), operated by Cornell University’s Mann Library, is a full-text digital library of 149 key agricultural and life science journals at low cost to universities, agricultural research organizations, and government ministries in eligible low-income countries. TEEAL is used at 62 institutions in 32 developing countries. Journal coverage starts in the 1990s and is updated annually. TEEAL has a searchable database of citations from CAB Abstracts, BIOSIS, Econlit and PubMed. TEEAL is an offline tool—no Internet or phone line is required—that can be shared on a local area network, or used on a stand-alone PC (TEEAL, 2010).

3.2.3.2 Health InterNetwork Access to Research Initiative

The Health InterNetwork Access to Research Initiative (HINARI) provides free or very low cost online access to the major journals in biomedical and related social sciences to local, not-for-profit institutions in developing countries (HINARI, 2010).

HINARI was launched in January 2002, with some 1500 journals from 6 major publishers: Blackwell, Elsevier Science, the Harcourt Worldwide STM Group, Wolters Kluwer International Health & Science, Springer Verlag and John Wiley, following the principles in a Statement of Intent signed in July 2001. Since that time, the numbers of participating publishers and of journals and other full-text resources has grown continuously. Today more than 150 publishers are offering more than 7,000 journals in HINARI and others will soon be joining the program.

HINARI was developed in the framework of the Health InterNetwork, introduced by the United Nations’ Secretary General Kofi Annan at the UN Millennium Summit in the year 2000.

Local, not-for-profit institutions in two groups of countries may register for access to the journals through HINARI. The country lists are based on gross national income (GNI) per capita (World Bank figures). Institutions in countries with GNI per capita below
$1250 are eligible for free access. Institutions in countries with GNI per capita between $1250–$3500 pay a fee of $1000 per year/institution.

Eligible categories of institutions are: national universities, research institutes, professional schools (medicine, nursing, pharmacy, public health, dentistry), teaching hospitals, government offices and national medical libraries. All staff members and students are entitled to access to the journals.

Participating institutions need computers connected to the Internet with a high-speed (56k baud rate or higher) link.

For institutions ineligible for access to journals through HINARI, other initiatives may provide access. There are also links on the HINARI menu to full-text resources which are free to all.

3.2.3.3 Access to Global On-line Research in Agriculture

Launched in 2003, the Access to Global On-line Research in Agriculture (AGORA) program, established by the Food and Agriculture Organization of the UN (FAO) together with major publishers, enables developing countries to gain free or low-cost access to an outstanding digital library collection in the fields of food, agriculture, environmental science and related social sciences. AGORA provides a collection of 1278 journals from the world’s leading academic publishers to institutions in 107 countries (AGORA, 2010). AGORA is designed to enhance the scholarship of the many thousands of students, faculty and researchers in agriculture and life sciences in the developing world.

Led by FAO, the goal of AGORA is to improve the quality and effectiveness of agricultural research, education and training in low-income countries, and in turn, to improve food security. Through AGORA, researchers, policy-makers, educators, students, technical workers and extension specialists have access to high-quality, relevant and timely agricultural information via the Internet.

Institutions wishing to use AGORA must register with FAO. Participating institutions’ libraries receive a password that can be used by all students, faculty and/or staff at the institution to access the database.

Institutions in countries with gross national product (GNP) per capita below $1000 (Band I countries) are eligible for free access. Institutions in countries with GNP per capita from $1000–$3000 (Band II countries) pay a fee of $1000 per year/institution. Individual publishers reserve the right to add to or delete from these country eligibility lists. All institutions joining AGORA Band II receive an initial free trial period of three months. Income generated through AGORA is invested in local training initiatives.

Within these countries AGORA benefits not-for-profit national academic, research, or government institutions in agriculture and related biological, environmental and social
sciences. Eligible institutions whose staff and students may have access to the journals are: universities and colleges; research institutes; agricultural extension centers, government offices and libraries.

Participating institutions need computers connected to the Internet with a connection of 56k baud rate or higher. The system is designed to work with Internet Explorer version 4.0 or higher, Netscape version 6 or higher, Mozilla Firefox 1.0 or higher. Users also need a recent version of Adobe Acrobat viewer for the journal articles in PDF format.

3.2.3.4 International Network for the Availability of Scientific Publications

Established by the International Council for Science (ICSU) in 1992, the International Network for the Availability of Scientific Publications (INASP) focuses on communication, knowledge and networks, with particular emphasis on the needs of developing and emerging countries (INASP, 2010). INASP responds to national priorities for:

- Access to national and international scholarly information and knowledge
- Capacities to use, create, manage and communicate scholarly information and knowledge via appropriate ICTs
- National, regional and international co-operation, networking and knowledge exchange

INASP also advises and advocates for improved policy and practice in achieving sustainable and equitable development through effective communication, knowledge and networks.

INASP works with 23 partner countries and over 80 network countries around the world. INASP uses the United Nations Human Development Index (HDI) and the World Bank GNI to identify eligible countries. The partnerships between eligible countries and INASP work towards activities being led, implemented and sustained by the countries themselves. This involves a significant, long-term commitment of expertise, time and money from both sides. As it is not possible to work with all eligible countries in this depth, they are divided into two groups:

- **Partner countries:** INASP and the country jointly commit to support research communication activities, according to the country's specific needs, plans and policies. The partnerships are professional collaborations between Country Coordinating teams and INASP. Our partner countries are:
  - **Africa:** Côte d'Ivoire, Ethiopia, Ghana, Kenya, Lesotho, Madagascar, Malawi, Mozambique, Rwanda, Tanzania, Uganda, Zambia, Zimbabwe
  - **Asia Pacific:** Bangladesh, Nepal, Pakistan, Sri Lanka, Vietnam
  - **Latin America:** Bolivia, Cuba, Ecuador, Honduras, Nicaragua
- **Network countries:** INASP enables access to resources such as training materials, publications, and a List of Free/OA Resources via country-specific web pages. If a network country's involvement adds value to partner countries and/or
INASP's wider network, they may also be involved in multi-country or regional initiatives. Decisions on involving network countries in specific activities are dealt with on a case by case basis. In network countries where a Country Coordinator is in place, the country can also benefit from INASP-negotiated free subscriptions to e-resources. As and when capacity allows, network countries may transition to partner countries. Decisions are based on an assessment of the following background information.

- Activity and size of research community
- Track record while a ‘network' country
- Availability of appropriate coordinating/implementing partners in country
- Availability of financial support, including local financial commitment
- Availability of sufficient ICT capacity
- Geographical proximity to other partner countries
- INASP knowledge and experience of the country
- Institutional level support structures
- Language: can opportunities be effectively managed and used?
- National level support structures
- Needs assessment that indicates relevance/demand for the activities
- Potential for activities to become led, implemented and sustained by the country
- Recent payment of subscriptions to publishers (which may adversely impact INASP's ability to negotiate preferential licensing)
- Security situation—as indicated by the United Kingdom Foreign and Commonwealth Office travel warnings relating to the country or parts of the country where activities will take place—allows INASP staff and/or partners to visit country to implement work
- Requests from researchers
- Whether existing support in country meets the demand for research communication
- Whether the partnership would fit with INASP's strategic framework
- Whether the partnership would fit with the country's national plans and priorities

INASP's current program focus is the Program for the Enhancement of Research Information (PERii). PERii is the second five-year phase of INASP's Program for the Enhancement of Research Information. Focusing on the needs of developing and emerging countries, PERii works with partners to support global research communication by strengthening: knowledge and skills of those working in research communication, participation in international knowledge networks, and research communication policy and practice. PERii is guided by five key principles: equity, stakeholder participation, strategic partnerships, social responsibility and sustainability. PERii’s core program areas focus on:

- Affordable access to international scholarly literature
- Successful writing, publishing and communication of research from developing and emerging countries
Effective use, evaluation and management of ICTs to support research
Development of modern, digital research libraries
Advice and advocacy around the role of research communication and the people engaged in it for sustainable and equitable development.

PERii strengthens the skills of individuals working in the research communication cycle through:

- Training and supporting researchers, journal editors, publishers, librarians, and ICT professionals to make the most of technological and online opportunities for research communication.
- Trainees go on to train their peers, extending the program's reach and enhancing the capacity of the research community.
- Facilitating the exchange of experience and skills through publication, networking and mentoring, ensuring that lessons learned in one country can be capitalized on in others.

PERii ensures developing and emerging countries are part of international knowledge networks:

- Support is given to researchers in developing and emerging countries to write, publish and communicate their research findings nationally and internationally, so their work can have maximum impact and they can take their place in the global research community.
- No matter where they are, researchers in developing and emerging countries must have access to the same research as their international peers. PERii builds relationships between countries and publishers to ensure affordable, sustainable subscriptions to online resources from across the globe.

3.2.3.5 Partnership for Higher Education in Africa – Bandwidth Agreements

Because ICT is key to enhancing the capacity of African universities to provide quality training and conduct high caliber research, PHEA has been heavily engaged in ICT-related work from the outset. The priority for partner institutions was access to more bandwidth at lower cost, which is essential for teaching, learning and research at the universities. In 2005 almost all of the Joint Partnership grants focused in ICT. Building on work that began in 2002, the founding four foundations made $5 million in grants to the African Virtual University (AVU) to establish Africa's first bandwidth consortium for partner institutions, now hosted by the Nigerian ICT Forum. Hewlett joined with a $400,000 grant to AVU to purchase additional bandwidth. In view of the continuing high cost of connectivity on the continent, the Partnership has issued a Statement of Principles on affordable bandwidth for African universities. Finally, the Ford and Rockefeller foundations joined in making grants to the Kenya Education Network (KENET), which permits KENET to link its 23 member universities to the bandwidth consortium system.
Partnership assistance on bandwidth was complemented by grants to the Tertiary Education Network (TENET) of South Africa and to the African Network Operators Group (AfNOG) to collaborate with grantees on bandwidth management training and implementation. The Mellon Foundation, which helped to establish TENET, also contributed funds to allow TENET to work on a sub-regional and regional basis on bandwidth management and the establishment of National Research and Education Networks (NRENs).

Educational technology (eLearning) and the digitization of African research materials were also foci of grant making. The Carnegie Corporation of New York, the Ford Foundation, the Kresge Foundation, the MacArthur Foundation, and the Rockefeller Foundation joined together in 2008 to launch a four-year eLearning initiative in partnership with the South African Institute for Distance Education (SAIDE) and the Centre for Educational Technology (CET) at the University of Cape Town. The Hewlett Foundation made two grants to AVU, totaling $950,000 for the development of eLearning materials. The Massachusetts Institute of Technology (MIT) received $800,000 from Carnegie Corporation for collaboration with universities in Nigeria, Tanzania, and Uganda on digital engineering laboratories. The Mellon Foundation, through its Aluka initiative, made over $3.3 million in grants for the digitization of images and information on African plants, as part of an effort to assist African institutions manage and disseminate African research information (PHEA, 2010a).

3.3 DEVELOPING CAPACITY FOR LINKAGES AMONG AGENTS OF INNOVATION: NETWORKS, TECHNOLOGY UTILIZATION, TECHNOLOGY COMMERCIALIZATION, AND POLICY INFLUENCE

Research systems under national control are increasingly being replaced by networked scientific systems. As an alternative to models of scientific nationalism, in which each nation needed to provide its own scientific infrastructure, infrastructure can now be shared through networks or linkages at the regional or international level (Wagner, 2008):

“Self-organizing networks that span the globe are the most notable feature of science today. These networks constitute an invisible college of researchers who collaborate not because they are told to but because they want to, who work together not because they share a laboratory or even a discipline, but because they can offer each other complementary insight, knowledge, or skills....[The new invisible college] gives developing countries a …chance to create strategies for tapping into the accumulated store of scientific knowledge and applying what they learn to local problems.”

This section considers capacity development programs that facilitate more-effective linkages and networks among elements of the agricultural innovation system. These include links among public research organizations, universities, regional organizations, the private sector, the policymaking community, and developed country institutions.

Strategic questions, decisions, and issues arise in program design:
• **Researcher Driven vs. Donor Driven Networks:** Because of the impression that research networks serve a function of providing salary supplements to scientists via per diems to attend meetings, Eicher (2009) cautions that research networks should flow from a solid research base, not from a decision by a donor to set up a network to promote scientific exchange.

3.3.1 Linkages Among Researchers

3.3.1.1 Regional Universities Forum for Capacity Building in Agriculture

The Regional Universities Forum for Capacity Building in Agriculture (RUFORUM), a consortium of 25 universities in Eastern and Southern Africa, was established in 2004. The consortium originally operated as a program of the Rockefeller Foundation from 1992. RUFORUM has a mandate to oversee graduate training and networks of specialization in the Common Market for Eastern and Southern Africa (COMESA) countries. Specifically, RUFORUM recognizes the important and largely unfulfilled role that universities play in contributing to the well-being of small-scale farmers and economic development of countries throughout the sub-Saharan Africa region (RUFORUM, 2010). RUFORUM aims to enhance human capacity for interdisciplinary problem solving in the region, the competence and competitiveness of regional universities, the role and visibility of universities in research for development, and the linkage of universities to grassroots development issues.

RUFORUM is involved in a number of research initiatives. These involve:

- Engaging with communities to strengthen innovation capacity and knowledge generation
- Increasing productivity and enhancing sustainable natural resource use and management
- Conducting risk analyses and designing coping strategies for mitigating against climate variability and change, and associated crop-animal-human health epidemics
- Exploiting potential of indigenous vegetables for food security and nutrition
- Strengthening leadership, management and cross-cutting professional skills of university managers, lecturers and students.

The RUFORUM training program is designed to augment the pool of agricultural researchers and policy professionals in sub-Saharan Africa by supporting graduate studies in agriculture and related fields and by enhancing the capabilities in the member universities. Three approaches are used: regional MSc/MPhil and PhD programs, attachments (linking students to field-oriented research), and short targeted courses for professional and skill development. RUFORUM has a deliberate policy to promote women’s education, primarily through increasing opportunities for graduate training, and working with women and other actors to advance women’s academic careers. RUFORUM is working with the member universities to mainstream gender in their programs and to establish deliberate plans to increase access to especially postgraduate education and job placement of women and other disadvantaged groups. RUFORUM
research and development activities are also designed to ensure active participation of women.

The consortium has several unique features for building Africa’s innovation capacity and for engaging universities in development process and practice:

- It is owned and managed by Africans
- It derives its agenda largely from the continent wide policy frameworks especially of the African Union's NEPAD Comprehensive African Agricultural Development Program (CAADP), the NEPAD Science and Technology Framework, the African Union Policy Framework on Revitalizing Higher Education in Africa, the Sub Regional Multi–Country Agricultural Productivity Programs, the National Poverty Reduction Strategy Papers (PRSPs) of the Member States and Governments, constant review of global trends and foresight planning in order to ensure that Africa has the required capacity for global competitiveness
- It allows for joint action by the member universities. This is enhanced through joint faculty appointment for the 12 universities, payment of local fees by graduate students and national mechanisms (National Forums) which ensure wide stakeholder participation in the RUFORUM programs
- The consortium provides a wide array of training opportunities for stakeholders, and is in the process of establishing credit transfer mechanisms among the member universities

One of RUFORUM’s strengths is that it has established a very effective peer review process (G. Toennissen, personal communication). All proposals are reviewed by other African scientists, just as US National Science Foundation (NSF) proposals are reviewed. Initially, that review process included one external scientist, but African reviews have reached the point where they no longer need the external scientist. The review process is taken very seriously. At meetings of all of the participating grantees every other year, people who reviewed proposals also question the principal investigators when they present results. RUFORUM is therefore generating within Africa a constructive peer review process at both the proposal and at the results stage.

3.3.1.2 Regional Initiative in Science and Education

The Regional Initiative in Science and Education (RISE) aims to strengthen higher education in sub-Saharan Africa by increasing the population of qualified faculty teaching in Africa’s universities (RISE, 2010). RISE prepares PhD- and MSc-level scientists and engineers through university-based research and training networks in selected disciplines. Its primary emphases are on preparing new faculty to teach in African universities and on upgrading the qualifications of current faculty.

RISE networks provide comprehensive graduate training programs, where students and faculty seeking advanced degrees can take advantage of the complementary instruction and research opportunities available at each institution within the network. Networks also
enable researchers from multiple universities to use specialized scientific instrumentation that may be available at only one of the sites, or to pool resources to obtain new equipment. The approach in some of the networks allows staff to consult for and be seconded to industry, and new funding is helping network universities develop products for commercialization. Administrators note that research management capacity is a critical need and that RISE is increasingly supporting such efforts, including grants management workshops. Although university–national lab relationships were encouraged in the call for proposals, networks primarily include universities.

RISE is supported by grants from the Carnegie Corporation of New York to the SIG at the Institute for Advanced Study. SIG is leading the RISE initiative in partnership with the Nairobi, Kenya-based African Academy of Sciences.

The following five networks were selected in 2008 from among 48 proposals:

**African Materials Science and Engineering Network (AMSEN)**

*Academic Director:* Lesley A. Cornish, Director, DST/NRF Centre of Excellence in Strong Materials, University of the Witwatersrand, Johannesburg, South Africa

*Other participating institutions:* University of Nairobi, Kenya; University of Namibia; Federal University of Technology, Akure, Nigeria; University of Botswana

*Description:* AMSEN focuses on developing the skills in materials science and engineering needed to develop and add value to the extensive mineral deposits in southern Africa.

**African Natural Products Network (RISE-AFNNET)**

*Academic Director:* John David Kabasa, University Professor, Natural Products Research Laboratory, Department of Physiological Sciences, Makerere University, Kampala, Uganda

*Other participating institutions:* University of Nairobi, Kenya; Sokoine University, Tanzania

*Description:* RISE-AFNNET seeks to develop Africa’s rich biodiversity into a natural products industry of social and economic significance through coursework and research in engineering, biochemistry, environmental science, pharmacology, economic development, and nutrition.

**Southern African Biochemistry and Informatics for Natural Products (SABINA)**

*Academic Director:* John D. Saka, Professor of Chemistry, Chancellor College, University of Malawi

*Other participating institutions:* University of Namibia; University of Dar es Salaam, Tanzania; University of Pretoria, South Africa; University of the Witwatersrand, South Africa; Council for Scientific and Industrial Research (CSIR), South Africa; Tea Research Foundation of Central Africa, Malawi

*Description:* SABINA works with natural products that have the potential to increase food security, public health, and value-added exports. Its research emphasis is on biochemistry and chemistry of natural products.

**Sub-Saharan Africa Water Resources Network (SSAWRN)**

*Academic Director:* Denis Hughes, Director, Institute for Water Research, Rhodes University, South Africa
**Other participating institutions:** Eduardo Mondlane University, Mozambique; University of Botswana; Makerere University, Uganda

**Description:** SSAWRN focuses on the most pressing water issues of sub-Saharan Africa, including rising use, declining quality, insufficient research and teaching capacity, inadequate weather stations, and the likelihood of increased variability of water supplies associated with future climates.

**Western Indian Ocean Regional Initiative in Marine Science and Education (WIO-RISE)**

**Academic Director:** Margareth S. Kyewalyanga, Director, Institute of Marine Sciences, University of Dar es Salaam, Zanzibar, Tanzania

**Other participating institutions:**
Eduardo Mondlane University, Mozambique; University of Cape Town, South Africa

**Description:** WIO-RISE provides research and training in skills associated with the utilization of coastal and marine resources and protection of the coastal and marine environment.

An evaluation of the RISE program is in the planning stages.

### 3.3.1.3 Wellcome Trust African Institutions Initiative

The Wellcome Trust’s African Institutions Initiative aims to build a critical mass of sustainable local health and disease research capacity, including biomedical research and public health research, across Africa, through strengthening African universities and research institutions (Wellcome Trust, 2010).

The initiative supports the creation of South-South and North-South consortia and networks, both between higher education institutes and research institutes located within Africa and between these institutions and higher education institutions in the United Kingdom. Institutions outside the United Kingdom and Africa may also be members of consortia. African partners include a mix of institutions with well-established research activities and universities in the early stage of developing research potential. Each consortium is led by an African institution.

The African Institutions Initiative supports capacity development in the areas of training, research, and research management. The initiative provides fellowships to young researchers at the PhD and postdoctoral levels, builds a critical mass of local research capacity and helps to develop research environments geared to national priorities across Africa (e.g., through competitive grant schemes). The initiative also supports the human resources and infrastructure necessary for the administrative, governance, financial, and management functions needed for institutions to deliver research excellence. There is a strong emphasis on leadership training and professional development.

The following consortia have been funded through the African Institutions Initiative:

**Consortium for Advanced Research Training in Africa (CARTA)**
Kenya, South Africa, Tanzania, Uganda, Malawi, Nigeria, Rwanda, United States,
Australia, Switzerland and United Kingdom
Director: Dr. Alex Ezeh, African Population and Health Research Centre, Nairobi, Kenya

One Health Initiative, African Research Consortium for Ecosystem and Population Health
Côte d'Ivoire, Chad, Senegal, Ghana, Tanzania, Uganda, United Kingdom, Switzerland and Norway
Director: Professor Bassirou Bonfoh, Swiss Centre of Scientific Research, Côte d'Ivoire

One Medicine Africa-UK Research Capacity Development Partnership Programme for Infectious Diseases in Southern Africa (SACIDS consortium)
Tanzania, Mozambique, Democratic Republic of the Congo, Zambia, South Africa, Kenya and United Kingdom
Director: Professor Mark Rweyemamu, Sokoine University of Agriculture, Tanzania

Research Institute for Infectious Diseases of Poverty (IIDP)
Ghana, Côte d'Ivoire, Mali, Nigeria, United Kingdom and Switzerland
Director: Dr Margaret Gyapong, Dodowa Health Research Centre, Ghana Health Service

Southern Africa Consortium for Research Excellence (SACORE)
Malawi, Zambia, Zimbabwe, Botswana, South Africa and United Kingdom
Director: Dr Newton Kumwenda, Malawi College of Medicine

Strengthening Research Capacity in Environmental Health (SNOWS)
Kenya, Ghana, Uganda, South Africa, Sudan, Denmark and United Kingdom
Director: Professor Esi Awuah, Kwame Nkrumah University of Science and Technology, Ghana

Training Health Researchers into Vocational Excellence in East Africa (THRiVE)
Uganda, Rwanda, Tanzania, Kenya and United Kingdom
Director: Professor Nelson Sewankambo, Makerere University, Uganda

3.3.1.4 African Network for Agriculture, Agroforestry and Natural Resource Education

The African Network for Agriculture, Agroforestry and Natural Resource Education (ANAFE) is a network of 131 educational institutions in 35 African countries whose objective is to strengthen the teaching of multi-disciplinary approaches to land management. The ANAFE Secretariat is hosted at the International Centre for Research in Agroforestry (ICRAF) headquarters in Nairobi. This provides a vantage for network management, linkages with the research and development activities of ICRAF and its partners, and convenient communication facilities (ANAFE, 2010).

Administratively, the network is attached to ICRAF. Day-to-day activities are supervised by an Executive Secretary. The Swedish International Development Cooperation Agency (SIDA) has provided financial support to ANAFE since July 1991. Members contribute to the cost of managing specific activities. ANAFE works closely with Agriculture, Agroforestry and Natural Resource Management initiatives in Africa.

3.3.1.5 Sustainable Food Security in Central West Africa
Established in 1989 with support from the Ministry of Foreign Affairs of the Netherlands, Sustainable Food Security in Central West Africa (SADAOC) networks tertiary institutions in Burkina Faso, Côte d’Ivoire, Ghana, Mali, and Togo with collaborators in the Netherlands. SADAOC undertakes research, capacity building, and policy dialogue in the countries (SADAOC, 2010).

SADAOC is a sub-regional organization that undertakes research, capacity strengthening, and policy dialogue activities through its national networks in five member countries (Burkina Faso, Côte d'Ivoire, Ghana, Mali, and Togo). Networks comprise multidisciplinary alliances of research institutes, universities, government institutions and non-governmental organizations, all of which are concerned with food security in West Africa.

Examples of SADAOC activities include supporting a working papers series; convening workshops on such topics as street food and public health, women and food supply and security systems, decentralization and food security; and facilitating general policy dialogue on food security through a roundtable of member-country ministers.

3.3.1.6 Building Africa’s Scientific and Institutional Capacity

Building Africa’s Scientific and Institutional Capacity (BASIC), a program of the Forum for Agricultural Research in Africa (FARA), aims to strengthen African universities’ ability to build the capacity that Africa requires for endogenously driven innovation system (BASIC, 2010). BASIC helps universities build capacity for teaching at the undergraduate level by bringing non-African partner universities and Africa-based agricultural research institutions together to jointly revise curricula, course content, teaching and training approaches, methods and course contexts, and the postgraduate training provided to university and college faculties.

3.3.2 Linkages Among Research, Extension, and Farmers

Some strategic decision points in the design of capacity development programs for extension include:

- **Privatized vs. Government-Operated Extension Services:** Privatization of extension services can increase efficiency, improve quality of service, and increase responsiveness to customers and innovation. However, it also can carry the risk of marginalizing smallholder farmers.

- **Cost-Recovery Schemes:** While cost-recovery schemes can help to ensure sustainability of extension services, they also pose a risk of marginalizing smallholder farmers.
3.3.2.1 Alliance for A Green Revolutions in Africa: Agro-Dealer Program

The Bill and Melinda Gates Foundation and the Rockefeller Foundation have partnered in the support of AGRA at $150 million over the coming five years. The initiative’s goal is to develop high-yielding food crop varieties, drawing on the experience of the development of high-yield wheat varieties in Mexico that served as the basis of the Asian Green Revolution. AGRA makes investments in education, research, extension, and markets (AGRA, 2010).

AGRA’s most successful effort has been village-level agro-dealer programs, a model for extension that does not involve the public sector at all. NGOs identify individuals who run small village-level shops to determine if that individual—often a woman—is interested in expanding to include agricultural products such as pumps, fertilizers, and seeds. Interested individuals go through a six-month training program by suppliers. For example, seed companies teach agro-dealers how to sell seed, how to demonstrate seed to farmers, how to package seed to maintain quality and guarantee quality. At the end of the training, agro-dealers who have demonstrated capability to train farmers are certified and receive credit from the suppliers. Credit guarantees are also made to the suppliers. The Most agro-dealers have plots behind their shops, where they grow the varieties they are selling, and cobs in their stores which show what the product will look like. AGRA has taken the agro-dealer concept to scale: over 9,000 agro-dealers in 6–7 countries have been trained, with plans to train an additional 20,000 (G. Toennissen, personal communication).

3.3.2.2 India’s Agricultural Technology Management Agency

The experience of agricultural extension in India is illustrative of a capacity-development model designed to better link extension, research, community-based organizations, and the private sector. In 1998, the World Bank and the Government of India tested a new extension model focusing on improving farm income through agricultural diversification. Under the model, extension activities, which were heretofore highly centralized in India and concentrated in the agriculture sector, were decentralized, integrated, and reoriented at the district and block levels through a new institution called the Agricultural Technology Management Agency (ATMA). ATMA was introduced to coordinate and integrate different line departments (e.g., agriculture, livestock, horticulture, fisheries) and to link with research efforts at the district levels (multidisciplinary science centers affiliated with state agricultural universities, national agricultural research institutes, or NGOs). Participatory, bottom-up planning procedures were used to make the system more responsive, transparent, and accountable. A key role for ATMA was in identifying markets and supply chains for promising high-value crops and products. ATMA also engaged in partial cost recovery from farmers by charging for specific extension activities. The level of cost recovery was gradually increased over time as farmers recognized the value of the services. ATMA provided a framework for public-private partnerships, as both agribusinesses and NGOs—which target wealthier farmers in higher-potential regions and the rural poor in lower-potential areas, respectively—served on the ATMA district-level governing boards. The ATMA approach was tested in 28
project districts across 7 states. ATMA was highly successful in increasing average farm income (6% annual increase vs. a 1% annual increase in non-project districts), diversifying the farming systems in the 28 project districts, and in organizing producer groups (10,000+). In addition, the project had a significant impact on rural women, in that one third of all producer groups were women's groups (Mishra and Swanson, 2009; Singh et al., 2006).

3.3.2.3 USDA National Institute for Food and Agriculture Poland Development Project

From 1990 to 1996, USDA’s National Institute for Food and Agriculture (NIFA) collaborated with 31 land-grant universities to assist the Polish Ministry of Agriculture in restructuring and reorienting its agricultural extension system at the national, provincial, and local levels. More than 100 university extension personnel, most on 6-month assignments, served in Poland on this project during this period of tremendous change and uncertainty. By the time the project finished, two-person teams from the United States had served in 42 of Poland's 49 provinces (NIFA, 2010).

Using a training-of-trainers approach, the project emphasized the skills and knowledge required to succeed during the transition to a market economy, focusing on such areas as business planning, farm management, and marketing. Other programmatic areas included leadership development, extension methodology, agro-tourism, and youth development. Factors contributing to project success included:

- Determination and receptiveness to new ideas by Polish counterparts
- Flexible approach based on local needs—US extension personnel were required to develop a joint plan of work with their Polish counterparts and implement activities on a collaborative basis
- Demand-driven programming at the local level, with US teams working in the field rather than in Warsaw
- Longer-term (6-month) assignments, which allowed adequate time to train Polish extension staff to train others
- Excellent collaboration among USDA agencies working in Poland, such as the Economic Research Service, Agricultural Marketing Service, National Agricultural Statistics Service, and the Foreign Agricultural Service's Cochran Program.
- High caliber of extension personnel from the US land-grant university system

3.3.2.4 US–Iraq Agricultural Extension Revitalization Project

The US Department of Agriculture’s Foreign Agricultural Service (USDA FAS) is involved in a variety of trade capacity building and technical assistance activities to help Iraq revitalize its agricultural sector so it can become an engine for economic growth and strengthen US market share. Iraq’s agricultural extension system is one USDA focus. The US-Iraq Agricultural Extension Revitalization (IAER) project is intended to facilitate Iraqi rural economic development by revitalizing its agricultural extension system so that a private-sector-driven agricultural sector can emerge (USDA FAS, 2009).
From December 2006 through July 2008, phase one of the IAER project trained nearly 500 Iraqi nationals through 22 agricultural extension courses provided by a consortium of five US land-grant universities working in partnership with Iraq’s Ministry of Agriculture (MOA), Ministry of Higher Education (MOHE), Ministry of Water Resources and Irrigation (MOWRI), and related institutions. The five land-grant universities are Texas A&M University, Washington State University, Utah State University, University of California at Davis, and New Mexico State University.

The courses were held in Middle Eastern countries near Iraq. Courses ranged from a few days to 3 weeks and included such topics as arid crop production development, livestock production and animal health, and water resources management and irrigation technology. Staff from the US land-grant universities taught the courses to MOA officials, agriculture university faculty and students, and extension personnel to enhance the capacity of small- and medium-sized farmers’ and producers’ production, marketing, and management skills.

A component of the first phase of the IAER project was a small merit- and feasibility-based grants program that provided more than $250,000 to 25 participants. In addition, some trainees were provided with laptops, camera equipment, and soil kits to use in demonstrating the knowledge and skills gained to local farmers and other extension professionals. Extension agents trained through the program were able to apply their skills in reestablishing broiler production in Kurdistan following destruction of the existing flocks by avian influenza, as well as in demonstration projects for farmers and other extension agents on alfalfa cultivation, silage making, greenhouse construction, irrigation techniques, composting techniques, and poultry farming for egg production. Several projects focused on women farmers.

In December 2008, the second phase of IAER was initiated in Baghdad, in two stages. During the first stage, begun in 2009, 60–70 Iraqi extension specialists received up to 8 weeks of advanced extension training at the five US land-grant universities. The US-based training will use highly specialized, science-based technology and current extension methodology in areas such as aquaculture, animal health, dry-land field crops, horticulture, soil and water management, greenhouse production, and agribusiness and youth training. Groups of 10–12 Iraqis received the training in the development of instruction materials and curricula at one of the five US land-grant universities. The next stage of phase two, projected to conclude in September 2010, the US-trained Iraqi extension specialists are to return to Iraq and apply their new skills, knowledge, and materials in training other extension agents and provide advice to farmers and producers in their communities.

3.3.2.5 West African Network of Farmer Organizations and Agricultural Producers

Founded in 2000, the West African Network of Peasant Organizations and Producers (ROPPA) gathers representatives of farmer organizations from 13 West African...
countries. The network requests specific services from the research and extension communities (Asenso-Okyere and von Braun, 2009; ROPPA, 2010).

ROPPA’s objectives include promoting competitive and sustainable agriculture, informing and training members of farming organizations and agricultural producers associations; supporting and supervising the organization of peasant farmers and agricultural producers in all countries in order to promote their participation in defining and implementing development policies and programs in the agricultural sector, promoting solidarity among ROPPA members, and promoting dialogue between ROPPA and regional and international organizations. ROPPA has an important integrating role in the context of globalizing international markets, decentralization to the territorial level in West Africa, and strategic decision-making at the sub-regional level by the West African Economic and Monetary Union (ECOWAS/UEMOA). ROPPA is an open organization and makes decisions by consensus. The ROPPA has started a number of training programs for peasant leaders on international trade agreements.

3.3.3 Linkages Between Private Industry and Public Research Institutions to Promote Technology Utilization and Commercialization

Programs describing effective linkages between private and public research institutions with the view toward commercializing and utilizing technologies are presented in this section. Several factors contribute to the effectiveness of the programs:

- **Designing Structures and Investments that Promote Linkages:** The coordination of investments in farmers, research, education, and extension, along with the design of organizational structures that facilitate connectedness between complementary institutions and incentives that encourage communication and cooperation and linkages with farmers, are essential to fostering research–innovation linkages. Investments in ICTs, university curricula, and changes in the roles and relationships between national agricultural research institutes, extension, and universities will be required. The establishment of electronic delivery systems for agricultural information to rural communities in Uganda is one example of such structures. Telecenters in various cities supply information such as farm stock prices, weather reports, pest and disease early warning systems, market information, new technologies, and sources of credit and training (IAC, 2004a).

- **Creating a Conducive Policy Environment:** Policy changes are essential for private sector investment in public research. For example, recent changes to the South African Revenue Service have helped to foster more public–private linkages (as noted at the 2009 South African Third Stream Income Conference, Suzanne Grant-Lewis, personal communication). These include incentives to the private sector to run research programs through universities, changes in venture capital regulations to allow deductions for venture capital companies to sell shares, establishment of intellectual property protection policies and establishment
of government innovation agencies. Addressing intellectual property rights constraints is a critical aspect of creating a conducive policy environment, e.g., through private sector provision of patented processes and materials free to developing country institutions (IAC, 2004a). The African Agricultural Technology Foundation (AATF; described in greater detail below) is an institutional innovation that can encourage such partnerships. AATF helps public institutions access proprietary technologies and know-how that they could not otherwise acquire because of restrictive patenting or licensing practices. AATF brokers royalty-free transfers of useful technologies (biological, chemical, and mechanical processes) between IP owners and research institutions, with the objective of developing technologies that met the needs of resource-poor farmers. Government has an important role in facilitating negotiation of such agreements for design, conduct, and financing of research (IAC, 2004a).

- **Changing Cultural Perceptions about Public-Private Relations**: In some countries, industry is seen as being unwilling to bear research costs; consequently, universities are considered to subsidize industry’s research. Further, in some countries, is a reluctance or even distaste for engaging with the private sector. Some universities want to avoid commercial activities on campus and would prefer that spin-offs go off campus (as noted at the 2009 South African Third Stream Income Conference, Suzanne Grant-Lewis, personal communication).

- **Strengthening Research Management Capacity**: Many countries lack a framework for indirect costs, which can stimulate development of research management capacity key to supporting public–private partnerships. Developing a framework for indirect costs is a critical step towards promoting public–private partnerships (as noted at the 2009 South African Third Stream Income Conference, Suzanne Grant-Lewis, personal communication).

- **Funding Mechanisms to Accelerate Adoption of Innovations**: New funding mechanisms may be developed to foster the adoption of innovations. Royalty-like award funds, for example, disbursed to innovators in proportion to measured value to farming households from adoption of a new technology, are a potentially promising approach for accelerating adoption of innovations (Chicago Council on Global Affairs, 2009). This approach encourages all types of improvement and avoids the disincentive effects associated with winner-take-all competitions. Awards would cover only a small fraction of project costs, in order to guide and stimulate other public and private investments.

- **Scientists vs. Entrepreneurs**: As the World Bank’s STI program points out:

  “It is generally accepted that entrepreneurs cannot use their entrepreneurial skills to become good scientists. But the converse is also true. Most good scientists cannot use their scientific skills to become good entrepreneurs. Unfortunately, this truism is often overlooked when policy makers attempt to
promote technology commercialization. Policy makers establish incubators and techno-parks to nurture new businesses started and operated by scientist-entrepreneurs. These commercialization institutions frequently fail to live up to their founders’ expectations, in part because they tacitly assume that top notch scientists can handle the marketing, sales, financial, legal and overall managerial tasks performed by a top notch entrepreneurs. This is rarely the case. Therefore, if policy makers want to promote technology commercialization, they will need to establish linkages between top notch scientists on the one hand and top notch entrepreneurs on the other hand (World Bank STI, 2010).”

3.3.3.1 African Agriculture Technology Foundation

The African Agriculture Technology Foundation (AATF) is a not-for-profit organization designed to facilitate and promote public/private partnerships for the access and delivery of appropriate proprietary agricultural technologies for use by resource-poor smallholder farmers in Sub-Saharan Africa (AATF, 2010). AATF provides expertise and know-how to facilitate the identification, access, development, delivery and utilization of proprietary agricultural technologies.

AATF bases its activities on three strategic thrusts, each associated with a set of challenges, strategies, and criteria for success:

1. *Negotiating access to proprietary technologies enhancing African agricultural productivity:* AATF engages in technology scoping, interaction with technology developers, and negotiation. It keeps abreast of the latest information about agricultural production constraints and priorities in Africa and is familiar with major national, regional and Africa-wide policies on agricultural development. AATF devotes the majority of its attention to proven technologies, rather than those that are in the concept stage.

2. *Managing partnerships to introduce innovative agricultural technologies to African farming systems:* AATF identifies and develops partnerships with the most appropriate organizations for product development. These may be public or private organizations at the national or international level. AATF’s attention to product delivery includes working with partners to strengthen retail distributorships or access complementary inputs at a reasonable price. AATF may also pursue access to funds for limited and targeted subsidies or output-based contracts. Partnerships may also include investments for information provision (such as farm-level demonstrations). AATF ensures that intellectual property management is addressed and assists its partners to comply with the relevant regulatory and biosafety regimes. It ensures that its partners are investing the required resources in product stewardship and develops workable liability arrangements.

3. *Managing knowledge and information:* AATF develops access to information on production constraints in African agriculture, the technical characteristics of candidate technologies, and relevant regulatory, biosafety and IPR requirements.
AATF also develops its own knowledge base about issues related to the enabling environment for agricultural technology. Much of AATF's information provision is related to its specific products. AATF presents information to stakeholders on the performance and potential of its products and engages in issues training with its partners. AATF also ensures that it is providing information about the potential and performance of its products to those who are concerned with biotechnology and with broader agricultural technology development.

AATF pursues its long term objectives following a phased approach. AATF continuously undertakes intelligence gathering on technological breakthroughs locally and internationally with a view to generating ideas that can be nurtured into projects for addressing constraints to crop productivity in Sub-Saharan Africa (Phase 0). Promising ideas are discussed and screened for feasibility through consultations with stakeholders, leading to the formulation of Project Business Plans (Phase 1). For each project, the Business Plan serves as a key document for guiding project implementation and the interactive mechanisms for collaborating partners during research, testing and adaptation of products as well as technologies in target areas (Phase 2) and for guiding activities critical for product deployment to reach smallholder farmers and other end users (Phase 3). The entire process of identification, formulation and implementation of AATF projects follows a flexible and iterative scheme involving periodic wide-ranging stakeholder consultations.

3.3.3.2 Australia’s Cooperative Research Center (CRC)

Australia’s Cooperative Research Center (CRC) program was established in 1991 to improve the effectiveness of Australia’s R&D programs across 6 sectors, including agriculture. The CRC links research at universities, state and federal research institutions (e.g., the Australian Commonwealth Scientific and Research Organization [CSIRO]), and private industry, with a focus on technology utilization and commercialization (CRC, 2010; IAC, 2004a). Key features of the program include a close interaction between researchers and the end-users of research, as well as industry contribution to CRC education programs to produce industry-ready graduates. Administered by the Ministry for Innovation, Industry, Science, and Research, the CRC provides funding through annual competitive awards to partnerships between end-users and researchers for collaboration on specific challenges for the end-users. CRCs pursue solutions to these challenges that are innovative, have high impact, and have potential for being effectively deployed. To date there have been a total of 168 CRCs. There are currently 48 CRCs operating in 6 sectors: environment (10), agriculture and rural-based manufacturing (14), information and communication technology (5), mining and energy (4), medical science and technology (8) and manufacturing technology (7). Since the commencement of the CRC Program, all parties have committed more than $12.3 billion (cash and in-kind) to CRCs. This includes almost $3 billion from the CRC Program, $3.1 billion from universities, $2.5 billion from industry, and $1.2 billion from CSIRO.
PHEA has supported some efforts to strengthen links between universities and the private sector. A technology incubator project at the University of Dar es Salaam is one example. Because the private sector is weak in most of Africa, and because multinational corporations typically operate R&D elsewhere, the problem of poor technology commercialization results partly from a lack of connections and partly from lack of partners. In the process of assisting universities to strengthen skills in fundraising and creating constituencies, however, PHEA has found that university alumni are powerful in the private sector. Reaching out to such individuals has been a first step towards improving technology commercialization. One university, for example, appointed a private sector representative of a computer firm on its advisory board and has negotiated a favorable supply contract with her company. The new relationship opens the possibility that this firm might start commissioning research from the computer engineering department. Through a similar alumni connection a bank in one country is providing funding to build a business school. New opportunities exist for R&D from other companies, such as Hewlett Packard and Google, supporting universities (A. Johnson, personal communication).

3.3.3.4 Cornell University-Sathguru Partnership for Technology Licensing

Sathguru Management Consultants in India is a leader in aggregating academic technologies for pro-poor application. It has facilitated licensing technologies from Cornell University to private and public sector organizations and enterprises for technology commercialization and dissemination (World Bank STI Global Forum, 2009). Cornell-Sathguru has focused on the South Asian and Southeast Asian regions and has plans to expand to the sub-Saharan African region.

Because developed country technologies are often intellectual property (IP) protected and require sophisticated license negotiation and because licensing technologies requires a capable party to inspire a licensor to assume licensing risks, many licensors lack the needed people, patience, and internal processes for application of technologies in developing countries. Capacity development is therefore an integral part of the Sathguru-Cornell University approach. Appropriate, adaptable technologies are selected from technology partners, a package of necessary scientific, technical, legal, and human requirements for transfer are assembled, suitable and receptive implementing parties in developing countries are identified and mentored, the technology transfer and commercialization process between creators and implementers is planned and managed, and ongoing mentoring and support is provided to assure that technology transfer and assimilation take root. Program impacts have included the successful transfer of both high and low-tech innovations (e.g., drought tolerant crop technologies, Late Blight disease resistance and improved agronomic traits in potato, insect resistance in eggplant, novel fruit and vegetable cultivars, nutritional enhancement and shelf-life extension of foods, biological controls, cell lines for veterinary medicine, and research tools and technical properties), involvement of faculty and students from both Cornell University and partners in developing countries, the creation of spin-off activities, and engagement
with in-country policy planners and industry in capacity development efforts (Vijayaraghavan and Cahoon, 2009)

3.3.3.5 National Institute of Agricultural Extension Management Public-Private Partnership

A capacity-development program for input suppliers, underway at the Indian National Institute of Agricultural Extension Management (MANAGE) in Hyderabad, India, is an example of a highly successful public-private partnership. The goal of the initiative was to train input supply dealers in order for them to more effectively serve all types of farmers, thereby strengthening the overall Agricultural Extension System. There are over a quarter million input supply firms in India, but most of their sales personnel lack university-level education in agriculture. The MANAGE partnership trained input supply personnel in location-specific crop production technologies and practices related to field problems, the efficient handling of inputs, and laws governing regulation of agricultural inputs. Trained dealers with an extension diploma earned degrees qualifying them to serve as both base-level extension staff as well as input-supply dealers. A distance education approach was used for the training over a one-year period, using multi-media instructional devices and interaction with resource persons in the field. Topics included technical skill training (e.g., climatic conditions, soils and soil analysis, Integrated Nutrient Management (INM), Integrated Pest Management (IPM), and Crop Production Technologies for all crops grown in the district, including high-value crops: horticultural crops, vegetable crops & floriculture), extension skills training (e.g., extension and communications methods, diffusion and adoption of innovation, role of mass media, etc.), business management practices, business ethics, training on the concepts of privatization, liberalization, globalization, World Trade Organization (WTO) regime, etc., and training in regulatory responsibilities (e.g., laws related to agricultural Inputs and the Consumer Protection Act). Over 1500 input supply dealers have been trained through the program since 2004 (Reddy and Swanson, 2009).

3.3.3.6 Alliance for a Green Revolution in Africa: Linking NARS and the Private Sector

AGRA was able to resolve constraints in the seed commercialization system in Kenya, where seed commercialization was previously handled by a parastatal that commercialized only limited varieties to certain agro-ecosystems, limiting the possibilities for seed companies. Through a professionally facilitated meeting among seed companies and public breeders with materials available for licensing were able to identify constraints in the process and discuss solutions. AGRA subsequently provided funding to get the bureaucratic constraints resolved (G. Toennissen, personal communication).

3.3.3.7 Rockefeller Foundation: Facilitating Rice Biotechnology Licensing

One approach for promoting technology commercialization is as simple as getting university and NARI scientists together with companies when the scientists have something to offer. Following a Rockefeller Foundation effort to develop rice
biotechnology capacity in India, in both the Indian Council for Agricultural Research (ICAR) and some of the universities, real results were obtained after about 5-6 years, which should have been of interest to India’s private sector. Monsanto and Syngenta were already moving in and hiring the scientists away. Rockefeller worked with ICAR to create a national rice biotechnology network in India, in which an annual scientific meeting brought together supported scientists, representatives of the national biotechnology program in India, and Indian seed companies. As soon as the seed companies became aware of the scientific results, they began developing licensing agreements and paid for the network, which continues today (G. Toennissen, personal communication).

3.3.3.8 Alliance for the Seed Industry in East and Southern Africa

Seed companies in Africa rely on public sector breeding programs in NARS and the CGIAR system to provide new varieties. USAID has been supporting partnerships between the seed sector and regional economic communities in Africa. The Alliance for the Seed Industry in East and Southern Africa (ASIIESA) is a memorandum of understanding (MOU) between the African Seed Trade Association (ASTA) and the Common Market for East and Southern Africa (COMESA). An earlier example, the West Africa Seed Alliance, was created to stimulate the creation of private enterprise in seed, with assistance from ICRISAT, the Citizens’ Network for Foreign Affairs (CNFA), and Iowa State University. Through the ASIIESA programs, needs for agribusiness and farmers, more agribusiness-relevant research and education priorities (such as adaptive research and application research needs) can be communicated to the national level, and public-private sector partnerships, adaptive research, and extension delivery can be established and improved. Alliances such as the ASIIESA may help facilitate connecting farmers to research by getting good varieties in the hands of farmers and helping farmers learn how to use the product (L. Le Page, personal communication). Criticisms of this approach include that it does not build the local seed industry and that it may not serve the poor or small-scale farmers. Local companies sell seed at a fifth of the price of the multinational corporations (G. Toennissen, personal communication).

3.3.4 Linkages Among National Agricultural Research Institutes, Public Universities, and the CGIAR

A number of possible strategies have been suggested to strengthen linkages between NARIs and public universities and between NARIs and the CGIAR. Funding mechanisms, such as competitive grant schemes, could be devised that reward partnerships, including those involving weaker partners, such as the smaller NARS. NARIs could also review university undergraduate curricula to ensure that students understand constraints and opportunities in smallholder agricultural farming systems. Graduate students could be posted at NARIs for the conduct of their master’s or dissertation research. Universities could also engage more directly in supporting national priorities. The I@mak.com reform project at Makerere University in Uganda is an innovative example. In the framework of decentralization in the country, the university
reorganized its academic programs, aiming to train cohorts of public servants in health, agriculture, and administration to staff district offices (IAC, 2004a).

3.3.4.1 CGIAR-NARS Linkages

The CGIAR has a strong system-wide and a center-wide commitment to capacity building in the NARS. A study commissioned by the CGIAR interim Science Council reviewed both group and individual training within the CGIAR as it contributes to capacity strengthening in the NARS (CGIAR, 2006). Partner organizations within the NARS included universities, NARIs, regional and sub-regional bodies, the private sector, NGOs, agricultural extension, farmers’ organizations. Some of the training occurs formally through degrees, courses, or in recognizably educational settings, but other training is informal and occurs in the context of work experience, peer learning, networks, or policy dialogues. The panel found consistent evidence of the effectiveness of CGIAR effectiveness in training and learning; the research agendas of many NARIs, even the weakest among them, have been shaped by Center inputs and linked to international scientific agendas. While the study found that the training is broadly relevant to capacity needs of NARS with regard to strengthening their research base, it may not necessarily lead to institutional strengthening. Training quality was generally found to be high, but with limited opportunities to apply newly acquired knowledge and skills. Weak quality assurance may relate to a lack of teaching experience among Center staff and the fact that individual and informal training is not monitored by an explicit mechanism. In most Centers, systems for efficient management and delivery of training and learning are not in place, and examples of good practices are unevenly distributed. Where NARS are weak, Centers may need to integrate their training and learning activities with other capacity development approaches, partner with local universities, and coordinate their plans with those of other stakeholders. Those cases with successful outcomes often had the following conditions in common: long-term commitment by CGIAR centers; a long-term funding commitment; local institutional support and leadership; a mixture of formal and informal training/learning activities, designed to fit specific needs (e.g., instructional learning through courses in specialized settings, experiential learning and learning by doing, collaborative learning through joint research, mutual exchange, mentoring, and colleague exchange, linking diverse R&D projects to help them learning from each others’ experiences and contexts; using meetings and conferences as learning settings); the formation of multidisciplinary teams and critical mass of scientists; and a latent demand for the technology in question that meets identified needs. Key future training demands are foreseen for specialized short courses, individual non-degree, higher degree training, and more online training. Major potential benefits were foreseen to be achieved from targeting policymakers more widely in activities and intensifying the level of support to universities, through partnerships involving Centers, southern universities, and northern universities. Limited benefits were foreseen for expanding farmer training beyond that needed to validate research methodologies.
3.3.5 Linkages Between Research and Policymaking

3.3.5.1 US National Academies African Science Academy Development Initiative

The African Science Academy Development Initiative (ASADI), launched in 2004 by the US National Academies and funded by the Bill & Melinda Gates Foundation, is a 10-year effort to strengthen the capability of African science academies to provide independent, evidence-supported advice to inform African government policy making and public discourse related to improving human health. The initiative also aims to foster a deeper appreciation on the part of African governments for the benefits of decision making based on evidence and analysis—with a view toward building the demand for Academy-led efforts (NAS, 2010).

The grant supports intensive capacity-development efforts with the science academies of Uganda, South Africa, and Nigeria—competitively selected on the basis of their potential to develop an effective and sustained policy-advisory process, the receptivity of their governments to seek advice from the scientific community, and the existence of a critical mass of scientific talent willing to serve as participants in policy-advisory activities. Collaborative partnering with these academies is helping to develop infrastructure, personnel, relationships between the academy and its government, and rigorous procedures for providing policy advice. The grant also provides modest support to the academies of Ghana, Cameroon, Senegal, Kenya, and the regional African Academy of Sciences for strategic planning efforts.

Complementary to the efforts to build capacity at the national level, a regional conference—held annually over the 10-year life of the project—is intended to enhance cooperation among African science academies, strengthen relationships among representatives of the academies and the policy making community, and foster a greater understanding and appreciation of the value of evidence-based policy advice. In addition to annual conferences, annual joint learning sessions have created a support network of African and US science academy staff involved in policy-advisory activities. These meetings have focused on collaborative problem solving, the exchange of best practices and strategies for project implementation, and practical training.

The program has been carried out using a phased approach. Early activities have included training for academy staff, establishing contacts with appropriate government agencies and other organizations, fundraising, and implementing a variety of convening and consensus-based activities on subjects selected by the African academy in consultation with its government, with staff members from the US National Academies serving as external consultants. Over the course of the initiative, partner academies will conduct activities increasingly independently and will be responsible for securing matched funds so that the academies’ programs will be sustained after the grant period has ended. Partner African science academies also are assembling an international database of African scientists with technical support from the US National Academies. The most recent version of the database includes the expertise, contact information, and current affiliation of over 750 leading African scientists on the continent and in the African
Diaspora. When shared across countries, the database will help science academies easily identify and recruit experts for policy-advisory activities.

The ASADI vision is to develop African science academies so that they are regarded as trusted sources of credible scientific advice in each nation. Ultimately, it is hoped that many aspects of public policy may benefit from the experience and scientific rigor of the best minds in each country.

Policy-Advisory Activities: Partner African science academies have been developing and testing different models to inform government policy making. These have included both consensus-based activities—in-depth policy studies by a formally constituted committee to explore important issues and to offer formal, evidence-based guidance to national decision makers—and convening activities, gatherings of representatives with diverse perspectives to discuss and illuminate issues using an evidence-based approach. Accomplishments of partner academies in building these models are described below.

Consensus Studies
Consensus-based policy studies are in-depth analyses conducted by a committee of experts on subjects selected by an academy in consultation with the government. Careful procedures are used for selecting members to the committee: assuring that the committee’s experience and expertise are appropriate to the task and screening for financial or other interests that might interfere with members’ ability to serve objectively. The appointed committee of experts—balanced and free from conflicts of interest—reviews research, works together to achieve consensus, and, where appropriate, offers policy guidance. Partner science academies in Africa have been working to adapt the model of the consensus study to the local context.

Forums, Symposia, and Workshops
Science academies have the ability to convene diverse perspectives—representatives of industry, academia, non-profit organizations, donors, and government—to illuminate emerging issues of interest to a nation. Symposia, workshops, and series of workshops—forums or roundtables—convened in the name of a standing committee are among the convening models under experimentation by African science academy partners through the ASADI partnership. Convening events have brought a diverse array of interests to the table for discussions on a broad range of nationally significant topics including nutrition, poverty, and health. Proceedings or summaries from these events have been produced. Several academies have established standing committees, or forums, to explore topics related to a particular theme on a regular basis. At the Nigerian Academy of Science, a standing Forum on Evidence-Based Health Policy Making has been established that has convened several workshops on such topics as blood safety, maternal and child health, and health systems. In South Africa, a Forum on Poverty Alleviation has been established and has convened a workshop on science-based improvements to rural/subsistence agriculture, and in Uganda, a Forum on Health and Nutrition has been established and has convened a workshop on issues surrounding malaria control and prevention.

Training: ASADI has assisted African science academy staff in developing stronger
skills to build complex advisory capacities within each academy. The support includes training in those functions that underpin advisory capacities, such as financial management, human resource management, maintaining constituencies, and resource mobilization. Close one-on-one partnering relationships between US National Academies staff and African science academy staff—linking counterparts at the managerial, financial, program, research, and administrative levels—are contributing to the development of skills to support the full array of academy operations, including:

- Establishing and sustaining relationships with government agencies and other organizations
- Planning and implementing projects of the highest quality
- Scheduling, preparing for, and managing meetings
- Establishing advisory committee management procedures
- Identifying and recruiting expert advisers
- Preparing literature reviews
- Writing and editing high-quality, peer-reviewed reports
- Communicating with the media and disseminating Academy products
- Managing finances and developing budgets
- Managing personnel
- Fundraising and preparing proposals
- Developing leadership and oversight functions

**Strategic Planning:** All African science academies affiliated with the ASADI program have developed and finalized strategic plans to formally consider the future course of their institutions. In consultative sessions involving Academy Fellows, senior managers, staff, and stakeholders, ASADI partners have completed visioning exercises to describe the ideal future identity of their organizations, assessments of their institutions’ current situation (including strengths, weaknesses, opportunities, and threats), definition of each institution’s core values, prioritization of strategic goals, development of a roadmap of approaches to achieve strategic goals, and development of methods for tracking progress. Among the factors considered by many academies in the strategic planning process were the identification of key constituencies for an academy; the development of a service-orientated, advisory role for the academy; the role of the academy membership in supporting an advisory role; the establishment of long-term financial sustainability; the development of effective outreach; and the development of staff.

**Annual Conferences:** Hosted each year of the initiative by one of the African science academies, annual conferences have aimed to foster greater understanding of evidence-based policy advice and to highlight current public-policy challenges in which the rigor of an academy’s advisory processes could add value for decision making. These conferences are also a forum for sharing progress and knowledge gained through policy-advisory activities and for strengthening relationships among representatives from African science academies and the African policy making community. Summaries of annual conferences have been published and made available to key stakeholders. Previous conferences have focused on the use of policy advice from science academies for achieving the Millennium Development Goals and improving food security in Africa.
The 2007 annual conference focused on the role of science academies in informing policies related to water and health. In addition to annual conferences, annual joint learning sessions have created a support network of African and US science academy staff involved in policy-advisory activities. These meetings have focused on collaborative problem solving, the exchange of best practices and strategies for project implementation, and practical training.

**Monitoring and Evaluation:** A five-year external evaluation of ASADI has been conducted over the first phase of the project, with principal focus on the three science-academy partners in Nigeria, Uganda, and South Africa. The evaluation included baseline observation and inquiry sessions at all affiliated academies, annual visits to each of the three intensive partners, periodic meetings with US National Academies staff, and regular review of evaluation-relevant materials shared by program participants. Members of the evaluation team also participate in the annual conferences and joint learning sessions to gather data and facilitate discussions on evaluation.

Two overarching principles characterized the ASADI evaluation approach: participation and capacity building. The evaluation engaged, through a participatory process, a broad range of US and African stakeholders in the design, monitoring, and assessment components of the evaluation. A diverse core group of program participants at each academy was also established to ensure continuity in evaluation design, implementation, and results analysis. A participatory approach to evaluation also helped to make more explicit the goals, assumptions, and expectations of the overall initiative; to develop a theory of change of the initiative; to clarify the users of evaluation; and to identify performance measures to be used across and within institutions. The evaluation was also itself a capacity-building exercise. The evaluation team provided training in evaluation theory, design, and implementation for US National Academies staff and for members and staff of all participating African academies. The evaluation of ASADI included both qualitative and quantitative measures and tracked both processes and outcomes of the program. The evaluation involved the analysis and monitoring of change in attitudes, behaviors, and skills at the individual and organizational levels and the extent to which evidence-based decision-making in partner countries may be developing as a result of the initiative.

The first five-year evaluation demonstrated, broadly, that the performance of each of the three primary partners has been different and very specific to local personalities and context. All the partner academies have been able to convene solid meetings and produce thoughtful summaries, and there is encouraging documentation of the growing recognition of the academies by government stakeholders. However, the evaluation also revealed a number of invalid assumptions, aggravated perhaps by the perception of long-term funding, related to over-dependence on US-inspired advisory models instead of development of more locally appropriate advisory models. A more incremental approach—renewal grants of two years tied to more aggressive performance incentives—may have pressured academies into developing more viable business models. Another substantial challenge was supporting the development of governance capacity within the African academies and encouraging the African academy leaders to take full ownership.
of their institutions’ futures. Finally, the influence of the local political system and the local media on successful science advising was not fully factored into the program’s design.

3.4 KEY FINDINGS

The following key findings have emerged when looking across the range of capacity-development approaches. The following attributes appear to characterize the most promising programs.

3.4.1 Targeting “Soft” Capacities

Promising capacity-development efforts cultivate “soft” or human capacities—attitudes, behavior changes, critical thinking, relationships, and legitimacy—as well as “hard” or technical capacities. “Soft” capacities have a strong influence on staff motivation, which in turn influences the levels of staff turnover and staff retention within organizations.

3.4.2 Mentoring and Individual Support

Mentoring and individual support—linked to strengthening organizational reward and incentives systems—constitute a substantial component of promising capacity-development efforts at all levels. For recent trainees, follow-up support and mentoring in the context of the organizations in which individuals work is very important, especially for women. At the level of facilitation of networks and partnerships, these programs encourage mentoring and support for technology transfer and commercialization processes (e.g., providing brokers to help developing countries license proprietary technologies).

3.4.3 Staff Retention, Leadership, and Incentives

The most promising capacity-development approaches have a strong emphasis on developing greater global competitiveness of organizations by developing capacities to attract and retain high-quality personnel, which include non-monetary but morale-building measures such as: linking authority with accountability; benefits such as housing, education for children, and health care; social prestige; recognition; mentoring; access to literature; freedom to network professionally; availability of competitive grants; sabbatical leave; and a merit-based, innovation-friendly working atmosphere. These programs also focus on strengthening leadership that can bring out the best in staff.

3.4.4 Partnerships

The most promising capacity-development efforts facilitate partnerships that take advantage of complementary assets of participating institutions, with an openness to new types of partnering arrangements for training, organizational development, and network formation, including: South-South partnerships vs. North-South partnerships (and hybrid models such as sandwich and distance learning programs) for training and organizational
development, regional vs. national models for training and organizational development, local vs. overseas sourcing for training, and engagement of private-sector actors vs. public-sector actors (e.g., for traditionally public-sector roles, such as extension). Many promising efforts establish partnerships at the highest levels (e.g., at the level of Vice Chancellor/President for partnerships involving universities), as opposed to at the individual or departmental levels. These capacity-development initiatives also engage in policy advocacy to facilitate partnerships (e.g., policies to encourage private-sector investment in universities, incentives to venture capitalists, and policies to ease intellectual property constraints to technology licensing).

Capacity-development partnerships with greatest potential also appear to be those that take a strategic, criteria-based approach to selecting partner institutions. Before the project is initiated, these programs conduct background research and facilitate strategic planning efforts so that partners can participate in designing their own projects and developing work plans jointly with donors. In the context of training, these programs develop the capacities of a critical mass of individuals within carefully selected institutions.

3.4.5 Moving Beyond Research Capacity: Strengthening Research Management and Governance, Research Commercialization, and Research Use in Policy

Some of the most promising capacity-development efforts support not only the programmatic capacity to conduct research but also non-programmatic capacities to manage, commercialize, and apply research to decision making. Most examples reviewed fall into the category of strengthening research capacity alone; however, exclusive emphasis on research capacity development is not sufficient to strengthen institutions.

The development of research management and governance capacity includes all functions that support the conduct of research and that are key to maintaining partnerships, such as financial management, resource mobilization, endowment and reserves management, human resources management, libraries, infrastructure, dissemination and publication systems, and administration). Research management capacities are also critical for supporting the ability to borrow and adapt research done elsewhere. Programs that have invested in this area report a high level of spillover effects.

Developing entrepreneurship and innovative capacity is also important both for individuals and organizations, and the most promising programs have stressed this. Educational programs include hands-on entrepreneurial practicum in the curriculum, and organizational capacity-development programs take an active role in facilitating linkages between top-notch scientists and top-notch entrepreneurs who can effectively address the marketing, sales, financial, legal and overall managerial aspects of technology commercialization. These programs also help to advocate for and address policy constraints to commercialization, e.g., through brokering royalty-free transfers of technologies and creating incentives for private sector investment in public research.
Finally, a very few programmatic examples have included a focus on developing capacity to use research to influence policy. Although such programs carry a high risk of failure, they also have a very high potential for significant impact if successful.

3.4.6 Engaging Constituents

Many of the most promising capacity-development programs have a strong emphasis on engaging and building diverse constituencies, including farmers’ organizations, policymakers, the private sector, and other agriculture-sector actors, as well as potential sources of future funding, such as university alumni and donors. Facilitating the capacity to build constituencies can be as simple as supporting the convening of regular meetings between the research community and other actors.

3.4.7 Sustainability

An important attribute of the most promising capacity-development efforts is a commitment to sustainable capacity outcomes. Sustainability plans include cost sharing by the partner, cost-recovery schemes, and strengthening of resource mobilization capacities to prepare partners for when donor support ends.

3.4.8 Encouraging Women’s Participation

The most promising programs appear to have specific, written policies to mainstream women’s increased participation, including specific policies targeting recruitment of qualified female participants. These programs have tailored specific interventions for women, many with a strong emphasis on mentoring. Gathering data on women’s participation in capacity-development activities is another important first step towards encouraging women’s participation.

3.4.9 Assuring Quality and Scientific Integrity

Many of the most promising programs made use of merit-based, competitive processes in the selection of candidates or awarding of grants. Peer-review systems, in which both local and external reviewers are used, are also promoted by these programs to assure quality of research proposals or research results.

Chapter 4: Evaluating Capacity Development

Few evaluations have been conducted to assess the capacity of organizations to conduct research and development (R&D), the capacity development processes themselves, or the extent to which capacity development leads to improvement in organizational performance. However, monitoring and evaluation (M&E) of capacity development efforts are of critical importance because poorly conceived or implemented initiatives can fail to improve or can worsen performance. Monitoring involves observation while the work is still in progress, and evaluation is an assessment, often after the fact, that
determines the worth, value, or quality of an activity, project, program, or policy (Horton et al., 2003).

This chapter summarizes a process for preparing for research capacity-development evaluations; outlines guiding principles for the design of research capacity-development evaluations; reviews methods and tools for implementing research capacity-development evaluations; summarizes several case studies of research capacity-development evaluations; and identifies key findings and challenges from the review of research capacity-development evaluation efforts.

4.1 PREPARING FOR EVALUATION

The following steps—to be accomplished before data collection is started—are critical for preparing for evaluation of capacity development efforts:

- **Clarity why and for whom the evaluation is being done:** Evaluation can be used both to judge performance—*summative* evaluation—and/or to inform decision making for program improvement—*formative* evaluation. Evaluation can have an important role in accounting to specific constituents (e.g., donors, taxpayers) and in advocating for further support of a program. Evaluation can also be used to inform decision makers and to improve a particular program (IOM, 2008). The purpose of evaluation should be clarified in advance with stakeholders. Lack of clarity can sometimes lead to misunderstandings among stakeholders that the evaluation is being done to judge them personally and to apply individual sanctions for poor performance. It is important to convey that evaluation is used to assess capacity as a whole and to provide input for how capacity development efforts can be more effective. Clarifying the purpose of the evaluation is also important in order to identify stakeholders who should be involved in the process (Horton et al., 2003).

- **Involve intended users throughout the evaluation process:** The most effective way to ensure that the evaluation’s result will be used is to involve the intended users. These users can include stakeholders external to the organization whose capacity is being developed (e.g., ministry officials, industry representatives) (Horton et al., 2003).

- **Cultivate necessary support for the evaluation:** Ensuring commitment to the evaluation and the use of its results—by both internal and external stakeholders—is critical for success of the evaluation. Senior managers, in particular, need to support the use of time and resources for evaluation. Staff members, including support staff, need to be motivated and committed to building their organizations’ futures (Horton et al., 2003).

- **Mobilize adequate resources to carry out the evaluation:** The availability of human and financial resources for the evaluation need to be negotiated in advance. Evaluation specialists from outside the organization can help to design
the study and facilitate the collection and analysis of data. For a participatory evaluation, resources need to be allocated for covering the time of staff members (Horton et al., 2003).

- **Discuss possible results of the evaluation:** This helps stakeholders consider possible actions that might be needed, as well as to sharpen the evaluation questions and methods used (Horton et al., 2003).

- **Agree on basic principles to guide the evaluation:** Basic principles need to be agreed upon in advance to guide the work and to assist in resolving differences of opinion that may arise (Horton et al., 2003).

### 4.2 PRINCIPLES TO GUIDE THE DESIGN OF CAPACITY DEVELOPMENT EVALUATIONS

A set of guiding principles may be defined for planning and implementing evaluations, as well as for assessing the evaluation after its completion. Such principles can ensure the quality and use of capacity development evaluations. These principles can include standards that have been developed by professional evaluation groups. The following list is by no means exhaustive. Any evaluation team will need to establish its own set of guiding principles for a particular evaluation.

- **Utility:** The evaluation should serve the information needs of intended users. A utilization-focused evaluation philosophy encourages the use of the evaluation results by internal and external stakeholders (Joint Committee on Standards for Educational Evaluation, 1994; Horton et al., 2003).

- **Feasibility:** Evaluations should be realistic, prudent, diplomatic, and cost-effective (Joint Committee on Standards for Educational Evaluation, 1994).

- **Propriety, Integrity, and Transparency:** An evaluation should be conducted legally, ethically, and with due regard for the welfare of those involved in the evaluation, as well as those affected by its results (Horton et al., 2003; Joint Committee on Standards for Educational Evaluation, 1994).

- **Accuracy:** An evaluation should provide sound information (i.e., defensible sources, valid and reliable information, justified conclusions, etc., ) on the object of the evaluation (Joint Committee on Standards for Educational Evaluation, 1994).

- **Sensitivity to context:** The changing socioeconomic and political environment, as well as the organizational internal environment, in which organizational operation occurs need to be considered in designing and performing the evaluation. In some cases, an approach that protects anonymity of individuals may be appropriate (Horton et al., 2003).
- **Participation and negotiation:** Internal and external intended users should be involved in the entire cycle of evaluation, from design to implementation to review of results. Users need to develop ownership for the evaluation and need to agree on the steps, as opposed to leaving such decisions up to external experts. Controversy exists over the concept of evaluation as a capacity-building intervention in support of organizational effectiveness because it challenges the view that evaluation should be independent of the thing measured. However, self-assessment approaches, in contrast to external evaluation approaches, have value in evaluating organizational capacity development and can in fact enhance program and organizational outcomes. Advantages over conventional external evaluation include encouraging internal and external actors to gather to discuss and assess their work, stimulating collective reflection and analysis, more effectively identifying strengths and weaknesses, leading to a greater commitment to the results, and applying findings to setting new directions (Horton et al., 2003).

- **Learning by doing:** Every evaluation of a capacity development effort should itself contribute to the capacity development effort and ultimately to the organization’s performance. The main benefit of evaluation may be the individual and organizational learning that takes place while undertaking the evaluation. Participatory approaches help build the evaluation team’s capacity to conduct evaluations (Horton et al., 2003).

- **Iterative approach:** The main benefits to evaluation often come from the process rather than from the results presented in a report. Important questions or issues frequently come to the surface during the process of evaluation that require adjustments in data collection and analysis (Horton et al., 2003).

- **Systematic documentation:** Main decisions taken, questions asked, sources used, and information obtained need to be systematically documented during the evaluation process (Horton et al., 2003).

### 4.3 METHODOLOGICAL CONCEPTS FOR EVALUATING CAPACITY DEVELOPMENT

#### 4.3.1 Methodological Questions

Horton et al. (2003) outline the following set of methodological questions that should be answered before conducting an evaluation:

- **What questions will the evaluation address?** It is important to ensure that evaluation questions are asked, and that they are well formulated and relevant. The list of questions should be reasonable.
• **Who will use the results?** It is important to determine whether the audience is internal or external to the organization, particularly with regard to how sensitive information will be handled.

• **How can a “logic model” or “theory of change” be used to focus the evaluation?** A “theory of change” or “logic model” is a set of logic and assumptions underlying a particular intervention and the results (activities, outputs, outcomes, and long-term impacts) it expects to achieve. Frequently, the national and international partners have different objectives and assumptions that have not been openly discussed and agreed upon.

• **What will be the unit of analysis and scope of the evaluation?** These refer to the boundaries of the evaluation: the coverage of the evaluation (organization, unit within an organization, or system of organizations), the topics addressed, and the time horizon. These may depend on the resources and time available.

• **How can shared understanding and commitment to the evaluation be developed?** Evaluation is a highly sensitive activity, given the involvement of personal and organizational politics and the generally negative connotations most people have of evaluation. Involving stakeholders in the evaluation from the outset, openly discussing issues of capacity development and its evaluation, and validating findings with key stakeholders are approaches that can help to deal with sensitivities, deepen commitments, and promote common understanding of evaluation.

• **How will the process be managed?** The processes need to be facilitated, and roles and responsibilities of those who will supervise the work and deliver products need to be identified. Use of external facilitators or investment in specialized training in facilitation for staff may be required.

• **What information needs to be collected?** It is usually best to collect the smallest amount of information necessary to answer the evaluation questions. Primary information, collected specifically for the evaluation, and secondary information, pre-existing information, may be used as inputs.

• **What tools should be used?** Multiple tools are available for collecting information. A combination of qualitative and quantitative methods may be used. Tools may include:
  - Self-assessment workshops
  - Review of documents
  - Key informant interviews
  - Group interviews: Useful in capturing the consensus of relatively homogeneous groups.
  - Personal histories
  - Evaluation studies or case studies
○ Direct observation: Useful if made by outsiders with comparative experience with similar organizations.
○ Questionnaire surveys: While these are a most frequently suggested tool, they require significant time, resources, and skills in preparation, sampling, administration, management of databases, statistical analysis, research, and other tasks.

- How can the results be cross-checked, triangulated, and validated? These approaches are designed to increase the confidence in results. Using multiple information sources and reviewing findings with stakeholders are approaches to check the consistency of results.

- How should the results be presented? Evaluations need to be presented in a format that is useful to users. Frequent verbal presentations, as opposed to a final written report, may be the main vehicle for learning about the evaluation and its results.

- How can use of the results be encouraged? Evaluation results are just one of many factors influencing decision making. Decision makers’ personal interests, organizational ideologies, history, culture, norms, and other information may also influence decision making. Identifying potential users and involving them in the evaluation process, using participatory self-assessment methods, and using a “learning by doing” approach are key steps in ensuring use of the evaluation conclusions, recommendations, and the evaluation process itself.

4.3.2 Identifying Performance Issues, Strategic Evaluation Questions, and Indicators in Organizational Assessment

A useful theoretical framework for organizational assessment, developed by Universalia Management Group and the International Development Research Center (IDRC) in Canada, defines organizational performance and three levels of factors that can both influence and be influenced by organizational performance: organizational capacity, internal environment or organizational motivation, and the external environment in which the organization operates (Figure 4.1) (Horton et al., 2003; Lusthaus et al., 2002; Lusthaus et al., 1999). Organizational assessment involves evaluation of all four areas.
In the planning stages of evaluation, it is important to identify, across all four areas, where there are issues and to identify the depth of analysis each warrants. Possible areas where issues might occur are listed in Figure 4.1 in the bullets under each heading. Questions can then be developed to guide data collection in the evaluation. These include: 1) **descriptive** questions, eliciting descriptive information about what is happening now 2) **normative** questions, eliciting comparative information between what is observed with what is expected, and 3) **impact** questions, eliciting analysis of causal relationships between observed conditions and interventions. Indicators should be selected once a clear picture of the concept being measured is developed. Organizational performance can be measured using indicators clustered in the following four main issue areas:

- **Effectiveness**: The degree to which the organization achieves its objectives
- **Efficiency**: The degree to which the organization generates products using a minimum of inputs
- **Relevance**: The degree to which the organization’s objectives and activities reflect the necessities and priorities of key stakeholders.
- **Financial sustainability**: The conditions to make an organization financially viable.

Organizations may wish to identify 10–15 key organizational performance indicators that can be regularly monitored, but also other indicators (from the areas of external environment, internal environment/organizational motivation, and organizational
capacity) to help understand performance (e.g., employee morale, timeliness of financial information, economic indicators, absenteeism, and number of new funders) (Lusthaus et al., 1999). Tables C.1.C.2., C.3, and C.4 in Appendix C identify some of the common issues associated with organizational performance, external environment, internal environment/organizational motivation, and organizational capacity and provide sample performance indicators (Lusthaus et al., 1999). Indicators need to be developed that are specific to each organization and its context.

4.3.3 Outcome Mapping

With strong pressure on donors to demonstrate impact and direct attribution, there is often severe limitation of the potential to understand how and why impact occurs. Many donors struggle to measure results and to demonstrate attribution far beyond the reach of their programs, even though impact is rarely achieved by the work of a single donor. This linear, “cause and effect” thinking contradicts the understanding of development as a complex process that occurs in open systems (Earl et al., 2001).

Acknowledging that development is about people relating to each other and to their environments, outcome mapping is a special evaluative methodology that helps development programs plan for and assess the capacities that they are helping to build in the people, groups, and organizations who will ultimately be responsible for improving the well-being of their communities. Outcome mapping focuses on one specific type of result: outcomes as behavioral change. Outcomes are defined as changes in the behavior, relationships, activities, or actions of the people, groups, or organizations with which a program works directly (as opposed to changes in state, e.g., poverty alleviation or reduced hunger). The outcomes can be linked to a program’s activities but not directly caused by them. Partners include those individuals, groups, and organizations directly linked to a program or those where opportunities exist for indirect influence by the program. While recognizing that impact is an ultimate goal toward which programs work, proponents of outcome mapping argue that behavioral changes are correlated to impact. Outcome mapping focuses primarily on providing information that programs require to improve their performance. This methodology is particularly well suited as an evaluation tool for capacity development programs (Earl et al., 2001).

4.4 CASE STUDIES

4.4.1 Strategic Evaluation of IDRC’s Contributions to Capacity Development

In 2005, IDRC conducted a strategic evaluation to investigate the organization’s contributions to the development of capacities among partners in the South (Lusthaus and Neilson, 2005; Neilson and Lusthaus, 2005). The focus was on processes and results of efforts: what capacities have been enhanced, whose, how, and how effectively? IDRC set out to look at the following:

- Who/what are the targets of efforts?
What strategies and methods have been used to support capacity development and how effective are they?
What context and factors affect ability to bring about positive outcomes?
What are the perspectives of southern partners?

IDRC’s methodological approach required balancing coverage across the Centre’s wide range of activities and approaches to capacity development with sufficient depth in selected experiences to provide meaningful information. IDRC also considered the appropriateness of each methodological approach to the topic, the human and financial resources available for the evaluation, and the burden of data collection on Centre partners and staff. The conceptual and methodological design was also informed by a consideration of the literature, of other agencies’ work, and the background studies to this evaluation (Deby, 2005).

The evaluation approach rests on the assumption that capacity development is a complex phenomenon, and sought to accomplish the following:
- Identify the relevant systems in place, and changes within and among these, looking for the interconnections among systems
- Map relationships and how these unfold
- Incorporate different perspectives and points of view on the same phenomena
- Look for dynamics rather than static “results”

This evaluation drew on the “theory of change” concept, but did not adhere to a “theory of change” evaluation model. The IDRC evaluation compared the “espoused theories” (what an organization says it does) to theories of action (capacity development projects and activities (Lusthaus and Nielsen, 2005).

The evaluation was qualitative, using both deductive (i.e., analyzing data according to a pre-established framework and categories) and inductive (i.e., allowing patterns, themes and categories to emerge in the data) approaches. Qualitative evaluation was chosen because of the diversity and variability of cases, outcomes, processes and contexts. The IDRC evaluation used triangulation of sources and methods to enhance rigor.

IDRC’s evaluation sought to understand the perspectives of selected partner organizations regarding their objectives, work, and the resulting changes they experience, identifying actual effects of an intervention, including unintended effects, rather than focusing on the expectations of those who designed the intervention, so-called “goal-free evaluation”. IDRC also wanted to analyze particular approaches (e.g., training, mentoring, and networking) with regard to their contribution to capacity development.

A multi-phased approach was used for the evaluation. First, 8 background studies were carried out, next, an investigation was conducted of how IDRC understands capacity development and how that understanding is operationalized. In subsequent phases, a framework for describing results of capacity development activities was developed and applied to a sample of research projects, 5 case studies were carried out to explore significant issues in greater depth, and an overall analysis was conducted. The evaluation
sample included about 50 projects approved between 2000 and 2005. A “purposeful sampling” approach was employed, in which information-rich cases were selected to generate insights into key issues and into the effectiveness of interventions, rather than generalization to a population (Deby, 2005). Projects were identified through talking with staff and considering work highlighted through background work, and by developing selection criteria. Data sources included documents, interviews with partners and project leaders, and field-based observation of interaction.

A results framework was created using a matrix of the primary outcome areas of capacity building identified empirically (Nielsen and Lusthaus, 2005):

- **Individual Level**: skills, competencies, attitude
- **Organizational Level**: function, process, external legitimacy, internal confidence
- **Networks (regional/global)**: skills, competencies, attitude, external legitimacy
- **State**: policy influence, technology influence, innovation, expanded incentives
- **Societal (users of research, e.g., policymakers, business, advocates)**: Policy influence, technology influence, expanded incentives

by the dominant types of IDRC interventions:

- Education and training
- Mentoring and coaching
- Networking
- Face-to-face interactions.

“Results” of capacity development efforts were defined in “learning outcome” terms, as: changes in awareness, information, knowledge, understanding, confidence, attitudes, motivation, behaviors, policies and practices; and how these changes are enabling the learner(s) to better manage themselves and their environment (Deby, 2005).

### 4.4.2 ISNAR/IDRC Evaluating Capacity Development Project

The International Service for National Agricultural Research (ISNAR) and IDRC collaborated in the development of a project to evaluate capacity development in agricultural R&D organizations, giving rise to the Evaluating Capacity Development (ECD) project (Horton et al., 2003). Six agricultural research capacity development studies formed the core of the project; in each case, an international organization was supporting a capacity development effort in a national organization. Each evaluation team consisted of individuals from the paired organizations. The design and implementation of the project involved managers and evaluators at 12 organizations in Africa, Asia, Europe, North America, and Latin America. The project focused on capacity development in an organizational context, as opposed to capacity development of individuals or of national institutions.

The ECD project set out to answer the following questions:
• What capacities need to be developed in R&D organizations?
• How can capacity development be fostered?
• How should partnerships for capacity development be built?
• How should organizational capacity development efforts be evaluated?
• How can evaluation be used to strengthen capacity and improve an organization’s performance?

A theoretical framework for assessing organizational performance, developed by Universalia Management Group and IDRC in Canada, was used, in which organizational performance—the ability of an organization to meet its goals and achieve its overall missions—is influenced by the organization’s capacity, its internal environment, and by the external environment in which it operates (see Figure 4.1) (Lusthaus et al., 1999; Lusthaus et al., 2002). Organizational performance was measured using the following indicators:

• **Effectiveness:** The degree to which the organization achieves its objectives
• **Efficiency:** The degree to which the organization generates products using a minimum of inputs
• **Relevance:** The degree to which the organization’s objectives and activities reflect the necessities and priorities of key stakeholders.
• **Financial sustainability:** The conditions to make an organization financially viable.

A **utilization-focused approach** was used to encourage the use of evaluation results. **Self-assessment and participatory methodologies** were used in all 6 evaluations in the evaluation design, data collection, and final analysis. This approach had the advantages over conventional external evaluation of encouraging internal and external actors to gather to discuss and assess their work, stimulating collective reflection and analysis, and leading to a greater commitment to the results. A participatory approach also helped build the evaluation team’s capacity to conduct evaluations.

**4.4.3 Evaluation of ATLAS/AFGRAD Program**

An evaluation was commissioned by the US Agency for International Development (USAID) to assess development impact resulting from investments by the agency, over a 40 year period, in US-based graduate training for highly qualified African professionals (Gilboy et al., 2004). The Advanced Training for Leadership and Skills (ATLAS) operated from 1991 to 2003; African Graduate Fellowship Program (AFGRAD) operated from 1963 to 1990. Over the phases of the programs, 3,263 Africans from 52 countries participated in the program.

Impact was broadly defined by the assessment team as: Any change that occurred at the institutional, sectoral, national, or regional level attributed to ATLAS/AFGRAD-sponsored training.
The evaluation team broadened the notion of impact beyond “whether or not the program fulfilled the project’s objectives”. The evaluation looked at all impact, not just using USAID’s narrowly defined indicators. The evaluation did not document negative impacts. The assessment team designed an “impact assessment framework” to focus on those indicators that could reveal characteristics about change.

The assessment employed a modified version of the widely used Kirkpatrick Evaluation Framework, documenting change at the individual level, the institutional level, and at levels beyond the institution. The analysis of the data also followed this framework.

1. **Reaction** - the trainee’s impression of the program; the level of satisfaction with the course, trainer, pace of instruction, content and materials; (INDIVIDUAL)

2. **Learning** - the acquisition of skills and knowledge from the training; (INDIVIDUAL)

3. **Application** - the performance of the trainee on the job following training; (INSTITUTIONAL)

4. **Results** - changes that the trainee’s performance brought to the organization in efficiency, productivity or profitability. (INSTITUTIONAL; COMMUNITY, NATIONAL, SECTORAL, REGIONAL, INTERNATIONAL)

The assessment collected data from the following sources:

- **Participant Survey**: a statistical survey of a weighted randomized sampling of participants (203 completed surveys statistically weighted to represent 60 percent of the total number of program participants, 3,219) that included both quantitative and qualitative data. Quantitative data were stratified to ensure proportional representation by sex, region, and program, and relative standard error was calculated to assess data reliability. Qualitative data were grouped by similarity and ranked by frequency of citation in order to analyze trends.

- **Country Site Visits**: included participatory workshops, individual interviews and selected institutional visits in 7 countries. Before and after interviews with non-participants were conducted to gauge performance changes in participants.

- **Internet Search**: A randomized, statistically based search approach on program participants was conducted.

- **Interviews**: with program management officers, USAID/Washington education specialists, USAID Mission staff, African institutional leaders, and supervisors of participants.

### 4.5 KEY FINDINGS FROM THE REVIEW OF RESEARCH CAPACITY-DEVELOPMENT EVALUATIONS

Looking across those evaluations that have been conducted of research capacity-development efforts, a number of key findings and challenges emerge.

Donors lack a common understanding of capacity development that can help staff in carrying out their work; most donors have conducted in-depth discourse on capacity development (Lusthaus and Neilson, 2005). A wide variety of approaches to capacity
development are used by donors, but little information exists about what mix of activities best supports capacity development; in most cases, interventions are developed opportunistically. Further, inconsistent approaches in categorizing capacity building work make analysis of efforts difficult (Lusthaus and Neilson, 2005).

Most donors focus on “harder”, functional, or technical issues but few focus on “softer”, intangible human issues (e.g., motivation, relationships, legitimacy) (Lusthaus and Neilson, 2005). However, the fact that staff turnover in partner organizations was identified as a major challenge in many evaluations points to the need for capacity development efforts to increasingly address human issues, such as staff motivation and staff retention (Horton et al., 2003; P. Kelley, personal communication). The degree to which individual skills, knowledge, and attitudes are embedded or assimilated in group activities and processes in an organization may be a good indicator for how well such organizations can withstand high rates of staff turnover.

Most donors focus narrowly on changes within the research area and on individual changes rather than changes at the institutional or systems level, even though corporate-level documentation of many donors purports to support institutional capacity development (Lusthaus and Neilson, 2005). Although there is interest among donors in focusing at the organizational level, there is a perception that this involves a greater financial commitment and that professional expertise is lacking to manage such a focus (Lusthaus and Nielson, 2005).

There is inadequate attention paid by donors to M&E activities (Horton et al., 2003). Some donors did not invest in a systematic evaluation, and what evidence is available is anecdotal (A. Hastings, personal communication; Suzanne Grant-Lewis, personal communication; A. Johnson, personal communication). Of those donors that did conduct evaluations of capacity development activities, few are publicly available, so the lessons learned cannot be applied more broadly (Suzanne Grant-Lewis, personal communication, P. Kelley, personal communication). IDRC’s evaluation is fully publicly available, a rare exception. Uneven evaluation approaches in different geographic areas makes comparison difficult (P. Kelley, personal communication). One evaluation did not systematically catalogue negative findings (Gilboy et al., 2004). There is a frequent tendency to overestimate the time and resources available, and to develop complex evaluation plans that later must be simplified (Horton et al., 2003). Finally, donors that designed evaluations before projects were implemented allowed the greatest flexibility in making course corrections through the evaluation process and the greatest opportunities for shared learning (NAS, 2010).

**Literature Cited**


Beintema, N. 2006. Participation of Female Agricultural Scientists in Developing Countries. Washington, DC: IFPRI.


Appendixes

APPENDIX A: SCOPE OF WORK FOR SHORT TERM TECHNICAL ASSISTANCE IN AGRICULTURAL RESEARCH

As part of a new food security initiative, USAID seeks to increase support for agricultural research. Linked to this, the Agency also expects to make investments in strengthening the human and institutional capacity for agricultural research in developing countries. The goal of these investments is to go beyond training scientists, but also tackle the effectiveness of research systems in developing and delivering new technologies and management practices to small-scale producers.

Many factors contribute to the effectiveness of research systems, spanning the individual institutions as well as linkages between them. These may include:

- Linkages between global and national researchers to harness the benefits of global public goods research (e.g. between the CGIAR and NARS).
- Mechanisms that link national research and extension systems to both prioritize research based on the needs of producers and to disseminate technology.
• Systems for transfer of technology from public research to the private sector (e.g. seed industry).
• Establishing strategic priorities that will guide the research agenda, human resources, training, and financial resources.
• Financial management systems to ensure alignment with priorities, timeliness, and consistency needed to support research.
• Aligning and developing human resources (faculty, managers, researchers, students) to support strategic priorities.
• National or institutional policies that related to research or the application of technology.

To explore these issues as they relate to the design of new programs, USAID is seeking a short-term consultant to conduct background research and analysis. The specific tasks for the consultant include:
1. Synthesize the key findings from past assessments and programs on strengthening the capacity of agricultural research institutions in developing countries that address the issues listed above.
2. Summarize the range of programmatic approaches to institutional development, including any opportunities, constraints, or contextual considerations associated with different approaches.
3. Summarize the range of programmatic options for medium and long-term training of researchers, highlighting any cost and effectiveness or contextual issues associated with different approaches.
4. Provide recommendations on possible indicators for assessing or monitoring training and institutional development programs. This includes milestone (e.g. outputs and outcomes) as well as impact indicators.
5. Participate in meetings with USAID and external experts for the purpose of discussing priorities and programmatic options for strengthening human and institutional capacity.

USAID will support any travel associated with this consultancy. The estimated level of effort for this contract is sixty days over the course of three months.

Qualifications:
1. A masters or PhD in an area of agricultural research.
2. At least ten years experience with international agricultural research, including familiarity with global institutions (e.g. World Bank, CGIAR), national agricultural research systems, and the US land-grant university system.
3. Excellent written communication skills as evident by a publication record or recent writing sample.

APPENDIX B: ABBREVIATIONS AND ACRONYMS

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AAC</td>
<td>African Agricultural Capital</td>
</tr>
<tr>
<td>AARINENA</td>
<td>Association of Agricultural Research Institutes in the Near East and North Africa</td>
</tr>
<tr>
<td>AATF</td>
<td>African Agricultural Technology Foundation</td>
</tr>
<tr>
<td>Acronym</td>
<td>Description</td>
</tr>
<tr>
<td>---------</td>
<td>-------------</td>
</tr>
<tr>
<td>ACARE</td>
<td>African Centers of Agricultural Research Excellence</td>
</tr>
<tr>
<td>ADC</td>
<td>Agricultural Development Council</td>
</tr>
<tr>
<td>AERC</td>
<td>African Economic Research Consortium</td>
</tr>
<tr>
<td>AFGRAD</td>
<td>African Graduate Fellowship Program</td>
</tr>
<tr>
<td>AFNNET</td>
<td>African Natural Products Network, RISE</td>
</tr>
<tr>
<td>AfNOG</td>
<td>African Network Operators Group</td>
</tr>
<tr>
<td>AGORA</td>
<td>Access to Global Online Research in Agriculture</td>
</tr>
<tr>
<td>AGRA</td>
<td>Alliance for a Green Revolution in Africa</td>
</tr>
<tr>
<td>AGROCURI</td>
<td>Agricultural Open Curriculum and Learning Initiative</td>
</tr>
<tr>
<td>AITRP</td>
<td>AIDS International Training and Research Program</td>
</tr>
<tr>
<td>AMMSI</td>
<td>African Mathematics Millennium Science Initiative</td>
</tr>
<tr>
<td>AMMSEN</td>
<td>African Materials Science and Engineering Network, RISE</td>
</tr>
<tr>
<td>ANAFE</td>
<td>African Network for Agriculture, Agroforestry, and Natural Resources Education</td>
</tr>
<tr>
<td>ARS</td>
<td>Agricultural Research Service, US Department of Agriculture</td>
</tr>
<tr>
<td>ASADI</td>
<td>African Science Academy Development Initiative</td>
</tr>
<tr>
<td>ASARECA</td>
<td>Association for Strengthening Agricultural Research in Central and Eastern Africa</td>
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<tr>
<td>ASIESA</td>
<td>Alliance for the Seed Industry in East and Southern Africa</td>
</tr>
<tr>
<td>ASTA</td>
<td>African Seed Trade Alliance</td>
</tr>
<tr>
<td>ASTI</td>
<td>Agricultural Science and Technology Indicators</td>
</tr>
<tr>
<td>ATLAS</td>
<td>Advanced Training for Leadership and Skills Program</td>
</tr>
<tr>
<td>ATMA</td>
<td>Agricultural Technology Management Agency, India</td>
</tr>
<tr>
<td>AVU</td>
<td>African Virtual University</td>
</tr>
<tr>
<td>AWARD</td>
<td>African Women in Agricultural Research and Development</td>
</tr>
<tr>
<td>BASIC</td>
<td>Building Africa’s Scientific and Institutional Capacity</td>
</tr>
<tr>
<td>BIFAD</td>
<td>Board on International Food and Agricultural Development</td>
</tr>
<tr>
<td>CAADP</td>
<td>Comprehensive Africa Agriculture Development Program</td>
</tr>
<tr>
<td>CAB</td>
<td>Commonwealth Agricultural Bureaux (CAB International)</td>
</tr>
<tr>
<td>CARTA</td>
<td>Consortium for Advanced Research Training in Africa, Wellcome Trust African Institutions Initiative</td>
</tr>
<tr>
<td>CET</td>
<td>Center for Educational Technology, University of Cape Town</td>
</tr>
<tr>
<td>CGIAR</td>
<td>Consultative Group on International Agricultural Research</td>
</tr>
<tr>
<td>CIAT TBSF</td>
<td>International Center for Tropical Agriculture Tropical Soil Biology and Fertility Institute</td>
</tr>
<tr>
<td>CIDA</td>
<td>Canadian International Development Agency</td>
</tr>
<tr>
<td>CIPs</td>
<td>Country Investment Plans</td>
</tr>
<tr>
<td>CIMMYT</td>
<td>International Center for the Improvement of Maize and Wheat</td>
</tr>
<tr>
<td>CMAAEE</td>
<td>Collaborative Master’s Program in Agricultural and Applied Economics</td>
</tr>
<tr>
<td>CNFA</td>
<td>Citizens’ Network for Foreign Affairs</td>
</tr>
<tr>
<td>COMESA</td>
<td>Common Market for East and Southern Africa</td>
</tr>
<tr>
<td>CORAF/WECARD</td>
<td>West and Central African Council for Agricultural Research and Development</td>
</tr>
<tr>
<td>CRC</td>
<td>Cooperative Research Center, Australia</td>
</tr>
<tr>
<td>CRSPs</td>
<td>Collaborative Research Support Programs</td>
</tr>
<tr>
<td>Abbreviation</td>
<td>Full Form</td>
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<tr>
<td>--------------</td>
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</tr>
<tr>
<td>CSIRO</td>
<td>Commonwealth Scientific and Industrial Research Organization, Australia</td>
</tr>
<tr>
<td>ECD</td>
<td>Evaluating Capacity Development Project, IDRC/ISNAR</td>
</tr>
<tr>
<td>ECOWAS/UEMOA</td>
<td>Economic Community of West African States</td>
</tr>
<tr>
<td>EMBRAPA</td>
<td>Brazilian Agricultural Research Corporation</td>
</tr>
<tr>
<td>FAO</td>
<td>United Nations Food and Agricultural Organization</td>
</tr>
<tr>
<td>FARA</td>
<td>Forum for Agricultural Research in Africa</td>
</tr>
<tr>
<td>FAS</td>
<td>Foreign Agricultural Service, US Department of Agriculture</td>
</tr>
<tr>
<td>FIC</td>
<td>Fogarty International Center, National Institutes of Health</td>
</tr>
<tr>
<td>FTE</td>
<td>Full-time equivalent</td>
</tr>
<tr>
<td>GHFSI</td>
<td>Global Hunger and Food Security Initiative</td>
</tr>
<tr>
<td>GNI</td>
<td>Gross National Income</td>
</tr>
<tr>
<td>GNP</td>
<td>Gross National Product</td>
</tr>
<tr>
<td>GO-FAU</td>
<td>Global Open Food and Agriculture University</td>
</tr>
<tr>
<td>GRIN</td>
<td>Germplasm Resources Information Network</td>
</tr>
<tr>
<td>HDI</td>
<td>Human Development Index, United Nations</td>
</tr>
<tr>
<td>HERS-SA</td>
<td>Higher Education Resource Services-South Africa</td>
</tr>
<tr>
<td>HICD</td>
<td>Human and Institutional Capacity Development</td>
</tr>
<tr>
<td>HINARI</td>
<td>Health Inter Network Access to Research Initiative</td>
</tr>
<tr>
<td>HIV/AIDS</td>
<td>Human Immunodeficiency Virus/Acquired Immunodeficiency Syndrome</td>
</tr>
<tr>
<td>IAC</td>
<td>Inter Academy Council</td>
</tr>
<tr>
<td>IAER</td>
<td>US-Iraq Agricultural Extension Revitalization</td>
</tr>
<tr>
<td>IARCs</td>
<td>International Agricultural Research Centers</td>
</tr>
<tr>
<td>ICAR</td>
<td>Indian Council for Agricultural Research</td>
</tr>
<tr>
<td>ICARDA</td>
<td>International Center for Agricultural Research in the Dry Areas</td>
</tr>
<tr>
<td>ICRAF</td>
<td>International Center for Research in Agroforestry</td>
</tr>
<tr>
<td>ICRISAT</td>
<td>International Crop Research Institute for the Semi-Arid Tropics</td>
</tr>
<tr>
<td>ICSU</td>
<td>International Council for Science</td>
</tr>
<tr>
<td>ICT</td>
<td>Information and Communications Technologies</td>
</tr>
<tr>
<td>IDRC</td>
<td>International Development Research Council</td>
</tr>
<tr>
<td>IFPRI</td>
<td>International Food Policy Research Institute</td>
</tr>
<tr>
<td>IIDP</td>
<td>Research Institute for Infectious Disease of Poverty, Wellcome Trust African Institutions Initiative</td>
</tr>
<tr>
<td>INASP</td>
<td>International Network for the Availability of Scientific Publications</td>
</tr>
<tr>
<td>INM</td>
<td>Integrated Nutrient Management</td>
</tr>
<tr>
<td>IPGRI</td>
<td>International Plant Genetic Resources Institute</td>
</tr>
<tr>
<td>IPM</td>
<td>Integrated Pest Management</td>
</tr>
<tr>
<td>IP</td>
<td>Intellectual Property</td>
</tr>
<tr>
<td>IPR</td>
<td>Intellectual Property Rights</td>
</tr>
<tr>
<td>IRRI</td>
<td>International Rice Research Institute</td>
</tr>
<tr>
<td>ISNAR</td>
<td>International Service for National Agricultural Research</td>
</tr>
<tr>
<td>IT</td>
<td>Information Technology</td>
</tr>
<tr>
<td>KARI</td>
<td>Kenyan Agricultural Research Institute</td>
</tr>
<tr>
<td>KENET</td>
<td>Kenya Education Network</td>
</tr>
<tr>
<td>Abbreviation</td>
<td>Full Form</td>
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<tr>
<td>--------------</td>
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</tr>
<tr>
<td>LEWS</td>
<td>Livestock Early Warning System</td>
</tr>
<tr>
<td>LMICs</td>
<td>Low- and Middle-income countries</td>
</tr>
<tr>
<td>MANAGE</td>
<td>Indian National Institute of Agricultural Extension Management</td>
</tr>
<tr>
<td>M&amp;E</td>
<td>Monitoring and Evaluation</td>
</tr>
<tr>
<td>MFPED</td>
<td>Uganda Ministry of Finance, Planning, and Economic Development</td>
</tr>
<tr>
<td>MIT</td>
<td>Massachusetts Institute of Technology</td>
</tr>
<tr>
<td>MOA</td>
<td>Ministry of Agriculture, Iraq</td>
</tr>
<tr>
<td>MOHE</td>
<td>Ministry of Higher Education, Iraq</td>
</tr>
<tr>
<td>MOU</td>
<td>Memorandum of Understanding</td>
</tr>
<tr>
<td>MOWRI</td>
<td>Ministry of Water Resources and Irrigation, Iraq</td>
</tr>
<tr>
<td>MSI/ICM</td>
<td>Millennium Science Initiative</td>
</tr>
<tr>
<td>NARIs</td>
<td>National Agricultural Research Institutes</td>
</tr>
<tr>
<td>NARS</td>
<td>National Agricultural Research Systems</td>
</tr>
<tr>
<td>NAS</td>
<td>National Academy of Sciences</td>
</tr>
<tr>
<td>NASS</td>
<td>National Agricultural Statistics Service, US Department of Agriculture</td>
</tr>
<tr>
<td>NEPAD</td>
<td>New Partnerships for African Development</td>
</tr>
<tr>
<td>NERICA</td>
<td>New Rice for Africa</td>
</tr>
<tr>
<td>NGOs</td>
<td>Non-governmental organizations</td>
</tr>
<tr>
<td>NIFA</td>
<td>National Institute for Food and Agriculture, USDA</td>
</tr>
<tr>
<td>NIH</td>
<td>US National Institutes of Health</td>
</tr>
<tr>
<td>NRENs</td>
<td>National Research and Education Networks, South Africa</td>
</tr>
<tr>
<td>NSF</td>
<td>National Science Foundation, USA</td>
</tr>
<tr>
<td>OECD/DAC</td>
<td>Organization for Economic Cooperation and Development/Development Assistance Committee</td>
</tr>
<tr>
<td>PDF</td>
<td>Portable Document Format</td>
</tr>
<tr>
<td>PERii</td>
<td>Program for the Enhancement of Research Information (INASP)</td>
</tr>
<tr>
<td>PHEA</td>
<td>Partnership for Higher Education in Africa</td>
</tr>
<tr>
<td>PIs</td>
<td>Principal investigators</td>
</tr>
<tr>
<td>PPP</td>
<td>Purchasing Power Parity</td>
</tr>
<tr>
<td>PRSPPs</td>
<td>Poverty Reduction Strategy Papers</td>
</tr>
<tr>
<td>R&amp;D</td>
<td>Research and Development</td>
</tr>
<tr>
<td>RISE</td>
<td>Regional Initiative in Science and Education</td>
</tr>
<tr>
<td>ROPPA</td>
<td>West African Network of Farmer Organizations and Agricultural Producers</td>
</tr>
<tr>
<td>RUFORUM</td>
<td>Regional Universities Forum for Capacity Building in Agriculture</td>
</tr>
<tr>
<td>SABINA</td>
<td>Southern African Biochemistry and Informatics for Natural Products, RISE</td>
</tr>
<tr>
<td>SACCAR</td>
<td>Southern African Center for Cooperation in Agricultural Research</td>
</tr>
<tr>
<td>SACIDS</td>
<td>One Medicine Africa-UK Research Capacity Development Partnership Program for Infectious Diseases in Southern Africa, Wellcome Trust African Institutions Initiative</td>
</tr>
<tr>
<td>SACORE</td>
<td>Southern Africa Consortium for Research Excellence, Wellcome Trust African Institutions Initiative</td>
</tr>
<tr>
<td>SADAOC</td>
<td>Sustainable Food Security in West and Central Africa</td>
</tr>
<tr>
<td>Acronym</td>
<td>Full Form</td>
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<tr>
<td>---------</td>
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</tr>
<tr>
<td>SADC</td>
<td>Southern African Development Community</td>
</tr>
<tr>
<td>SAIDE</td>
<td>South African Institute for Distance Education</td>
</tr>
<tr>
<td>SAUs</td>
<td>India’s State Agricultural Universities</td>
</tr>
<tr>
<td>SIDA</td>
<td>Swedish International Development Agency</td>
</tr>
<tr>
<td>SIG</td>
<td>Science Initiative Group</td>
</tr>
<tr>
<td>SISERA</td>
<td>Secretariat for Institutional Support for Economic Research in Africa</td>
</tr>
<tr>
<td>SNOW</td>
<td>Strengthening Research Capacity in Environmental Health, Wellcome Trust African Institutions Initiative</td>
</tr>
<tr>
<td>SSAWRN</td>
<td>Sub-Saharan Africa Water Resources Network, RISE</td>
</tr>
<tr>
<td>S&amp;T</td>
<td>Science and Technology</td>
</tr>
<tr>
<td>STI</td>
<td>Science, Technology, and Innovation Program, World Bank</td>
</tr>
<tr>
<td>SWAps</td>
<td>Sector-wide Approaches</td>
</tr>
<tr>
<td>SWOT</td>
<td>Strengths, Weaknesses, Opportunities and Threats</td>
</tr>
<tr>
<td>TEEAL</td>
<td>The Essential Electronic Agricultural Library</td>
</tr>
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<td>TENET</td>
<td>Tertiary Education Network, South Africa</td>
</tr>
<tr>
<td>THRiVE</td>
<td>Training Health Researchers into Vocational Excellence in East Africa, Wellcome Trust African Institutions Initiative</td>
</tr>
<tr>
<td>UGL</td>
<td>University of Ghana, Legon</td>
</tr>
<tr>
<td>UNCST</td>
<td>Uganda National Council for Science and Technology</td>
</tr>
<tr>
<td>UNCTAD</td>
<td>United Nations Conference on Trade and Development</td>
</tr>
<tr>
<td>UNDP</td>
<td>United Nations Development Program</td>
</tr>
<tr>
<td>UNESCO</td>
<td>United Nations Educational, Scientific, and Cultural Organization</td>
</tr>
<tr>
<td>USAID</td>
<td>US Agency for International Development</td>
</tr>
<tr>
<td>USDA</td>
<td>US Department of Agriculture</td>
</tr>
<tr>
<td>USHEPiA</td>
<td>University Science, Humanities, and Engineering Partnerships in Africa</td>
</tr>
<tr>
<td>WACCI</td>
<td>West Africa Center for Crop Improvement</td>
</tr>
<tr>
<td>WIO</td>
<td>Western Indian Ocean Regional Initiative in Marine Science and Education, RISE</td>
</tr>
<tr>
<td>WTO</td>
<td>World Trade Organization</td>
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</tbody>
</table>
APPENDIX C: ASSESSING ORGANIZATIONAL PERFORMANCE

The following tables are reproduced from Lusthaus et al., 1999, Enhancing Organizational Performance: A Toolbox for Self-Assessment. The tables outline possible issues associated with organizational performance and the factors that influence, and are influenced by, organizational performance: external environment, internal environment, and organizational capacity. The issues identified can serve as a basis for developing evaluation indicators specific to particular organizations across all four areas.

Table C.1: Assessing Organizational Performance: Selected Issues and Indicators

<table>
<thead>
<tr>
<th>Performance Area</th>
<th>Possible Issues</th>
<th>Sample Indicators</th>
</tr>
</thead>
</table>
| **Effectiveness** | - The charter, mission statement, and other documents provide the raison d’être for the organization  
- The mission is known and agreed to by staff  
- The mission is operationalized through program goals, objectives, and activities  
- Quantitative and qualitative indicators are used to capture the essence of the mission  
- A system is in place to measure effectiveness  
- The organization monitors organizational effectiveness  
- The organization uses feedback to improve itself | - Number of clients served  
- Quality of services or products  
- Change with respect to equality  
- Environmental changes  
- Quality-of-life changes  
- Service access and usage  
- Knowledge generation and use  
- Collaborative arrangements  
- Demand for policy or technical advice from stakeholders  
- Replication of the organization’s programs by stakeholders  
- Growth indicators in terms of coverage of |
### Efficiency
- Staff members are used by the organization to the best of their abilities
- Maximal use is made of physical facilities
- Optimal use is made of financial resources
- The administrative system provides good value for cost
- High-quality administrative systems are in place (financial, human resources, programs, strategy, etc.) to support the efficiency of the organization.
- Benchmark comparisons are made of the progress achieved in the organization.

### Relevance
- Regular program revisions reflect changing environment and capacities
- The mission is undergoing review
- Stakeholder needs assessments are conducted regularly
- The organization regularly monitors its reputation
- The organization creates or adapts to new technologies
- Innovation is encouraged
- The organization regularly undertakes role analyses

### programs, services, clients, and funding
- Cost per program
- Cost per client served
- Cost-benefit of programs
- Output per staff
- Employee absenteeism and turnover rates
- Program-completion rates
- Overhead- total program cost
- Frequency of system breakdowns
- Timeliness of service delivery

### Stakeholder satisfaction (clients, donors, etc.)
- Number of new programs and services
- Changes in partner attitudes
- Changes in role
- Changes in funders (quality and quantity)
- Changes in reputation among peer organizations
- Changes in reputation among key stakeholders
- Stakeholders' acceptance of programs and services
### Financial Viability

<table>
<thead>
<tr>
<th>Area</th>
<th>Issues</th>
<th>Area</th>
<th>Issues</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>- Existing funding sources offer sustained support</td>
<td>- Changes to net operating capital over 3 years</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- The organization consistently obtains new funding sources</td>
<td>- Ratio of largest funder to overall revenues</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- The organization consistently has more revenue than expenses</td>
<td>- Ratio of cash to deferred revenues</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Assets are greater than liabilities</td>
<td>- Ratio of current assets to current liabilities</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- The organization keeps a reasonable surplus of money for use during difficult times</td>
<td>- Ratio of total assets to total liabilities</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- The organization monitors finances on a regular basis</td>
<td>- Growth in terms of number of funders, amount of resources mobilized, assets, capital, and revenues</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Capital assets and depreciation are monitored</td>
<td>- Levels of diversification of funding sources</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- The organization does not depend on a single source of funding</td>
<td>- Partners hired to provide services on a regular basis</td>
<td></td>
</tr>
</tbody>
</table>

*Source: Lusthaus et al. 1999*

**Table C.2: Assessing Issues Associated with the External Environment: Selected Examples**
<table>
<thead>
<tr>
<th>Administrative Environment</th>
<th>Extent to which:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>• Organization is influenced by rules of other organizations, institutions, and groups to which it relates or might be expected to relate</td>
</tr>
<tr>
<td></td>
<td>• Organization is influenced by expectations of consumers, policymakers, suppliers, competitors, and other organizations</td>
</tr>
<tr>
<td></td>
<td>• Organization’s objectives and activities are influenced by government, donors and other organizations</td>
</tr>
<tr>
<td></td>
<td>• Organization is influenced by important sector rules and regulations</td>
</tr>
<tr>
<td></td>
<td>• Organization is influenced by administrative norms and values in the country</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Legal Environment</th>
<th>Extent to which:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>• Laws in country support organization</td>
</tr>
<tr>
<td></td>
<td>• Legal framework supports the organization’s autonomy</td>
</tr>
<tr>
<td></td>
<td>• The legal framework is clear</td>
</tr>
<tr>
<td></td>
<td>• The legal framework is consistent with current practice</td>
</tr>
<tr>
<td></td>
<td>• The legal framework is conducive to organization’s work</td>
</tr>
<tr>
<td></td>
<td>• The organization monitors changes in the legal context which could affect the organization</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Political Environment</th>
<th>Extent to which:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>• Political and ideological trends of government support the organization’s work</td>
</tr>
<tr>
<td></td>
<td>• The government system facilitates collaborative arrangements</td>
</tr>
<tr>
<td></td>
<td>• The organization plays a role in national or sector development</td>
</tr>
<tr>
<td></td>
<td>• The organization has access to government funding</td>
</tr>
<tr>
<td></td>
<td>• The organization has access to international funding</td>
</tr>
<tr>
<td>Environment</td>
<td>Description</td>
</tr>
<tr>
<td>----------------------</td>
<td>------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
</tbody>
</table>
| Sociocultural        | The organization has access to the government’s knowledge and publications  
Government’s policies and programs support the organization  
Equity in the workplace is a social value  
The organization accounts for the effect of culture on program complexity  
Values found in the socio-cultural environment support the work of the organization  
The organization has access to a pool of capable human resources to recruit staff  
The organization analyzes and links demographic trends to its work |
| Economic             | The government’s economic policy supports the organization’s ability to acquire technologies and financial resources  
Money is available to do the organization’s work  
The organization is supported by donors |
| Technological         | Adequate physical infrastructure (power, telecommunication, transport) is in place to support the organization’s work  
Technology needed for organization’s work is supported by the overall level of national-technology development  
The government system facilitates the organization’s process for acquiring needed technology.  
The level of human-resource development in the organization is adequate to support new technology |
| Stakeholder          | Community is involved in the organization |
- Partners are involved in the organization
- Governments value the organization’s products and services
- Governments request or use the organization’s products and services?
- Similar organizations compete or cooperate with the organization
- Donors influence the organization
- Funders support the organization

<table>
<thead>
<tr>
<th>Area</th>
<th>Issues</th>
</tr>
</thead>
<tbody>
<tr>
<td>History Issues</td>
<td>Memorable events in organization’s history: milestones, successes, crises</td>
</tr>
<tr>
<td>Mission Issues</td>
<td>Extent to which</td>
</tr>
<tr>
<td></td>
<td>- A mission drives the behavior off the organization’s members</td>
</tr>
<tr>
<td></td>
<td>- The organization’s mission is related to its goals</td>
</tr>
<tr>
<td></td>
<td>- The organization’s members have accepted its mission and feel they can ascribe to it</td>
</tr>
<tr>
<td></td>
<td>- The mission is updated and linked to a set of goals</td>
</tr>
<tr>
<td></td>
<td>- The key values and beliefs driving members’ behavior are linked to the mission</td>
</tr>
<tr>
<td></td>
<td>- New staff embrace the mission</td>
</tr>
<tr>
<td>Culture Issues</td>
<td>Documents outline the organization’s values</td>
</tr>
<tr>
<td></td>
<td>- The people in the organization identify with the organization’s values</td>
</tr>
<tr>
<td></td>
<td>- People have good morale in the organization</td>
</tr>
</tbody>
</table>
People have a high level of commitment to performance in the organization
People in the organization have a positive attitude toward change
Functioning systems are in place to reinforce the organization’s values, such as those for promotions, incentives and training
People in the organization exhibit good will toward each other

Incentives

- People feel they are rewarded for their work
- People are adequately compensated
- Nonmonetary rewards support good behavior
- The incentive system is adequately managed
- The incentive system is under ongoing review
- People are equitably treated in the organization
- The organization is consistent between what it rewards people for and what it says it will reward people for

Table C.4: Assessing Issues Associated with the Organizational Capacity: Selected Examples

<table>
<thead>
<tr>
<th>Area</th>
<th>Components</th>
<th>Issues</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strategic leadership</td>
<td>Leadership</td>
<td>The extent to which:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- People have goals</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Responsibilities for leadership and decision making are known and distributed appropriately</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- The leaders in the organization are concerned to get significant tasks done well</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- The leaders in the organization are respected</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Staff members are willing to take on leadership</td>
</tr>
<tr>
<td>Strategic Planning</td>
<td>The extent to which:</td>
<td></td>
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<tr>
<td>--------------------</td>
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<td></td>
</tr>
<tr>
<td></td>
<td>The organization has a strategic plan</td>
<td></td>
</tr>
<tr>
<td></td>
<td>The strategy is known to the Board of Directors, senior managers, researchers, and other staff</td>
<td></td>
</tr>
<tr>
<td></td>
<td>People in the organization generally accept and support the strategy</td>
<td></td>
</tr>
<tr>
<td></td>
<td>The strategy has helped to clarify priorities, thus giving the organization a way to assess its performance</td>
<td></td>
</tr>
<tr>
<td></td>
<td>The strategy is used to make decisions</td>
<td></td>
</tr>
<tr>
<td></td>
<td>The strategy improves performance</td>
<td></td>
</tr>
<tr>
<td></td>
<td>The strategy supports equity</td>
<td></td>
</tr>
<tr>
<td></td>
<td>The strategy helps the organization use resources optimally</td>
<td></td>
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<tr>
<td></td>
<td>The organization has a process for understanding its clients and users, for clarifying and revising its mission and beliefs, and for working to achieve its goals</td>
<td></td>
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<tr>
<td></td>
<td>The organization has a process for scanning the environment to consider potential threats and opportunities</td>
<td></td>
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<tr>
<td></td>
<td>The organizational strategy helps the organization to identify its opportunities and constraints in</td>
<td></td>
</tr>
</tbody>
</table>
| Terms of Financial Resources and Infrastructure | terms of financial resources and infrastructure  
- A process for monitoring the application of the strategy is in place  
- A similar process for understanding client and stakeholder requirements and changes is in place  
- The organization has a process for ongoing review and updating of its strategy to reflect internal and external realities |
| Governance | The extent to which:  
- The governing structure both clarifies and supports the organization’s direction  
- A charter provides an adequate framework for carrying out the mission of the organization and for dealing with external challenges to the organization  
- The governing body scans the external and internal environments to understand forces affecting the organization  
- The governing body responds appropriately to important environmental trends and influences, whether social, political, or economic. For example, both quality and equality issues are reflected in the minutes and discussion. The governing body supports the principle of equity.  
- The governing body operates effectively and efficiently |
| Organizational Structure | The extent to which:  
- The organization’s structures support its mission and goals  
- The roles within the organization are clearly defined but flexible enough to adapt to changing needs  
- Department lines or divisions between groups are crossed easily, particularly when collaboration means an improved product, program, or service  
- Structural authority is used to further equity  
- Staff members have linkages with, and access to, other units in the organization important to their work |
| Niche Management | The extent to which:  
|                 | - The organization’s constituents (stakeholders) understand its role or area of specialization  
|                 | - The role of the organization is clearly defined in its mission  
|                 | - The areas of specialization are clear  
|                 | - Stakeholders support the areas of specialization  
|                 | - The organization undertakes research and development that strengthens its unique role  |
| Human resources Planning | The extent to which:  
|                 | - The right people are in the right jobs in the organization  
|                 | - The organization can forecast current and future demands for human resources  
|                 | - The organization knows how and where to find the people with the skills needed to fill its needs  
|                 | - The organization can link its mission and goals to its human-resource planning  |
| Staffing | The extent to which:  
| --- | ---  
| | The organization has a staffing system  
| | The organization has appropriate job descriptions or equivalents to determine the positions it is staffing for  
| | The organization has an appropriate system for selecting candidates (for example, reviewing CVs, conducting interviews, checking references)  
| | Individuals in charge of selection are appropriately trained to carry out this function (interviewing and listening skills, politeness, good judgment)  
| | Recruitment and selection materials (advertisements, postings, interview questions) are neutral, free of discriminating elements (gender, religious, etc.)  
| | Someone who is familiar with the day-to-day functioning of the organization is available to orient new staff members  
| Development | The extent to which:  
| --- | ---  
| | The organization has a policy for training and development, as well as a budget for training  
| | The organization encourages staff members to continue to learn and develop (by providing incentives for learning, by paying training costs, etc.)  
| | Someone in the organization can identify training needs  
| | The organization supports application and transfer of new learning on the job  
| | Training is demand driven (by the organization’s needs) as opposed to supply driven (by donors or by the market)  
| | The organization can and does assess training and its effects on the organization’s performance  
| | The organization has plans for mentoring younger staff members to help them advance in their careers  
<p>| | The organization has developed a personnel-policy manual |</p>
<table>
<thead>
<tr>
<th>Assessments and Rewards</th>
<th>The extent to which:</th>
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<tbody>
<tr>
<td></td>
<td>- The organization has a compensation policy that complies with the rules and regulations of the country</td>
</tr>
<tr>
<td></td>
<td>- Staff members see an adequate correlation between compensation and performance</td>
</tr>
<tr>
<td></td>
<td>- Staff members are generally satisfied with their compensation</td>
</tr>
<tr>
<td></td>
<td>- Compensation packages are externally competitive for the sector</td>
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<td></td>
<td>- The organization maintains internal equity of salaries and benefits (i.e., equal compensation for work of equal value)</td>
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<td></td>
<td>- Compensation differentials are appropriate to motivate staff</td>
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<tr>
<td></td>
<td>- The organization motivates staff with both monetary and non-monetary rewards</td>
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<thead>
<tr>
<th>Human Resource Relations</th>
<th>The extent to which:</th>
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<tbody>
<tr>
<td></td>
<td>- People in the organization feel protected from exploitation (through a collective agreement or through an appropriate set of personnel policies)</td>
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<tr>
<td></td>
<td>- Measures and procedures are established in the organization for dealing with people in emotional or physical distress</td>
</tr>
<tr>
<td></td>
<td>- The organization seeks ways to increase the loyalty and the commitment of the staff</td>
</tr>
<tr>
<td></td>
<td>- Morale in the organization is generally good</td>
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<tr>
<td></td>
<td>- The organization has measures in place for dealing with harassment in the workplace</td>
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<tr>
<td></td>
<td>- The organization has, if appropriate, a health and safety policy</td>
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<tr>
<td>Financial management</td>
<td>Financial planning</td>
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<table>
<thead>
<tr>
<th>Financial accountability</th>
<th>The extent to which:</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>• The auditors of the organization are satisfied with the financial managers’ controls of cash and assets</td>
</tr>
<tr>
<td></td>
<td>• The year-end date is clearly stated</td>
</tr>
<tr>
<td></td>
<td>• The Board of Directors reviews financial statements on a regular basis</td>
</tr>
<tr>
<td></td>
<td>• People on staff and the Board of Directors are competent to interpret financial information</td>
</tr>
<tr>
<td></td>
<td>• Financial information is contextualized in a strategic or business plan</td>
</tr>
<tr>
<td></td>
<td>• The Board of Directors establishes a committee to oversee financial issues</td>
</tr>
</tbody>
</table>
| Financial statements and systems | The extent to which:  
  - The organization has an adequate bookkeeping system  
  - The organization has adequate staff to record financial information  
  - Balance sheets and income and expense statements are prepared at least quarterly  
  - A procedure is in place to control and record the assets of the organization  
  - Cash-flow statements are prepared  
  - Cash is managed to allow the organization to benefit from a surplus and minimize the costs of cash shortages. |
| --- | --- |
| Infrastructure | Facilities | The extent to which:  
  - The organizational strategy identifies opportunities and constraints stemming from the facilities infrastructure  
  - The buildings and internal services (for example, water, electricity) are adequate to support and facilitate daily work  
  - Employees have an adequate transportation system to and from work  
  - Communications (hardware) function at the levels required  
  - An ongoing maintenance budget supports adequate maintenance systems and procedures  
  - The organization effectively and efficiently manages the infrastructure, including building and equipment maintenance  
  - An individual or a group within the organization is responsible for adequate planning to address ongoing infrastructure needs |
| Technology | The extent to which:  
  - Technological planning in the organization is adequate  
  - Overall, the organization’s level of technology is appropriate to carry out the organization’s... |
<table>
<thead>
<tr>
<th>Program Management</th>
<th>Planning</th>
<th>Implementation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>• The extent to which:</td>
<td>• The extent to which:</td>
</tr>
<tr>
<td></td>
<td>• Each program area and each major project has a written plan</td>
<td>• Staff support the organization’s efforts to get programs accomplished and to get products and</td>
</tr>
<tr>
<td></td>
<td>• Program and project plans are linked to the organization’s mission</td>
<td>services provided and to achieve objectives.</td>
</tr>
<tr>
<td></td>
<td>• The organization undertakes adequate program-planning and budget-programming activities to ensure that its programs support its mission</td>
<td>• A procedure is outlined to monitor results.</td>
</tr>
<tr>
<td></td>
<td>• The organization’s programs and projects are consistent with its mission, needs, strategies, and priorities</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Program planning takes into account technological, economic, gender, social, and environmental aspects to ensure the applicability of programs</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Programs are given adequate timelines</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Programs have adequate budgets</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Program planning includes an adequate analysis of roles and responsibilities</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• A procedure is outlined to monitor results.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>functions</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• No one unit is seriously lagging behind the others in the level of technology needed to carry out its work</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Access to international information is provided to all units through library and information-management systems</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Adequate systems and training are in place to manage the organization’s technology</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Adequate information technologies are in place to manage the organization</td>
<td></td>
</tr>
<tr>
<td>Monitoring and Evaluation</td>
<td>The extent to which:</td>
<td></td>
</tr>
<tr>
<td>--------------------------</td>
<td>---------------------</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Monitoring and evaluation systems are in place</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Program staff receive feedback on program performance</td>
<td></td>
</tr>
<tr>
<td></td>
<td>The monitoring and evaluation process includes adequate opportunities to clarify roles and responsibilities</td>
<td></td>
</tr>
<tr>
<td></td>
<td>The process includes adequate opportunities to review program indicators to measure progress against plans</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Timelines are monitored to reduce overruns</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Budgets are reviewed in a timely fashion</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Programs are reviewed on a regular basis to determine how well they contribute to the organization’s overall strategy</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Drawing lessons is encouraged</td>
<td></td>
</tr>
</tbody>
</table>

services to clients and beneficiaries

- The staff members providing products and services have good relations with each other
- Staff members work together to provide good products and services
- The program team has good problem-solving skills
- Health and safety for staff and clients are always a priority in implementation
- Resources are efficiently used to provide the product or service
- Schedules are adhered to in a reasonable fashion
- Staff members are motivated to work together to get things done
- Program meetings are productive
| **Organizational Process Management** | **Planning** | The extent to which:  
- Planning, policy, and procedure development occur in the organization at all levels, from the governing board to departments and individual projects  
- The process of planning contributes to the strategic direction of the organization  
- Plans are clear, and they provide adequate direction for the organization’s members  
- Plans, policies, and procedures are generally followed  
- Planning is part of the organization’s culture  
- Staff members feel that they are involved in planning  
- Planning is linked to monitoring and evaluation |
|---|---|---|
| **Problem solving and decision making** | **The extent to which:**  
- The implementation of work flows smoothly at every level of the organization  
- Decisions are timely  
- Performance gaps and opportunities are identified quickly enough to resolve them to the benefit of the individuals involved and the productivity of the organization  
- Problem-solving and decision-making mechanisms are in place  
- People on the governing board and within the ranks of senior managers have adequate organizational problem-solving and decision-making skills  
- Problem-solving and decision-making are adequate in departments and for important projects  
- The staff members feel empowered by the problem-solving and decision-making process |
| **Communication** | The extent to which:
| | - The staff members try to solve problems before they become big concerns
| | - People in the organization feel there is adequate, ongoing communication about the organization’s activities
| | - Staff members receive information about the organization’s mission and its progress in fulfilling the mission
| | - Information circulated in the organization about activities is rarely distorted
| | - Mechanisms are in place to correct rumors
| | - People have easy access to others they must deal with in the organization and can easily communicate with them
| | - Written communication is adequate
| | - Meetings are viewed as productive ways of communicating
| | - Adequate use is made of communication technology
| | - Two-way communication is encouraged
| | - Multi-channel communication is often used
| | - Listening is valued
| | - Cultural diversity is a consideration in communicating with others
| **Monitoring and Evaluation** | The extent to which:
| | - Policies and procedures are in place to guide evaluation and monitoring
| | - Resources are assigned to monitoring and evaluation
| | - Monitoring and evaluation are valued at all levels in the organization, as ways to improve
The organization obtains and uses data to monitor and evaluate its units and activities
Use is made of data gathered through the organization’s overall monitoring and evaluation activities
The organization has an evaluation plan or performance monitoring framework
Strategy, program, policy, and budgetary documents mention evaluation results
People have the skills to perform monitoring and evaluation
Monitoring and evaluation processes are valued
The organization learns lessons from monitoring and evaluation and makes changes as a result

<table>
<thead>
<tr>
<th>Interinstitutional Linkages</th>
<th>Networks, joint ventures, partnerships, and coalitions</th>
<th>The extent to which:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>The organization has adequate formal and informal linkages with like-minded organizations</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Institutional linkages are adequately supported</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Institutional linkages contribute efficiently to the organization’s goals and mission</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Fruitful, ongoing partnerships with external organizations through these linkages bring new ideas or resources, or both, to the organization</td>
</tr>
<tr>
<td></td>
<td></td>
<td>The organization is using these linkages to communicate information about its work to external stakeholders, including the general public.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Electronic linkages</th>
<th>The extent to which:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>The organization is electronically linked to the outside world of colleagues, clients, and markets (users) to make these relationships active and beneficial</td>
</tr>
<tr>
<td></td>
<td>Electronic networks are financially and technically supported</td>
</tr>
<tr>
<td></td>
<td>Electronic networks effectively respond to the needs, shared interests, and capabilities of the</td>
</tr>
</tbody>
</table>
organization

- Electronic networks support new efficient practices
- Fruitful, ongoing partnerships with external organizations through electronic linkages bring new ideas or resources, or both, to the organization
- The organization is using electronic linkages to communicate information about its work to external stakeholders, including the general public
A Performance-Based Review Process

I. Goals and Objectives of Assessment

Goal:

The goal of assessment at the Fogarty International Center (FIC) is to:
- Provide the tools and information necessary to improve each FIC sponsored program to achieve the FIC mission.
- Document progress and successes of the programs.
- Provide new directions for FIC programs.
- Identify role of the programs in fulfilling the FIC Mission.

The Fogarty International Center promotes and supports scientific research and training internationally to reduce disparities in global health.

Identify commonalities among FIC programs.

A. Guiding Principles:

- Assessment is a continuous quality improvement, review process.
- The primary responsibility for continuous assessment, reporting and analysis rests at the Program Officer (PO) level.
- Assessment will focus on outputs, outcomes and impacts and mechanisms to ensure that these occur. While reporting of metrics (number of trainees achieving advanced degrees, number of publications etc.) is necessary, meeting stated metric goals can become a check off exercise with little accomplished. Reviews will go beyond metrics and will depend on the basic principle of external peer review and recommendations. Evaluation, on the other hand, will include a major component of data collection and analysis.
- The assessment process will consider innovation, flexibility and risk-taking positively.
- Programs must be assessed against their own goals and objectives, taking into account fiscal resources and granting mechanisms.
- Review and evaluation will use retrospective measurements of the achievements over a certain time period (eventually a cyclical period) based in part on measured quantitative outputs, outcomes and impacts (metrics), as well as success stories and more qualitative outputs, outcomes and impacts. This information will be used to make recommendations for the future.
B. Specific Objectives:

- To stimulate the performance of programs at FIC and to encourage innovative approaches to address problems and issues relating to global health disparities.
- To demonstrate sound stewardship of federal funds and the programs they support.
- **To produce guidance for program officers and FIC management, to strengthen programs, improve performance, enhance funding decisions, demonstrate public health and economic benefits, and promote sound program policies, and evaluate mature programs.**
- Provide mechanisms to identify program accomplishments to FIC, NIH, HHS, funding agencies, national and international partners and the US Congress.
- Identify, share and stimulate best-management practices for improvement in performance in the FIC programs as a whole.
- To publish the results of the reviews and evaluations in peer-reviewed journals.

II. Elements and Basis for Review and Evaluation

The review and evaluation process is a continuum through a period of time (to be agreed to). It begins with the FIC Strategic Plan. Program plans, in the form of a well-developed Request for Applications (RFA) and Program Announcements (PA) are then developed with the input of the stakeholder community. The program officer will be in charge of ensuring that the appropriate stakeholder community is involved in the development of the program plan and the RFA. The program officer will monitor the progress of trainees and projects and may visit a project to interact with its management team, faculty staff, institutional administration and constituents. If mutually decided, a specialized team of experts can visit a project to advise it and make specific recommendations about specific elements and or issues (review visit). This type of correction can help a project correct itself mid-course rather than wait until the end of the project to terminate it for its weaknesses. The process will culminate with a visit of a group of experts, a Review Panel (RP) during year 4/5 of the program (this will differ from program to program and will depend on the program cycle) or at an appropriate time in the program. During year 9/10 of the program, a program evaluation will take place that will include data collection and data analysis by a contractor who specializes in evaluation.

A key to effective program review is the degree to which the review is normalized to the resources, objectives and program planning of the individual program. Given that each program has different financial resources, utilizes different talent pools with various specialties, faces different issues in host countries, works under unique institutional policies, and uses different approaches to reducing global health disparities, the review should be tailored to take program variability into account.

A. Program Development:

The foundation for individual program review is a well-developed program plan that culminates in an RFA. Importantly, planning a program will normally require a two year lead time to allow sufficient input, partnership development and administrative review.
Each program has its own RFA that can act as a strategic plan for that program. The RFA is keyed into the FIC, HHS strategic plan as well as the strategic plans of the program partners. Planning cannot be stressed enough in its importance. It can be based on experience, program results in the past, and stakeholder needs and expectations. Each program should have a plan developed which addresses its goals and objectives. Although this plan need not be formalized and written down, having a written form will ensure continuity for the program. The program plan can be informed through consultations, workshops, and meetings. It should be specific to resource needs, managing the program to meet those needs, data needs, and data gathering, analysis and storage.

A program plan, reflecting the input of management and constituents, will include:

- Vision and focus of where the program is heading and why;
- Backgrounds on issues and mechanisms for establishing priorities for investment of resources; and
- Goals and objectives and performance milestones targets that provide guidance for evaluating program performance.

Planning is fundamental to program assessment. Developing the understanding, communication and data collection processes necessary to meet the basic goals of the program is necessary. A program should be reassessed and new planning (planning workshops, planning meetings etc.) take place every five years or as appropriate. Of course network meetings can also be used as part of the continuous review and planning for a program.

B. Self-Assessment Process

Each program should conduct self-assessment and analysis on a regular basis in between the program assessments. Each program's self-assessment will be based on performance milestones unique to that program, as well as the criteria given below for all programs. Annual self-assessment can be accomplished at network meetings or following the submission of progress reports from the projects under the program. It is important that the self-assessment will include identification of results, potential problems and mechanisms. Self-assessment and program analysis is a checkpoint in preparation for the program review and program evaluation, which will occur at regular intervals. Analysis of program data should be conducted in conjunction with self-analysis. In some cases, both collection and analysis of program data may need to be contracted out. Data collected by the program could include:

- Reporting major research accomplishments--Publications in high profile journals; citations; trainee training; successful new grant applications; presentations at international meetings (and abstracts);
- Career accomplishments--Tracking the path and impact of graduates who have entered a health field, research, academia or government; percentage of trainees returning to country of origin (brain drain issue); membership on scientific or
policy committees; membership on advisory panels; analysis against control groups.

- Clinical Benefits--Improved understanding of new or existing diseases; improved tools to detect, diagnose, treat, and prevent disease; development of treatment or treatment regime for disease.
- Institutional Changes--Creation of networks, collaboration among labs; building infrastructure (labs, departments, research groups); provide critical mass; establish political support for institution, project; establish lab as regional center.
- Changing the Research/Health Care Agenda--Documentation of the changes in approach to solving global health care issues (e.g. laws impacted or changed, policies created or altered, awareness altered; media attention), better public health programs.
- Information Use--Documentation of how, when and in what way information was used by the target constituents to implement and/or change the ways they conduct business, use resources and/or change the quality of life, improve health and treat disease.
- Qualitative Effects--Qualitative description of impact of program on training, health, and social effects--success stories.
- Other

C. Reporting Framework

The key to continuous assessment is regular communication between the PI and the PO. Periodic reporting by the PI should be a routine part of this communication in order to document accomplishments and impacts in meeting program goals. It is this mechanism that specifically allows for qualitative measures of accomplishment to be addressed, such as health and/or economic gains made by implementation of program results. Reporting following significant project events should be mandated (e.g. publications in refereed journals, significant research findings, health care advances resulting from FIC grant activities, technical reports, workshops, special events). Fogarty is currently working on a standard format of quantitative and qualitative measurements and which will allow analysis across many programs.

III. Assessment Criteria

A. Criteria for Assessment

Continuing assessment is designed to strengthen, improve and enhance the impact of FIC. There are several important criteria that reflect the effectiveness of the FIC program and establish benchmarks that describe expected performance levels:

Areas of Assessment:

- Program Planning
- Program Management
- Project Selection
Recruiting Talent
Institutional Setting
Program Components
Human Subjects and Fiscal Accountability
Partnership and Communication
Results

Each is described in detail below:

1. Program Planning

Effective programs will use the strategic planning framework of the FIC as well as that of any partners as a basis for developing their RFA based on the needs of the U.S. scientific community, host countries, and as identified in collaboration with stakeholders such as other government agencies, foreign scientists, experts in the field. Effective planning may also involve regional programs. Partnerships with other agencies and organizations are considered important. Program plans will be reviewed annually and amended as necessary. These changes will be communicated to all involved parties (FIC Admin, NIH partners, PIs etc.). Sufficient time should be allotted into the planning process to maximize input and RFA preparation. Program planning will involve input from all constituencies important to the program.

Suggested Indicators of Performance

- Evidence of a planning process and a plan (priority determination, clear articulation)
- Relevance of program to FIC, NIH IC, HHS strategic plans
- Stakeholder involvement (numbers, duration, roles) in planning
- Integration of input into planning
- Reevaluation of program goals over time
- Strategic planning process

Suggested Questions

- What was the strategic planning process?
- What role do stakeholders have in setting the goals? The priorities?
- Who provided input for the initiative? How were stakeholders identified? How were they involved?
- How are modifications to the initiative implemented?
- Are the goals difficult, risk taking goals? Do they convey vision?
- How do goals fit into FIC, NIH, HHS strategic plans and initiatives?

2. Program Management

a. Project Selection: The program incorporates an excellent and relevant peer review process selecting those proposals that receive consistently high marks for merit,
application and priority fit. The selection/review process should take into account host
country needs in the program's scientific area. The program officer role should be well
defined.

Suggested Indicators of Performance:

Review process including: composition of panels, review criteria, quality of feedback to
PI, amount of time allowed for review, conflict of interest issues and involvement of
program officer.

Suggested Questions

- Under what institute/center did the review take place?
- Is the composition of the review panel appropriate to the program?
- If the program was interdisciplinary in nature, was the panel adequate to address
  all facets of the program?
- Are the review criteria appropriate and does the panel employ them?
  Were international issues taken into account?
- What was the role of the program officer in the selection of the panel?
  In the review?

b. Recruiting Talent: Every program will attract a variety of talent. The best efforts will
involve the best talent. The program must have mechanisms in place to identify and
attract the best and most appropriate talent available.

Suggested Indicators of Performance
Recruitment of new/young investigators; recruitment of foreign investigators; success
rate; minority applications; interdisciplinary teams; turnover of investigators

Suggested Questions

- How does the program advertise its RFA?
- How does the program make certain its RFA attracts new talent, international
talent and interdisciplinary teams?

c. Program Components: Each program is made up of various projects that come
together to form a program. It is the role of the PO to see to it that the various program
components have a chance to interact and gain experience from one another. The whole
program should have a greater effect than the sum of its parts.

Suggested Indicators of Performance
Network meetings; other meetings/ways at which PIs and/or trainees get together

Suggested Questions

- Are there networking opportunities available under the Program?
• What are some successful interactions that have been encouraged?

d. Institutional Setting: Programs vary in their institutional setting and institutional support. The program should be well supported by both the academic institution(s) involved and the federal institutions involved. There must be appropriate business practices available at both the domestic and the foreign institution for grant implementation to go smoothly.

Suggested Indicators of Performance
Matching funds; mentorship support; laboratory support; administrative support and good business practices

Suggested Questions
• Does the institution provide additional or matching funds for the program?
• How supportive is the institution for the program?
• How involved is the administration of the institution with the program?

e. Human Subjects and Fiscal Accountability -- Programs should demonstrate that they have appropriate mechanisms in place to account for federal funds and are properly documenting protocol reviews for human subjects.

Suggested Indicators of Performance
Presence of operational IRB; good accounting practices; good documentation practices; assurance that all intended funding is reaching the foreign collaborator and the trainees.

Suggested Questions
• Is there need for IRB review in this program? If so, does the institution (US and foreign) have a functional IRB? What are its credentials? Have they reviewed projects under this program?
• What role does the foreign institution play re. accounting under this project?
• How well are expenses documented?
• Is the funding reaching the foreign collaborator and the trainees?
• Is the funding being used to support agreed activities?

3. Partnerships and Communication
a. Partnerships (federal, national and international) are essential to addressing global health issues. Partnerships should be attracted, nurtured and maintained and will be examined during the assessment process.

Suggested Indicators of Performance
Numbers of partnerships; different types of partnerships (NIH, HHS, other federal, international, interdisciplinary, NGOs, industry); involvement of partners in the development of strategic goals; funds from partners; cost of partnership
Suggested Questions

- How were partnerships developed? What role did management play?
- Do the partners provide a significant contribution in funding or human resources?
- Could the effort have succeeded without the partnership?
- Has the program established long-term relationships that continue to be productive?
- What is the cost/benefit ratio of the partnerships?

b. Communications: To be fully successful, scientific results must be communicated to the user community and utilized. During the assessment the link of the program to the user community will be reviewed and implementation of the science into policy or other working frameworks will be assessed.

Suggested Indicators of Performance

Appropriate community input into the strategic planning; informational meeting/training sessions held with community; involvement of community on advisory board of program; involvement of community in selection of trainees; involvement of program in the community; demographics of contacts and efforts; requests for information, presentations; community needs surveys; user community feedback (mechanisms and tracking)

Suggested Questions

- Has the program defined its user community? Are they identified in the RFA? Do the projects have plans to interact with the user community?
- Are needs assessments of the community conducted?
- How does the program maintain contacts with the user community?
- What methods and tools does the program use to transmit scientific findings and results? How effective are they? Is the program on the forefront of using new technologies to improve their information transfer capabilities? Does the program present results and finding in the ways useful to the community?
- What role do users have in reviewing the progress of the program?
- What are the communication efforts the program makes?
- How satisfied is the user community? Are they getting the information they need? When they need it? If not, why not?
- How do programs assess their effectiveness in working with the user community?
- Do the programs have flexibility to adjust and react to unanticipated events that require new research and outreach activities?

4. Results of the Program

Depending upon age of a program, significant results will fall into different categories. The following should be documented and reported, analyzed and evaluated:

a. Program Input--the total of the resources put into the program (funds and as kind input from partners nationally and internationally--any "enabling resources")
b. Program Outputs--the program must be managed to produce program outputs which are the immediate, observable products of research and training activities, such as publications or patent submissions, citations, degrees conferred. In the best sense, quantitative indices of output are tools for the program. They allow POs and PIs to track changes, highlight progress and spot potential problems. Trends and variations in output may be much more significant than observations of the steady state. Fogarty may eventually use some of this data for benchmarking purposes. (expected for younger and older programs)

Suggested Indicators of Performance
Number and list of publications (journal articles, book chapters, reports, etc.); number and list of presentations; number of trainees; field of training? Number and type of degrees/certificates earned; number and list of meetings and attendance at meetings.

Suggested Questions
- What type of publications have been produced and how have they been utilized, distributed? Is the publication a direct result of the training?
- What types of students have been trained, in what areas and what degree has been earned?
- What meetings have been held? Who attended? What area was discussed? Was there any evaluation conducted?

c. Program Outcomes--Longer-term results for which a program is designed to contribute, such as strengthened research capacity within the U.S. and foreign laboratory, effective transfer of scientific principles and methods, success in obtaining/attracting further scientific and/or international support. (expected for more mature programs)

Suggested Indicators of Performance
Number of laboratories started: number of new grants or new funding procured; scientific methods discovered--number and type; scientific departments started or strengthened; awards received; careers enhanced.

Suggested Questions
- In what scientific areas were laboratories started? Was this totally lacking or is this supplemental? Do the labs support training? Are they well funded and supported by the institution? What percentage of the time do the PIs conduct research vs. administration and other duties? Is laboratory direct result of training?
- What scientific principles were developed? Who is using them? Are they used internationally? Is methodology a direct result of training?
- Where does the new grant funding/new funding in general come from? National or International? Is the new research funding a direct result of the training?
- Did any trainees or PIs receive awards as a result of training? If so, list and describe how training influenced this.
• Did the training influence any trainees' careers? How? Were they all promotions?

d. Program Impacts--The total consequences of the program, including unanticipated benefits. These can include the influence of research activities on clinical public health practice or health policy, success in establishing a sustainable career structure, affecting the career path of trainees, changes in health care systems, alterations in health care laws. Demonstrating impacts requires more complex analysis and synthesis of multiple lines of evidence of both a quantitative and qualitative nature. (expected for the most mature program)

Suggested Indicators of Performance
New policies adopted or advanced; new clinical procedures adopted; new career structure in place: alteration of health care system; alteration of health care laws

Suggested Questions
• What were the new policies adopted as a result of training provided by this program? How was the trainee or training involved with the policy?
• What new health practice was adopted as a result of training and how was this linked to the training?
• Were any health laws changed as a result of the program and how did this come about?
• Are there any economic impacts that can be demonstrated as a result of training? Environmental impacts? Health care impacts (laws, policies; systems etc.) How do these relate to training?
• Are there any success stories (using the metrics described and others as needed)? How do these relate to the training?
• Is impact local? National? Regional? International?
• Are partners involved in impact? Who are they and how are they involved?

IV. Assessment Roles

A. Role of the Fogarty International Center Advisory Board (FICAB) and FIC Administration
The review and evaluation process and schedule should be proposed at the program officer level and approved at the FIC administration level. It is anticipated that the Advisory Board (AB) will play a key role in assessment, either by chairing or co-chairing the Program reviews or by participating in the teams in some official capacity. Thus, the Program review panels (PRPs) can be considered a subcommittee of the Federal Advisory Committee Act (FACA) chartered FIC Advisory Board. Reports developed by the review panels will be approved and distributed by FIC administration in conjunction with the FIC Advisory Board. FIC will annually communicate the results of all the FIC assessments to the Director of NIH, the Secretary of HHS and to the Congress.

B. The Role of the Program Officer (PO)
The FIC has ultimate responsibility for the excellence and effectiveness of FIC programs. The PO will be responsible for the day-to-day assessment and analysis of the program progress. The PO will work with the Evaluation Officer to analyze program progress, synthesize program results, and to set up the review or evaluation. Together they will determine the appropriate outside experts to be part of the review as well as determine specifics of the review (e.g., dates, sites, presentations, and agenda).

C. Role of the Evaluation Officer (EO)

The evaluation officer, in coordination with the FIC PO's and the FIC administration will be responsible for setting the annual schedule for review and evaluation. She will apply for all funds for reviews and evaluations and will work out all budgets with the POs. She will work with the PO to set the agenda and schedule for the reviews. She will provide training for review chairs and members. She will work with the review panel to conduct the review, write the final report, and with FIC administration on the annual assessment report to the Director of NIH, the Secretary of HHS and to congress. She will schedule an annual meeting of FIC staff to discuss all the assessments that have taken place in a given year. She will work with other NIH ICs and other experts on assessment to ensure that the Fogarty assessments are current. She will serve as the planner and interface for program evaluations. The EO will be available to work with the PO on program analysis and synthesis of program results.

D. Program Advisory Visit--Make-up and Role

The program advisory visits are more informally designed to enable program officers to make informed mid-course corrections for projects or programs in their portfolios. They should be small in nature and targeted to a specific question or set of questions the program officer feels needs to be addressed. They do not need to be lead by an FIC advisory board member, but that is an option. There should be a summary report following advisory visits.

E. Program Review Panels (PRPs)--Make-up and Role

At five-year intervals a visiting committee, Program Review Panel (PRP) will conduct a formal review of the FIC programs using the formal framework and criteria given in Section III. The panel will be made up of 4-8 members, including at least one or as many as two, FICAB members, and 3 to 6 experienced administrators and decision-makers, health care professionals and scientists as well as people experienced in program review from other disciplines as appropriate. The PRP can include, but not be limited to, persons such as:

- Deans or Associate Deans of Appropriate Colleges or Universities
- World renowned scientists in appropriate fields
- Executives of national and international health care or related agencies
- Executives of national or international health care NGOs
- Officers of appropriate commercial and industrial entities
- Recognized medical practitioners in appropriate fields
• Expert international scientists or administrators who are stakeholders or partners in the program
• Scientists from partner institutions (IC)
• Representative with fiscal expertise (e.g. person involved with grants management)

PRP members should be highly respected and recognized in their fields. Panel membership should be jointly determined and agreed to by FIC staff and the AB as well as the evaluation officer. An individual respected by all parties, very familiar with FIC objectives and programs, and someone with a longer-term commitment to FIC should chair the PAT.

Using any and all material available and necessary to conduct its review, the role of the PRP should be as follows:

• To document and report on the program's overall productivity and accomplishments relative to FIC's mission and goals and the programs RFA and level of support.
• To assess the program's overall scientific or educational strength (e.g. by the significance of scientific or public health related advances and impacts, the rigor of the planning process, the level to which the best talent and resources have been brought to bear on program's goals and objectives and the success in meeting them, the rigor of the self-assessment process, publications, patents and other metrics of output).
• To assess the effectiveness of the programs management in meeting stated goals and objectives and in providing overall leadership for the program.
• To assess the program's partnerships and linkages, both nationally and internationally.
• To assess the program's position and role in its host institution and host country.
• To assess, considering all the above, the program's potential for growth.

Based on these assessments, the PRP should provide the PO and FIC management a comprehensive written report that documents the program's strengths and weaknesses, makes specific suggestions for program improvement, reports program accomplishments and provides for an overall assessment using criteria developed in Section III. The PRP shall have a draft assessment report ready upon leaving the program assessment. A final report shall be due to the PO and the evaluation officer within 30 working days of the review exercise, and is the responsibility of the PRP Chair. Upon receiving the report the PO will have a reasonable time, 21 working days to review the report, make factual comments, and if necessary write a response. A final version of the report with the PO's input is due to the FIC administration within 60 working days of the review. At the approval of the FIC administration, the report will become part of the official record of the program.

[1] For the purposes of this paper the term assessment is defined as the valuation of a program or procedure made by experienced persons according to their discretion. The process of assessment can be accomplished either through a review or an evaluation. An
evaluation is defined here as a large scale semi-quantitative judgment of a program done after a significant period of program operation; a review is defined as a more qualitative inspection of a program conducted after a relatively short period of program operation.