

innovATE

Innovation for Agricultural Training and Education



USAID
FROM THE AMERICAN PEOPLE



Virginia Tech
Invent the Future



Degree training and curriculum development to support HICD:
Good practices from USAID Collaborative Research Support Programs and
Feed the Future Innovation Labs for Collaborative Research

Kristal Jones
Claudia Rojas
Thomas Gill

January 2015

USAID/BFS/ARP-Funded Project

Award Number: AID-OAA-L-12-00002



Acknowledgements

This document was written as part of a series of InnovATE thematic studies. These research papers examine a particular AET system, cross-cutting theme, model, or technique and offer an analysis of the subject in question. These studies often highlight AET innovations in good practices. Case studies examine how agricultural education and training intersects with other development issues which are important to AET capacity building.

This project was made possible by the United States Agency for International Development and the generous support of the American people through USAID Cooperative Agreement No. AID-OAA-L-12-00002. For more information about the InnovATE project and other publications visit our website at <http://www.oired.vt.edu/innovate> or join the discussion in our Community of Practice at www.innovate-community.oired.vt.edu. Contact us at innovateprogram@vt.edu or call 540-231-6338.

Executive Summary

This Innovation for Agricultural Training and Education (InnovATE) thematic study expands upon the recent body of work examining how USAID Title XII agricultural research for development programs have addressed human and institutional capacity development (HICD). This report analyzes lessons learned from decades of Collaborative Research Support Programs (CRSPs) activities and identifies how these lessons might be transferable to the current Feed the Future Innovation Labs for Collaborative Research (ILs). In 2013, the CRSPs transitioned to the new IL model. This thematic study is timely as the ILs are beginning to articulate their approach to HICD within their focused research areas. This study focuses on contemporary means to support and facilitate degree training for women and developing country nationals, and agriculture education and training (AET) curriculum development innovations. The study identifies an opportunity for InnovATE to support linkages between IL research and HICD through curriculum development activities.

This study uses the current USAID HICD methodology of separating Human Capacity Development from Institutional Capacity Development, as a way to characterize historic CRSP activities. The CRSPs focused on supporting students from developing countries to pursue advanced degrees (long-term training) at U.S. universities with the hope that upon return, those students would apply their new knowledge and skills at their home institutions. Research shows that the newly established ILs appear to be largely following a similar model for HICD to that of the CRSPs. The exceptions are the few IL projects that have identified specific institutional partners and have focused on building physical infrastructure and research capacity. However, the FTF approach to alleviating food security through research, education and outreach, encourages all FTF funded projects to work together to create linkages between individual IL HICD activities.

Curriculum development is an important and useful indicator for institutional innovation because it is a sign of change. In addition, curriculum development is the point at which human capacity development and institutional capacity development intersect. The FTF funded InnovATE project, is mandated with supporting HICD throughout AET systems. One of the InnovATE areas of focus is supporting development and incorporation of relevant, modern curricula to expand institutional capacity. There is the opportunity for individual ILs to leverage the InnovATE expertise to ensure home institutions are prepared to accept the new skills and ideas that are fostered in long-term degree training candidates. InnovATE can work with ILs to identify curricular gaps causing research limitations at partner institutions, support returning degree recipients in applying skills at their home institutions, and create and strengthen professional networks that support HICD. By identifying which aspects of HICD each program within the FTF portfolio can best fulfill, the projects can work together in a range of partnerships to holistically address HICD.

Acronyms

AET	agricultural education and training
BIFAD	Board for International Food and Agricultural Development
CoE	Center of Excellence
CRSP	Collaborative Research Support Program
FTF	Feed the Future
HCD	human capacity development
HICD	Human and institutional capacity development
ICD	institutional capacity development
IL	Feed the Future Innovation Lab for Collaborative Research
InnovATE	Innovation for Agricultural Training and Education
Title XII	Famine Prevention and Freedom from Hunger Amendment (Foreign Assistance Act of 1975)
USAID	United States Agency for International Development

Table of Contents

Introduction.....	1
Problem statement.....	2
Human and institutional capacity development.....	2
The Collaborative Research Support Programs (CRSPs).....	4
The Feed the Future Innovation Labs for Collaborative Research	6
Methods used for this report	8
Human capacity development in CRSPs.....	9
Institutional Capacity Building in CRSPs	13
HICD in Innovation Labs	17
Good practices in HICD in CRSP/IL model	19
Next steps: Opportunities to leverage HICD activities of ILs and InnovATE.....	22
References.....	24
Annex: Reference details for Table 3 (Long-term degree training in CRSPs).....	27

Introduction

In 2010, President Obama launched the Feed the Future program to incorporate and leverage existing US government programming and approaches to supporting agricultural research, education and extension in developing countries (Lechtenberg, 2014; Levin, personal comm., 2014). The Board for International Food and Agricultural Development (BIFAD), USAID, external review panels and academic observers were tasked with identifying key strengths and weaknesses in approaches to agricultural development, as well as opportunities and potential threats of investment in agricultural development. As a result, several synthesis reports were commissioned and completed. Several of these reports focused on the role of Title XII (which authorized USAID-US university collaborations) funding and programming in supporting agricultural development (Rubin, 2008), reviewed key approaches to training in agricultural fields (Gilboy et al. 2010), and addressed the role of US universities in generating research and educational opportunities that support agricultural development (Jones et al., 2012; Lechtenberg, 2014).

The report builds on specific observations made in these review studies. In particular, this report analyzes how HICD was addressed by the former Collaborative Research Support Programs (CRSPs) in order to identify good practices for the new Innovation Labs (ILs) and related USAID programming. Jones et al. (2012) provide a synthesis of HICD activities within the CRSPs and recommends that HICD activities within CRSPs need to be more linked to the new whole-of-government approach of FTF in order to maximize impacts going forward. The transition from CRSPs to ILs in 2013 partly accomplished this goal, as IL activities and impact metrics are now more aligned with the FTF approach, which includes a cross-cutting emphasis on HICD. As part of the overall shift toward more Title XII investment and broader mandates for agricultural development in the USAID portfolio, the InnovATE program was established in 2012 to provide further impetus for building capacity in AET systems around the world.

The purpose of this report is to highlight good practices and areas for leveraging InnovATE expertise in the context of ILs and their HICD programming, in order to maximize the impact of investments in agricultural development and avoid duplicating efforts. In response to the most recent review of HICD and Title XII programs, this report focuses specifically on the implications of long-term degree training for human capacity development (HCD), and curriculum development for institutional capacity development (ICD), as well as the connections between these approaches. HCD and especially degree training is “frequently referred to as a ‘gem’ embedded within the CRSP model...[and] is one of the keys to the enduring legacy of the CRSPs and one that is not replicated by any other development model” (Jones et al., 2012: 7). Reviews of CRSP and IL approaches to HCD and subsequent impacts, also reveal complications in the narrative of how HCD and ICD interact. Lechtenberg et al. (2014) note that the linkages between HCD and ICD that have not yet been clearly identified, and there is a need for clear definition of metrics for successful ICD. This report builds on the observation from Lechtenberg et al. (2014: 34) that “relevance of the curricula [at agricultural institutions] to needs of the agriculture and food sector is a key gap limiting the impact of higher education institutions in FTF countries.” InnovATE is well-placed to support curriculum development that aligns with broader goals for agricultural development in FTF countries and Title XII programs. This report includes approaches and impacts of past ICD initiatives by CRSPs, as well as intended efforts of newly established ILs, to identify

opportunities for programming focused on HICD in AET systems can support and complement IL activities.

The following sections provide overviews of the current approach to HICD taken across USAID programming, as well as the historical background and current configurations of CRSPs and ILs in terms of organization, thematic areas, and the role of HICD within the research programs. A brief overview of the methodology used to gather data is offered, and then HCD and ICD initiatives of CRSPs and ILs are characterized. Based on the analysis, good practices for HICD as a holistic approach are then identified, along with opportunities for InnovATE to partner with and leverage HICD programming within the context of ILs.

Problem statement

USAID's current approach to HICD emphasizes integration and the need to link training at the individual level, to institutional level analyses and long-term investments (USAID, 2010). In the context of Title XII agricultural development programming, CRSPs had a history of providing degree training to promote HCD and of supporting ICD through joint research and training programs. As ILs identify ways to incorporate updated models of HICD, it is useful to analyze the strengths and weaknesses of CRSP approaches to HICD and identify best practices for measuring success. Curriculum development is a key component of InnovATE's work to strengthen AET systems and could provide a link between individual and institution-level capacity development across FTF programs. Articulating the possible connections between these levels of capacity development will help to clarify how ILs, InnovATE and other Title XII programs can leverage resources to best support HICD in agricultural research, education and extension.

Human and institutional capacity development

A 2010 report that includes the current USAID approach to HICD also overviews the history of HCD through short-term and long-term training, both non-degree and degree seeking, that supports individuals "to acquire new, predetermined knowledge, skills, and attitudes to address or solve targeted operational problems" (USAID, 2010: 5). In the context of the CRSPs, this approach to HCD has been hailed as successful at building key knowledge, skills, and attitudes needed to improve agricultural research, education and outreach in developing countries. However, the knowledge, skills, and attitudes must be applied at specific institutions and organizations in order to be fully expressed and to impact the broader institutional context. The new approach to HICD taken by USAID identifies the connections between individual-level training and systemic changes in organizations and institutions. Within the context of USAID programming, HICD is defined as "structured and integrated processes designed to identify root causes of performance gaps in host country partner institutions, address those gaps through a wide array of performance solutions in the context of all human performance factors, and enable cyclical processes of continuous performance improvement through the establishment of performance monitoring systems" (USAID, 2010: 7).

How do human and institutional capacity development fit together? One way to conceptualize the differences is to see training as an event and HICD as a process (USAID, 2010). Individual training can be understood as part of an ongoing process of needs assessment, support, and transfer of new knowledge to institutions. People and the institutions and organizations where they work, shape one another,

making HCD a crucial aspect of the HICD process. However, institutions are more than simply the sum of the individuals within them, and individuals with newly acquired skills are not necessarily able to apply those skills in settings that lack infrastructure, resources, or the capacity to change and adapt. It is also the case that not all skills and knowledge are similarly relevant across institutional settings.

The current USAID approach to HICD, in both a larger sense and within the context of agricultural development, stresses the need to engage both institutions and individuals throughout the entire process. Gilboy et al. (2010) describe this as a shift from an individual-level “best and brightest” approach to selecting students to a more holistic and integrated process. This could focus on identification of institutional and national needs, support for individual training to address those needs, and the building of long-term connections between US and developing country institutions. By choosing strategic areas of education and research in which to support developing-country students and scientists, investments in individual-level training would then reinforce efforts at institutional adaptation and change (Jones et al., 2012).

Identification of institutional and national needs does not go far enough, however. For effective HICD, there must be agreement as to how an institution should evolve over time and an assessment framework to support the change process. Due to the lack of metrics for measuring capacity development, it remains a challenge to clearly identify and measure the impacts of individual training on institutional development (Gilboy et al., 2010). The USAID framework, shown in Figure 1, identifies six performance factors of capacity: information, resources and materials, incentives, knowledge and skills, capacity, and motives. The first three reflect the institutional environment, while the second three describe individuals (USAID, 2010). Each of these factors has corresponding indicators of change relevant to the type of institution and HICD process being pursued.

Figure 1. HICD Factors

Institutional	INFORMATION	RESOURCES AND TOOLS	INCENTIVES
Individual	KNOWLEDGE AND SKILLS	CAPACITY	MOTIVES

Adapted from USAID, 2010

The identification of clear metrics for HICD is an important component of the planning and implementation process. Metrics may be more complex than simply the number of people who received training. USAID (2010) recommended measurement questions for HICD that include how to track professional impact of individual training recipients, and gender-related change, using gender-disaggregated data over time. The analysis of CRSP and IL HICD activities that follows these recommendations identifies which factors, as seen in Figure 1, have been and will be relevant to good practices for agricultural HICD.

The Collaborative Research Support Programs (CRSPs)

Organizational history

The CRSP model was created by USAID and BIFAD in 1977 under the Title XII Famine Prevention and Freedom from Hunger Amendment (Foreign Assistance Act of 1975). It was designed as a strategy to strengthen the engagement of USAID with U.S. universities and address issues of common interest with developing countries, namely promoting food security and economic growth (Jones et al., 2012). The CRSPs were intended to be a long-term mechanism to focus the research, education and extension capabilities of US land grant universities on carrying out the Title XII mandate (see Rubin, 2008, for a detailed description of the historical evolution of CRSPs). Functionally, “the CRSPs were a partnership between U.S. universities, developing country institutions, and USAID designed to apply science and technology and build human and institutional capacity to address issues of hunger and poverty” (Jones et al., 2012: 18). The collaborative nature of this model emphasized the linkages between actors working in agricultural development, and ensured that research conducted at both US and international institutions was relevant to the needs of developing countries.

CRSPs were housed at US universities (known as the Management Entity), were renewable on a five-year cycle, and were both centralized in terms of focus area and management and also highly collaborative. The thematic areas on which CRSPs focused will be discussed below, and were identified within the context of US government priorities, input from expert scientists and development practitioners, with the intent to meet the Title XII goal of “enhancing global agricultural development” (Rubin, 2008). In practice, CRSP activities have been lauded for the incorporation of research for development with HICD and extension efforts. To achieve these goals, CRSPs released sub-award Calls for Proposal that supported partner institutions in research projects focused on key countries or issues within their thematic area. Partner institutions could include other US universities, host country research and university institutions, and international agricultural research institutions. Funding was also directed toward long-term degree training of host-country and US national graduate students, as well as for short-term technical and certificate training for professionals (Jones et al., 2012). The CRSPs history of research and HICD projects has yielded strong networks of individuals and institutions that have benefitted from the support for long-term training.

Thematic areas

At their conception, the CRSPs were focused principally on four disciplines: sorghum and millet; fisheries and aquaculture; small ruminants; and human nutritional deficiencies. Within a few years, five other research areas were incorporated: beans/cowpeas; soils management; basic food crops/integrated pest management; post-harvest food losses (Rubin, 2008). Several thematic areas were added and adapted in subsequent decades, in response to changing needs and priorities for research and development. Table 1 provides a chronological history of CRSP thematic areas and their years of operation. In addition to the addition of new CRSPs, several of the CRSPs changed in name over the years, and adapted their research focus within a specific thematic area as new opportunities and needs were identified.

Table 1. Chronological CRSP History

CRSP Focus	Years of Operation
Small Ruminant CRSP	1978-1995
Global Livestock CRSP	1995-2009
Livestock-Climate Change CRSP	2010-2013
Sorghum, Millet and Other Grains (INTSORMIL)	1979-2012
Bean/Cowpea CRSP	1980-2007
Dry Grain Pulses (Pulse) CRSP	2007-2012
Trop Soils CRSP	1981-1996
Soil Management CRSP	1997-2008
Peanut CRSP	1982-2012
Human Nutrition CRSP	1982-1991
Global Nutrition CRSP	2010-2015
Pond Dynamics/Aquaculture CRSP	1982-2008
AquaFish CRSP	2006-2012
Fisheries Stock Assessment CRSP	1985-1994
Integrated Pest Management (IPM)	1993-2013
SANREM CRSP Phase I and II	1992-2005
SANREM CRSP Phase III and IV	2006-2013
BASIS/Assets and Market Access	1996-2013
Horticulture CRSP	2010-2015

Adapted from Jones et al. 2012

Role of HICD

As has been thoroughly documented in Jones et al. (2012) and Gilboy et al. (2010), the CRSP approach to building capacity of individuals and institutions for agricultural research was complex and highly successful in many ways. CRSPs invested heavily in long-term degree training, mostly at the graduate level, for agricultural science students from host and developing countries, as well as for students from the United States who were interested in international research and experience. According to USAID records, CRSPs supported roughly 3,280 degree students from 72 countries from their inception through 2012 (Jones et al., 2012). A strength of the CRSP model was that student research was oriented toward topics relevant in host countries, even when students were being trained at US universities, because student research projects were nested within broader CRSP research mandates (Gilboy et al., 2010). Many of these students went on to careers at their home institutions or within the international agricultural research system. In addition, short-term training on technical skills like field methodologies, GIS, and computer technologies increased the relevance of skills that could be integrated into research and development projects of many host country institutions.

Much of the capacity building focus within the CRSPs was at the individual level, and the linkages between human capacity and institutional capacity were implicitly seen to be additive – train more individuals who then become part of an institution and the capacity of that institution is built as well. A weakness of this individual-oriented approach is the assumption that training equals changes in institutions, without adequate identification of the mechanisms and supporting conditions necessary to leverage HCD into ICD. Jones et al. (2012) suggest the need for a more systematic gap analysis of institutional needs, and the targeting of CRSP training activities to those needs more than to the

identification of the brightest students, who might not be able to affect institutional change. CRSPs do offer some insight into potential models for linking HCD and ICD, as many of the US universities that engaged in long-term CRSP projects developed lasting institutional connections with host country universities and research institutions. These connections facilitated HCD by linking students and faculty from both institutions for long-term degree training, and those individuals were able to build professional relationships that fostered more collaboration and innovation once they graduated and returned to their home institution (Jones et al., 2012). This model of long-term institutional partnerships as a way to support HICD is overviewed and recommended by Lechtenberg et al. (2014) as a possible way forward for incorporating HICD into Feed the Future programs, including into ILs.

The Feed the Future Innovation Labs for Collaborative Research

Organizational structure

In 2013, the CRSP designation was shifted to reflect their incorporation into FTF, part of the President's new Global Development Policy (USAID, 2013a; Lechtenberg et al., 2014). The Feed the Future Food Security Innovation Center now houses several program areas, within which ILs are situated as integrated research and development projects (Levin, personal communication, 2014). The Innovation Center approach shifts the USAID management from research-centered within specific institutions, toward a model which incorporates whole-of-government underpinnings. The Innovation Center also supports other projects that fit into key program areas, including the InnovATE project within the Program for Human and Institutional Capacity Development. By reorganizing funding and programming for agricultural development under the FTF framework, the Innovation Center encourages collaboration across projects and the leveraging of skills and resources to achieve program goals (Chapotin et al., 2014).

The IL and Innovation Center format were created in part in response to the BIFAD report (Jones et al., 2012) reviewing the strengths and weaknesses of the CRSP model, and the opportunities to adapt that model to new FTF mandates (Chapotin et al., 2014). ILs are organized much like the former CRSPs, in that one US university is awarded the Management Entity contract, through which research goals are formulated and sub-awards are made. The Innovation Center focus on thematic program areas means projects have more specific research project mandates than most of the CRSPs. IL research activities must fit within the agricultural research and development programs identified by FTF, meaning ILs are well-placed to support USAID missions by generating locally relevant knowledge. In addition, because the Innovation Center umbrella identifies unifying thematic areas, non-IL projects like InnovATE can provide expertise and outputs that complement IL mandates (Chapotin et al., 2014).

Thematic areas

The FTF Food Security Innovation Center focuses research in seven key program areas (Feed the Future, 2014a):

1. Program for Research on Climate-Resilient Cereals
2. Program for Research on Legume Productivity
3. Program for Advanced Approaches to Combat Pests and Diseases
4. Program for Research on Nutritious and Safe Foods
5. Program for Markets and Policy Research
6. Program for Sustainable Intensification
7. Program for Human and Institutional Capacity Development

Within these program areas are nested 25 ILs. Table 2 lists the current ILs, noting within which program they fit, whether they are a continuation of a former CRSP, and which university leads each of them.

Table 2. Feed the Future Innovation Labs for Collaborative Research

Program	Innovation Lab	Lead University
<i>Climate-Resilient Cereals</i>	Applied Wheat Genomics	Kansas State
	Climate-Resilient Sorghum	Georgia
	Climate-Resilient Wheat	Washington State
	Climate-Resilient Millet	UC Davis
	Collaborative Research on Sorghum and Millet*	Kansas State
<i>Legume Productivity</i>	Climate-Resilient Beans	Penn State
	Climate-Resilient Chickpea	UC Davis
	Climate-Resilient Cowpea	UC Riverside
	Soybean Value Chain Research	Illinois
	Grain Legumes*	Michigan State
	Peanut Productivity and Mycotoxin Control*	Georgia
<i>Advanced Approaches to Combat Pests and Diseases</i>	Rift Valley Fever Control in Agriculture	Texas-El Paso
	Genomics to Improve Poultry	UC Davis
<i>Research on Nutritious and Safe Foods</i>	Food Processing and Post-Harvest Handling	Purdue
	Reduction of Post-Harvest Loss	Kansas State
	Adapting Livestock Systems to Climate Change*	Colorado State
	Aquaculture & Fisheries*	Oregon State
	Nutrition in Africa*	Tufts
	Nutrition in Asia*	Tufts
	Horticulture*	UC Davis
<i>Markets and Policy Research</i>	Assets and Market Access*	UC Davis
	Food Security Policy	Michigan State
<i>Sustainable Intensification</i>	Small-Scale Irrigation	Texas A&M
	Integrated Pest Management*	Virginia Tech
	Sustainable Intensification*	Kansas State

* Indicates an IL converted from an historic CRSP

Data from USAID, 2014b

Role of HICD

With the shift from CRSPs to ILs, and the reorganization of USAID resources to support agricultural development, HICD as an integrated process cuts across all of the ILs and is also the focus of the Program for Human and Institutional Capacity Building. Within the ILs, investment in long-term degree training within research projects will continue to be a key contributor to HICD, partially due to the BIFAD analysis which found long-term degree training to be a key strength of the CRSPs (Jones et al., 2012). In addition, U.S. university faculty are motivated to be involved by the opportunity to take on graduation students. Incorporating that strength into the new HICD framework will require more attention, and is the subject of ongoing conversations. Lechtenberg et al. (2014) recently released a report analyzing how HICD can be incorporated into FTF activities, and make several recommendations based on past experience. Of relevance to the ILs and related Innovation Center projects is the suggestion to build long-term a “Preferred Institution Partners Program,” which would allow US universities to re-establish the types of relationships that characterized early CRSP research activities (Lechtenberg et al., 2014: 17). The USAID-funded Innovative Agricultural Research Initiative (iAGRI) collaboration between Ohio State and Sokoine University of Agriculture in Tanzania is a current example of this approach (Ohio State, 2014). These partnerships could address the strategic goals of specific ILs, allowing for institutional gap assessments and subsequent HICD activities that are relevant to both institutional partners’ needs and abilities, as well as providing strategic guidance for the evolution of the host country institution. The report also suggests that curriculum development activities will be a key link between HCD and ICD, and can be facilitated in part by ongoing relationships between US and host country universities. Because all of the ILs have been established only since mid-2013, HICD activities are just getting underway. The analysis in this report analyzes what little data there is, to characterize intentions and early activities in ILs related to HICD.

Methods used for this report

This report draws on several sources of primary and secondary data to make detailed and precise statements about the relationships between HCD and ICD in the CRSPs, as well as plans for HICD in the newly established ILs, in order to identify good practices for HICD in agricultural research for development. To analyze HCD efforts in historic CRSPs focused on types of degrees and student gender for long-term degree training, we drew from annual reports and final review documents for each year, of every CRSP. These reports are catalogued and searchable on the CRSPs website. Because of the volume of documents accessed to compile Table 3 below, each individual annual report is not listed in the reference list at the end of this report. Instead, Annex 1 provides details about which documents were used to assess HCD activities in each CRSP, and notes any missing data. All specific examples and other data drawn from CRSP reports about HCD and ICD are referenced in the text.

To characterize the projected efforts of newly established ILs for HICD activities, the primary author of the report conducted an email-based survey with the director or primary contact for 24 of the 25 ILs (contact information for the Climate-Resilient Millet and Rift Valley Fever Control in Agriculture ILs was not available at the time of research). More than half of these emails, 17 in total, received responses. The survey was five open-ended questions that asked about the contributions that ILs and former CRSPs (when applicable) had made to curriculum development for higher education and nonformal (out of the

classroom) educational settings, as well as the materials produced for trainings, and the challenges and lesson learned in IL/CRSP curriculum development activities. In addition, the AquaFish IL agreed to a phone interview to discuss their experiences with curriculum development and HICD. Key points and planned approaches to HICD, especially in terms of curriculum development, in the ILs are summarized from the email and phone interviews, as well as from data pulled from the few annual reports available at <http://crsps.net>.

All data presented about long-term degree training in the CRSPs is disaggregated by gender and degree type, with percentages of total students trained in CRSPs from developed (North America and Western Europe) and developing countries are provided as well. Disaggregating the data has not to our knowledge been done in publically available reports on HCD in CRSPs, and provides the foundation for analyzing the outcomes of HCD efforts and potential impacts. Jones et al. (2012) note that disaggregated data on student gender over time is especially important to track improvements in gender equality as an indicator of HICD. The good practices for long-term degree training and curriculum development characterized here are then analyzed using USAID's (2010) HICD factors framework presented above. The recommendations for how best to connect InnovATE with IL mandates are made within this framework as well, noting the factors in which each type of program, InnovATE and IL, have a comparative advantage.

Human capacity development in CRSPs

Overview

A major objective of the CRSPs was to strengthen the human capacity of developing country nationals, but they also aimed to build the capacity of young scientists in the U.S. to address important development problems. The HCD element of the CRSPs also aimed to reinforce institutional relationships with host country entities by maintaining collaborations with young scientists, originally trained by CRSPs, once they return home to fill pivotal positions at their home institutions (Jones et al., 2012). The CRSPs invested about a quarter of their budget in academic training for at least 3,791 students (mostly graduate level) in programs in 130 countries between 1973 and 2011. Student degrees have been granted in a large number of disciplines including agronomy, entomology, food science, social sciences, and others. Considerable efforts were made in more recent years to ensure that an equal number of men and women were participating in these programs (CRSP, 2012). Most of the students trained under CRSP academic programs have returned to their home country, with up to 80% reported by 2011 (Jones et al., 2012; CRSP, 2012). These former CRSP students have participated in the development of agricultural academic programs and policies at their home institutions, which has also indirectly helped to strengthen agricultural reform models in their home countries¹.

The summary data provided in reviews of CRSP activities suggests a dynamic approach to HCD through long-term degree training. Table 3 provides data disaggregated by CRSP, gender, degree level and nationality, to contextualize the accomplishments and innovative practices of different CRSPs in terms of HCD (and as called for by Jones et al., 2012). Nationality is divided into students from developing countries (outside of North America and Western Europe) and developed countries (North America and

¹ Dr. Hillary Egna. May 2014. Personal communication.

Western Europe). Details about the years of existence for each CRSP can be found in Table 1, and Annex 1 provides reference details for the data used to estimate student numbers in each CRSP.

Table 3. Long-term degree training by CRSP, gender, degree and nationality

CRSP	B.S.		M.S.		Ph.D.		Student nationalities Developing/Developed (%)
	No. of degrees	M/F (%)	No. of degrees	M/F (%)	No. of degrees	M/F (%)	
<i>Small Ruminant (1978-1995)</i>	63	67/33	212	69/31	106	79/21	80/20
<i>Global Livestock (1995-2009)</i>	36	64/36	64	69/31	43	50/50	73/27
<i>Livestock-Climate Change (2010-2013)</i>	n.d.	-	n.d.	-	n.d.	-	n.d.
<i>INTSORMIL (1979-2012)</i>	46	72/28*	458	72/28*	444	72/28*	66/34
<i>Bean/Cowpea (1980-2007)</i>	120	55/45*	300	55/45*	180	55/45*	66/34
<i>Pulse (2007-2012)</i>	10	10/90	43	60/40	18	50/50	94/6
<i>Trop Soils (1981-1996)</i>	0	-	50	88/12	84	81/19	60/40
<i>Soil Management (1997-2008)</i>	0	-	57	84/16	43	78/22	79/21
<i>Peanut (1982-2012)</i>	0	-	56	64/36	41	70/30	60/40
<i>Human Nutrition (1982-1991)</i>	n.d.	-	n.d.	-	n.d.	-	n.d.
<i>Global Nutrition (2010-2015)</i>	-	-	10	n.d.	1	n.d.	100/0
<i>Pond dynamics 1982-2008)</i>	304	58/42	275	67/33	82	69/31	73/27
<i>AquaFish (2006-2012)</i>	160	52/48	143	50/50	36	56/44	87/13
<i>Fisheries Stock Assessment (1985-1994)</i>	0	-	39	75/25*	17	75/25*	54/46
<i>IPM (1993-2013)</i>	124	70/30*	176	70/30*	90	70/30*	92/8
<i>SANREM (1992-2013)</i>	60	35/65	130	51/49	88	52/48	71/29
<i>BASIS AMA (1996-2013)</i>	4	75/25	21	60/40	19	79/21	66/34
<i>Hort (2010-2015)</i>	37	44/56*	42	44/56*	18	44/56*	66/34

* Denotes gender breakdown for all long-term training (not disaggregated by degree level)

n.d. Denotes no data available

Table 3 presents a complex picture about the role that HCD played in the CRSPs, with the data disaggregated by gender, degree level and nationality. The data shows that for CRSPs established during the late 1970s and early 1980s, like Trop Soils and Fisheries Stock Assessment, men far out represented

women in long-term degree training programs. This trend was due in part to cultural and historical realities of the time period (women were underrepresented in the agricultural sciences around the world). For example, a final report from the Pond Dynamics/Aquaculture CRSP (Aquaculture CRSP, 2008) notes that women's presence in long-term degree training programs within their own CRSP increased significantly from 1999 onward, which aligns with increasing gender equality in agricultural sciences within US universities (Hill et al., 2010). In addition to analyzing the overall trends in gender and long-term degree training, it is important to look at the representation of women at different degree levels, to assess the potential for gender-sensitive ICD that can come from the presence of more women professionals in the university context (Jones et al., 2012). Analysis of degree levels by gender in Table 3 also reveals interesting and unexpected patterns. For several of the CRSPs, women were more represented (in proportional terms) in Ph.D. training than in Master's degree training, suggesting that there was a specific emphasis on supporting women to obtain the highest possible degree training. This emphasis also had the potential to then influence ICD through increasing the number of women eligible to take leadership at agricultural research and university institutions.

Another trend depicted in Table 3 is the wide range across CRSPs and across time of proportions of students from developing versus developed countries. It has long been noted that students from developing countries are less likely to have the appropriate and necessary skills and educational background to succeed in advanced degree programs in the US (Gilboy et al., 2010). In the context of the CRSPs, those that began activities in the late 1970s and early 1980s had a higher proportion of students from developed countries than those CRSPs that began activities in the late 1990s and early 2000s. However, CRSP reports continued to identify a lack of adequately prepared students as a barrier to increasing HCD activities for developing country students (Nutrition CRSP, 2011). Though the data were not detailed enough to provide a full analysis of the home country of students by degree level, our analysis of CRSP annual reports and other reviews of training activities showed a similar pattern in representation of developing country students to that of the representation of women in higher degree programs. Early CRSP long-term training activities included far more US students at the Master's and Ph.D. level, and over time the balance has shifted. Total numbers of students being supported for degree training has also increased over time, as US universities have solidified their systems for hosting international students, and have adapted course and research requirements to reflect topics relevant to developing country students' home contexts (Lechtenberg et al., 2014). By emphasizing HCD for developing country students within the CRSP framework, that goal is to support ICD at both US universities and within the systems to which these students return.

Examples of innovative practices in long-term degree training to build HICD

The overview of long-term degree training presented in Table 3 and the analysis above highlights the strong support for developing country students and, especially over the past 15 years, women students in obtaining advanced degrees. Financial, intellectual and professional support for individual students are important components of HICD, as long as those students go on to professional positions in host country AET institutions. The CRSP model is best known for this emphasis on long-term degree training, but a review of annual reports and final documents identifies several other important and innovative practices to support HICD. Several of these approaches are overviewed in this section, and will then be analyzed to identify good practices further in this report.

Funding

One important innovation in supporting HCD has been for the CRSPs to make the most efficient use of financial resources to support not only full degree programs for some students, but also to identify developing country students who are in need of support to conduct research in order to finish degrees in their home countries. The Global Nutrition CRSP, for example, has worked with faculty at a host country institution in Uganda to identify students who needed support to complete the research project component of their degrees, in this case, Master's in Public Health and Nutrition (Nutrition CRSP, 2012). Providing funding and academic support for advanced degrees, where money for student research might be non-existent, extends the reach of CRSP activities by facilitating the link between course completion and degree completion. Similarly, INTSORMIL has supported post-doctoral research opportunities for developing country scholars who have completed degrees at host country institutions and who could benefit from further capacity development by spending time conducting research in conjunction with faculty at a US university (INTSORMIL CRSP, 2012). Using CRSP financial and professional resources to support research experiences for students pursuing advanced degrees at host country institutions also has the potential to create different types of intra-institutional connections, as students currently active at host country institutions add relationships with CRSP faculty and US universities. These approaches are related to the sandwich programs described by Gilboy et al. (2010), where students study at US universities and conduct research in their home countries, in conjunction with local institutions, or study at home country institutions and come to the US for a short time to conduct research and receive specific training.

Student research process

A modified sandwich program approach was also used by CRSPs in their support for developed country students to connect to agricultural research and development organizations to conduct research. The Hort CRSP Trellis Fund, for example, provides support for advanced degree students' research in Hort CRSP priority countries and with local partners (see Horticulture IL, 2013 for an overview). As mentioned above, supporting developed country graduate students' research activities is another cost-effective way to generate relevant research and build capacity at the institutions with which the students are affiliated. These programs, as well as those designed to bring developing country students and professionals to the US for supplemental technical trainings, also help build and expand professional networks, which can support ICD through ongoing exchanges of knowledge, expertise, students and other resources. INTSORMIL (INTSORMIL CRSP, 2013) notes that these networks can also enhance ICD by creating linkages that support the transfer and dissemination of technologies and techniques generated from CRSP research activities.

Supplemental short-term training

Another way to extend the CRSP resources for HCD in the context of HICD has been to support supplementary short-term training for students currently pursuing advanced degrees at host country institutions. The Pulse CRSP has offered short-term trainings to students and staff at agricultural research and education institutions in household survey collection methods, statistical analysis approaches, the use of molecular markers in breeding programs, and approaches to organizing farmer field schools to support technology transfers (from annual reports). Other CRSPs, including Peanut and Hort, report as well using short-term technical training courses to build capacity in current students to serve as field research assistants as well as to supplement the lack of social science training in many

agricultural sciences curricula. The Horticulture CRSP (2011) reports a specific focus on short-term trainings in ‘train the trainer’ approaches to build extension capacity in host country faculty and students. The use of short-term trainings to supplement long-term degree training options for developing country students provides a first step toward using curriculum development to build HICD, as these short-term training modules are often designed to fill gaps in existing host country institution curricula.

Institutional Capacity Development in CRSPs

Overview

Enabling HCD through support for long-term degree training has been the “gem” of the CRSP model, in large part because the training of agricultural sciences professionals at US universities provides host country institutions with capacities that would not otherwise be possible given the level of resources and focus of curricula at those institutions (Jones et al., 2012). Gaps in curricula signify a weakness in institutional capacity, which can be addressed in several ways (Lechtenberg et al., 2014). One is to continue to provide developing country students the opportunity to study at US universities, so that their skills and knowledge are generated from strong curricula. However, identifying the curricular gaps at host country institutions that make advanced degree training at US universities necessary is also the first step toward shifting from HCD to ICD (Gilboy et al., 2010). In general, CRSPs were research oriented, and it was not a stated objective of most CRSPs to create courses and curricula. Within the context of the CRSP model, however, many of the approaches to ICD built upon the acknowledgement of curricular weaknesses, and generated a range of training courses, modules, and in some cases entire curricula that were incorporated into host country institutional offerings.

Table 4 presents a review of the content of major curriculum development activities undertaken by individual CRSPs and the level of education targeted by the curricula, the institution and country within which activities took place, and the year the activity was first noted in an annual report. Highlighting the content and the level of education to which curriculum development is targeted is especially important within the integrated context of HICD. Efforts to link individual-level long-term training to institutional-level curriculum change require a gap analysis of curricular weaknesses and a targeted approach to individual training to shore up curricular changes.

Table 4. CRSP curriculum development activities by content, educational level, location and year

CRSP	Curriculum content	Educational level	Institution	Country	Year
Small Ruminant	Andean Livestock Management	Master's	San Marcos University, Altiplano National University	Peru	1991
Global Livestock	Environmental issues Ecology research experience Nutrition and extension Poultry health	Secondary	Baeza Agricultural High School University of Guadalajara	Ecuador	1999
		Bachelors	University of Ghana	Mexico	1999
		Bachelors	Sokoine University	Ghana	2008
		Professional		Africa	2009
Livestock-Climate Change	-	-	-	-	-
INTSORMIL	-	-	-	-	-
Bean/Cowpea	-	-	-	-	-
Pulse	-	-	-	-	-
Trop Soils	-	-	-	-	-
Soil Management		-	-	-	-
Peanut	Post-harvest tech	Bachelor's	Makerere University	Uganda	2008
Human Nutrition		-	-	-	-
Global Nutrition	Nutrition and food security in public health	Bachelor's	Makerere University	Uganda	2011
		Master's	Institute for International Development Studies	Nepal	2012
Pond dynamics	Shrimp farming techniques Fish culture, statistics Pond construction and management	Secondary	Department of Aquaculture	Honduras	1994
		Master's	National University of Rwanda Moi University	Rwanda	1994
		Professional		Kenya	2001
AquaFish	Experimental design, Culture of aquatic organisms, Fish nutrition, Tilapia aquaculture, Limnology Aquaculture	Bachelor's, Master's	Universidad Juárez Autónoma de Tabasco	Mexico	1996-2008
		Bachelor's	Kwame Nkrumah University of Science and Technology	Ghana	2007-2013
Fisheries Stock Assessment	-	-	-	-	
IPM	IPM in agronomy	Bachelor's	Kyrgyz Agrarian University	Kyrgyzstan	2008
SANREM	Participatory research Sustainability Forestry Environmental management Biodiversity	Bachelor's	Zamorano University	Honduras	1996
		Bachelor's	EARTH University	Costa Rica	1996
		Secondary	High Schools	Philippines	1999
	Bachelor's	Nong Lam University	Vietnam	2003	
	Elementary	Elementary schools	Bolivia, Ecuador	2009	
	Conservation agriculture	Secondary	High School Curriculum Department, Ministry of Education and Training College of Agriculture	Botswana, Lesotho	2010
Conservation agriculture	Bachelor's		Lesotho	2011	
BASIS AMA	-	-	-	-	-
Hort	Style design and innovation Horticultural technologies Horticultural technologies	Bachelor's	Zamorano University	Honduras	2012
		Professional	Kenyan Agricultural Research Institute	Kenya	2012
		Professional	Kasetsart University	Thailand	2013

The overview of curriculum development activities in Table 4 suggests that some CRSPs had a wide range of engagement with curriculum development activities from the early 1990s onward, while others had no documented engagement with such activities. Half of the CRSPs report some type of curriculum development activity, ranging from elementary and high school curricula that focus broadly on CRSP thematic areas (like biodiversity or sustainability), to highly technical graduate level courses. The most extensive curriculum development activities were undertaken by the more specifically technical CRSPs – those focused on livestock management, and fisheries and aquaculture. Most of the curricula were developed for the tertiary level, for bachelor’s and Master’s degree programs. By focusing curriculum development on university institutions, CRSPs created the possibility for linking HCD and ICD, as individuals receiving long-term advanced degrees in conjunction with CRSP research were possibly the people who developed curricula for their home institutions. Limited data on the explicit linkages between long-term degree training and curriculum development within CRSPs exist, pointing to the need identified by Jones et al. (2012) for long-term tracking of individuals who participated in long-term degree training and the institutions within which they work.

Table 4 also depicts a clear orientation in CRSP curriculum development activities toward the long-term institutional partnerships recently recommended by Lechtenberg et al. (2014) as a means to ensuring ICD. In Central and South America, multiple CRSPs have contributed to curriculum, infrastructure and research capacity development at Zamorano University in Honduras and EARTH University in Costa Rica, while the Global Livestock CRSP has focused extensively on two universities in Peru. In East Africa, Makerere University in Uganda has been a key partner for several CRSPs in terms of curriculum development. In addition to specific institutional partnerships, the CRSPs established national-level relationships with several countries, working with multiple institutions for research and curricular activities. Mexico, Honduras, Costa Rica and Peru have been areas of high CRSP activity in Central and South America, while Uganda, Kenya, Tanzania and Ghana have been the focus of many activities in sub-Saharan Africa. Activities in Southeast Asia have been less clearly focused in particular countries. The shift from institutional partnerships to a country-level focus mirrors the FTF approach to identifying high priority countries with which to work, and which can serve as regional hubs of knowledge, research and technical expertise.

Examples of innovative practices in curriculum development to build HICD

As has been reviewed above, curriculum development as an approach to ICD was not always linked to HCD via long-term degree training, of the historic CRSP model. However, the link between individual training and research and ongoing CRSP research, increased the relevance of training to the home country context, which is also apparent in approaches to curriculum development (Jones et al. 2012). Curriculum development activities undertaken by CRSPs draw on needs analyses of partner institutions and agriculture sectors. These analyses help determine the level of education at which curriculum development is appropriate, as well as the frameworks where curricular change is possible. In other words, curriculum development has occurred all along the educational pipeline (Ewell et al., 2003), and CRSPs have utilized a range of innovative strategies to ensure success at each level.

Primary and secondary curricula

Curriculum development activities for primary and secondary education levels have taken one of two forms. One approach, used by several CRSPs, starts agricultural education early on, in order to make

students aware of issues related to CRSP research. As one Global Livestock annual report (1999: 11) explained, “the goal of the curricular restructuring has been to institutionalize an environmental ethic in the region’s young population, which should lead to a sustained and integrated environmental movement in the area.” Creating an environmental or agricultural ethic has, for example, led to the incorporation of biodiversity data gathering and discussions into primary school courses in the Andes (SANREM CRSP, 2009) and teaching about basic livestock health at the high school level (Global Livestock CRSP, 1999). A second approach to curriculum development at the secondary level has been to focus on technical training that is appropriate for secondary education. The Pond Dynamics CRSP, for example, developed shrimp farming facilities and corresponding curricula for a technical high school in Honduras in response to agricultural employment analyses that identified employment opportunities in the sector (Swindale et al., 1994).

Bachelor’s degree curricula

Many of the CRSP activities in curriculum development have focused on tertiary curricula, primarily at the bachelor’s degree level. Activities have taken two main forms – the contribution of specific modules (one course, or parts of one course) derived from CRSP expertise to existing curricula, or the establishment of new departments or facilities that can offer wholly new educational opportunities. Contributing modules to existing courses allows CRSPs to offer targeted input that reflects current research as well as needs identified by institutional partners. The Nutrition CRSP, for example, has created nutrition and food security modules for schools of public health and international development studies (Nutrition CRSP, 2011; 2012). Other CRSPs, like SANREM, have worked to incorporate broad concepts like sustainability and the principles of conservation agriculture, into partner institutions’ curricular offerings, as a first step toward more technical curriculum development activities. The other approach of establishing entirely new facilities within existing institutions can be seen in the example of Zamorano. Starting in the mid-1990s, SANREM CRSP invested in developing curricular and technical expertise at Zamorano oriented around social science methodologies as well as interdisciplinary, integrated agricultural approaches. In 2012, the Horticulture CRSP announced the creation of Regional Centers of Innovation, the first of which is located at Zamorano. This approach to ICD includes the creation of new curricula, courses and departments, as well as the materials necessary to teach and conduct research with a wide range of types of students (Horticulture CRSP, 2012).

Master’s degree curricula

More advanced curriculum development contributions have come from the livestock and fisheries CRSPs, in part because the research programs of these programs require advanced degrees. Curriculum development at the tertiary level is both highly specialized and designed to support students in applying the skills they learn in a range of professional settings. For example, the Small Ruminant CRSP (1991) focused on expanding existing animal husbandry curricula at the advanced degree level to encompass a wider geographic and species range in the Andes, building off CRSP research and a recognition that students have a hard time finding employment if their degrees and skills are overly specialized. Perhaps the most comprehensive curriculum development undertaken at the advanced degree level was by the AquaFish CRSP. Over the course of 12 years at UJAT in Mexico, AquaFish supported eight key faculty members and the development of courses in Experimental Design, Culture of Aquatic Organisms, Fish Nutrition, Tilapia Aquaculture, and Limnology. These courses were incorporated into curriculum revision for the bachelor’s degrees in Biology and Aquaculture Engineering, and the Master’s degree in

Environmental Sciences degrees. A similar approach was taken at KNUST in Ghana, where AquaFish supported the development of eight aquaculture courses from 2007 to 2013 that formed the backbone of a newly created bachelor's degree in Fisheries and Water Resources Management, and a soon-to-be established Master's degree in Aquaculture Business (AquaFish CRSP, 2013; Egna, 2014, personal communication).

Curriculum development process

Although the process of identifying, creating and implementing curriculum development opportunities and content differs widely across institutional settings and disciplines, there are several themes that are consistent across CRSP activities. First, and most important, the process of institutional analysis, of where the institution stands and where it would like to go, and the identification of curricular gaps must be done in concert with stakeholders, in order to ensure relevance of the curricula, and to maintain legitimacy within the institution. The Global Livestock CRSP has an excellent explanation of the participatory process it used to create animal protein nutrition extension courses with colleagues at the University of Ghana. The process brought together student and institutional interest in nutrition education with CRSP research on the role of animal protein in childhood nutrition, and then identified extension practices as the missing link to connect this knowledge with communities (Colecraft et al., 2008).

Another innovative approach to curriculum development was that taken by the SANREM CRSP in the development of secondary education curricula on conservation agriculture. SANREM project partners invited government representatives from education ministries in Botswana and Lesotho to a presentation about key opportunities for incorporating conservation agriculture into curricula and the potential impacts on rural development (SANREM CRSP, 2010). This approach recognized the institutional realities of curriculum development, and sought out collaboration not only with educators but with officials who have the final say on major curricular changes. Finally, the Small Ruminant CRSP offers a useful model for the curriculum development process in the context of advanced degree training. This CRSP described its approach as one that first defined an 'academic-professional profile' of the ideal graduating student, which then helped to identify the characteristics of the degree program and its educational objectives (Small Ruminant CRSP, 1991). From there, CRSP activities with current students and faculty were oriented toward training in research methods and techniques that could later be incorporated into new curricula that supported the academic-professional profile experienced by those working in collaboration with the CRSP.

HICD in Innovation Labs

Based on the BIFAD report on HICD in the historic CRSPs (Jones et al., 2012), the newly established ILs continue to emphasize HICD in both their plans and the few annual reports available from first year activities. The IL model reflects an integrated approach to HICD, which sees the development of human and institutional capacity as interconnected (two-way strengthening between HCD and ICD), rather than as linear processes (i.e. traditional understanding of HCD leading to ICD). In this section, we overview the responses we received to a survey, sent to all of the IL directors, which asked about current and future plans for curriculum development activities in the context of HICD. In general, the ILs report a continued interest in supporting HCD through long-term degree training that is linked to IL research and

home country institutions. Curriculum development as a specific activity is still underrepresented in reported IL activities and future plans. In total, of the 18 responses we received, only five ILs report active plans for any type of curriculum development to support HICD. However, several ILs identified other activities that reflect an integrated approach to HICD. Linking short-term and long-term training for individuals to institutional needs and strengths reflects Lechtenberg et al.'s (2014) call for FTF research for development activities to take a “preferred partner” approach to HICD by identifying key institutions and supporting capacity development to meet institutional gaps and challenges.

Curriculum development

Curriculum development activities that do exist in ILs can be categorized as either oriented toward the establishment of new degree programs or toward contributing to specific courses within a degree program or non-formal (outside of the classroom) educational need. Two ILs with active degree development plans are AquaFish and Livestock-Climate Change, and both are building on activities begun during the last phase of CRSP activity. The AquaFish IL has been working with the University of Ghana to establish a Master's degree program in Aquaculture Business, which will build on the curricula offering already in place for an undergraduate major supported by past CRSP activities. The Livestock-Climate Change IL has been working on expanding the poultry management disease control curriculum developed by the CRSP during the avian flu outbreak. This curriculum is targeted to grade schools, to educate children on basic ways to mitigate the spread of poultry disease, as well as for non-formal adult education situations where smallholder poultry producers, mostly women, can learn basics about poultry diseases. In addition, the Soybean Value Chain IL is in the process of developing a Master's degree in Soybean Plant Breeding at the University of Ghana, the curriculum for which will be built in part on IL research outputs. The Horticulture IL is also working on curricula on the principles of post-harvest science, which is being developed for community college level instruction in Central America. Finally, the SANREM IL has contributed to Master's degree-level soil science and conservation agriculture curricula at partner institutions.

Connecting individuals and institutions

Although only a few ILs explicitly plan to use curriculum development as an HICD tool with partner institutions and research collaborators, several are making linkages between individual training and institutional capacity through short-term training for research collaborators and related professionals, and long-term degree training. Short-term trainings for HICD are targeted mostly toward professionals as certificates or continuing education programs, and the intention is that by providing individuals with new knowledge and skills, they will bring those back to their institutions. The Horticulture IL, for example, has developed a year-long, online post-harvest course for professionals, and is also working on food safety and Good Agricultural Practice training. Short-term training for research collaborators, like those reported by the BASIS AMA IL, are generally oriented toward research methodologies, and are provided in the context of the host institution. One goal for conducting short-term trainings at the physical facilities and with staff from local institutions is to stimulate demand for more consistent curricular shifts toward those skills.

Another adaptive approach to HICD that links institutions to individuals is the shift toward long-term degree training targeted for current collaborators and students from partner universities. This shift, reported by several ILs, is happening through the use of sandwich programs and support for in-country

long-term degree training, both of which have been found to be more economically and socially efficient for students (Gilboy et al., 2010; Jones et al., 2012). Because these approaches to long-term degree training require substantial student time spent at host country institutions, the ILs are building on long-standing institutional linkages and implicitly moving toward the “preferred partnership” model.

In addition to explicit curriculum and degree program development activities, a few ILs reported HICD activities that also reflect the integrated approach linking institutions to individuals. The AquaFish IL reports that they are increasingly supporting long-term degree training at host country institutions, which they are able to do in part because of past investments (under CRSP activities) in curriculum and degree program development. The Horticulture IL is building on CRSP activities to improve the physical and curricular capacity of partner institutions through the D-Lab program model in Honduras and Thailand. The SANREM IL is working with the government of India to establish a natural resource management research center, building off of research findings and extension efforts from past SANREM CRSP activities.

Good practices in HICD in CRSP/IL model

The overviews and examples of HCD, ICD, and increasingly, HICD activities in historic CRSPs and current ILs can be analyzed within the current USAID assessment framework of factors in institutional capacity. This analysis can provide a starting point for identifying good practices in HICD activities. Figure 2 categorizes key good practices from CRSP and IL activities in long-term degree training and curriculum development that can help to build a range of institutional and individual capacities within the integrated HICD framework (USAID, 2010).

Figure 2. Good practices in HICD in agricultural research, education and outreach

Institutional	INFORMATION - Identify objectives for students’ professional and academic profile as a graduate of a degree or certificate program - Identify degree, course, and curricular gaps in an open and participatory manner	RESOURCES AND TOOLS - Support the acquisition of physical and technological infrastructure to support educational and research goals	INCENTIVES - Support ongoing professional networking opportunities to keep faculty engaged - Link curriculum development and in-country degree training to ongoing research
	KNOWLEDGE AND SKILLS - Identify necessary knowledge and skills for students to return to home institutions and contribute to ongoing research - Identify gaps in knowledge and skills that will be necessary and create opportunities for employment	CAPACITY - Identify for long-term degree and professional training individuals at key institutions who are positioned to contribute to institutional change upon return - Use innovative approaches to long-term degree training to ensure student success (ICT, sandwich programs)	MOTIVES - Support ongoing professional training and networks to provide students with a realistic understanding of professional possibilities - Build respectful and supportive long-term relationships to ensure support for ongoing research collaborations

Information

When the focus of HICD activities is on institutional factors, several good practices from CRSP and IL experience can be highlighted. Arguably the most important is that HICD activities must be conceptualized with as much information as possible, and that information on changing goals, priorities and successes must be shared in an open and inclusive manner so that all individual capacities can be directed toward common ends. Taking an open and iterative approach to needs assessment and change identification is the first step toward supporting structural changes across the institution that can be supported by and will in turn support useful curriculum development. Good practices for initiating HICD activities include performing gap analyses, identifying educational objectives, engaging in participatory curriculum development exercises, and using workforce development approaches to assess employment demand for specific skills. The Global Livestock CRSP provides an excellent example of how this process can generate new curricula (Colecraft et al., 2008). Other examples include the ongoing work by the Global Nutrition IL to contribute nutrition modules to public health curricula, and their collaboration with non-USAID projects aimed at comprehensive curriculum reform at partner institutions.

Resources and tools

Once educational objectives have been identified and agreed upon, several CRSPs have found that it is also important to identify the material resources necessary for the institution to meet them. Generally this has meant ensuring that the appropriate technologies and built infrastructure exist to support specific courses and curricula, as well as ongoing research activities. Investing in institutional resources and tools supports broad HICD as these can often be used for a range of types of educational opportunities, formal and non-formal, as well as for research activities. The Peanut CRSP offers the example of purchasing peanut mills for a technical training center so that students can experience first-hand the complexities of running and fixing these mills. Finally, institutions must provide incentives to individuals to continue to contribute their time and energy to building and maintaining overall capacity. CRSP and IL activities to create professional incentives at the institutional level include supporting student research that is relevant to host country issues and institutions, so that students' interests align with institutional goals. In addition, many CRSPs and ILs provide financial support for former students' ongoing engagement with international professional networks. These networks have generated long-term research collaborations that bring resources and new knowledge to host-country institutions, which in turn can lead institutions to encourage professional participation by personnel.

Knowledge and skills

As reviewed above, much of the CRSP and IL approach to HICD continues to focus on individual-level long-term degree training. In the past, this approach simply assumed that by training individuals, institutions would be strengthened upon their return. Within the updated, integrated HICD framework, however, CRSPs and now ILs are adapting approaches to long-term degree training to make more explicit and precise contributions to HICD. The same gap assessments used to understand institutional needs can also be applied to individual-level long-term degree training, by ensuring that demanded degrees and specializations will be appropriate to specific needs of host-country institutions. With this information, students can be tracked into a range of degree programs in the United States, and increasingly in their home countries. In addition, students' education can be supplemented by technical

and short-term trainings to add specific skill sets that will be useful in changing institutional contexts. These could include the incorporation of service or extension activities and hands-on training.

Capacity

In addition to knowledge and skills, individuals must have the capacity to make full use of their expertise. In the context of HICD, a recent argument has been made for moving away from identifying simply the 'best and brightest' for long-term degree training, irrespective of their home institutions and future possible professional path, and instead to focus on individuals within key institutions and departments who have a more precise ability to influence institutional change. Approaches to building individual capacities that fit into the integrated HICD model include the creation of short-term professional trainings targeted to specific types of professionals, as well as the use of sandwich programs and other innovative approaches to degree delivery that ensure that different types of individuals will have access to long-term degree training. The Pond Dynamics CRSP training module on pond management and construction for government fisheries personnel is one example of a targeted, professional training approach.

Incentives and motives

HICD is supported when institutional incentives and individual motives are aligned and mutually reinforcing. Institutions must provide appropriate incentives to encourage individuals to contribute to change, and individuals must be motivated by interests similar to those of the institution in order to fully contribute their skills. Supporting continued professional development and collaborative long-term research with students and professionals helps build understanding of possibilities, and allows them to identify pathways to accomplishing individual and institutional goals.

Curriculum development in HICD

Curriculum development as an activity is woven throughout the HICD good practices outlined above, and as suggested by Lechtenberg et al. (2014), curriculum development can in fact provide a key linkage between the institutional and individual levels of HICD. At the most basic level, gap and skill assessments at both levels can provide the foundation for development of degree programs and specific curricula, which in turn builds the knowledge and skills of individuals. Curriculum development activities can sometimes emerge out of research, as both the process and findings often generate the needed resources and information for creation of new curricula. Ongoing assessment of institutional gaps is crucial to ensuring that curricular innovations address not only information, resource and incentive gaps. Through the increased use of innovative learning and pedagogical approaches, curriculum development can shift the incentive structure within an institution to ensure interest from a broader range of students and professionals, including women. Finally, curriculum development can link university and research station expertise to other institutions, including those in government, private enterprise, and civil society. As knowledge and skills gaps are assessed for individuals and institutions, curricula can be developed for a range of audiences and offered by faculty at universities, thereby building interest and linkages across institutions while also increasing knowledge skills of individuals.

Next steps: Opportunities to complement and extend HICD activities of ILs

As the ILs have begun to clarify the scope of their research, education and outreach activities, and have returned to the lessons learned from CRSPs and other Title XII programs, it is clear that the primary focus for HICD will continue to be supporting long-term degree training for students from host countries. The focus on individual training and capacity development makes sense within the context of the increasingly specialized focus areas of many of ILs, especially those focused on more technical research. There is a growing interest in the ILs to adopt the “preferred partnership” model for institutional linkages suggested by Lechtenberg et al. (2014), which reflects as well the FTF approach to selecting countries, and regions within countries, to conduct research, education and outreach activities. Integrated HICD and whole-of-government approaches to agricultural research for development will be increasingly important to identify the comparative advantages of a range of Title XII projects, and to leverage different programs’ strengths to maximize impacts.

Projects like InnovATE that focus on building capacity in AET systems are well-positioned to contribute to HICD activities across the FTF portfolio, by providing expertise on institutional gap assessments, workforce development analyses and participatory curriculum development exercises. Partnerships between ILs and projects focused on AET can leverage the expertise of each project, and help create linkages between individuals and institutions. For example, if an IL has an institutional partner whose personnel and students could benefit from long-term degree training in areas in which the IL is working, the InnovATE project could conduct an institutional needs assessment for that specific area of expertise (e.g. post-harvest, genomic analysis, human nutrition). AET organizations can also work with returning personnel and students who are receiving long-term degree training through IL funding and research support, to identify curricular and professional development needs for students to more fully integrate into IL research activities. The process of an individual transitioning from student to professional, bridges IL and other areas of expertise, and complementary projects can provide additional engagement with students who become faculty and would like to codify their new knowledge and skills.

Projects focused on building capacity in AET can also support further integration of IL research findings from IL into partner activities through curriculum development and institutional training exercises. One example of this is the current synergy between activities of the Horticulture IL and the InnovATE project in Southeast Asia. The Horticulture IL has worked closely with the USAID-Cambodia mission in identifying commercial horticultural production as a key area for research, and has been working to develop best practices within the context of Cambodian agricultural production and economic systems. In spring 2015, the InnovATE project will incorporate Hort IL research findings into a regional training for faculty, administrators, and government officials interested in creating a Center of Excellence (CoE) for commercial horticultural production. The training will identify key knowledge and skill areas that students and professionals need to engage with the commercial horticulture sector, and will brainstorm ways to develop the necessary courses, curricula and degree programs to train individuals. This planned establishment of a CoE for research and training, at a partner university in Cambodia, will support further HICD for the ongoing research of horticulture in the region.

Other areas for strategic partnerships between ILs and AET capacity building projects include the creation and strengthening of professional networks to keep individuals who received degree training engaged in research activities. For example, there is growing network of several AET projects that has worked with several partner institutions in southern Africa to create a professional society for agricultural educators and scientists, which can serve as a model for ongoing engagement of researchers from ILs and partner institutions. Projects focused on AET can also contribute to the establishment of “preferred partnerships,” by building long-term relationships and providing guidance for developing curricula and professional network infrastructure, which complements the physical infrastructure focus of several ILs. Curriculum development is an ongoing process that is subject to changing labor market demand, financial support for agricultural education, and technological advances, to name only a few variables. Engaging the ICD expertise of complementary organizations to build upon the ILs long-term degree training emphasis, reflects the integrated HICD approach emphasized by USAID, and can strengthen each project’s ability to achieve both specific goals and the shared objective of increasing capacity in agricultural research, education and outreach to promote food security.

References

- Aquaculture CRSP. (2008). *Final report: 1996-2008*. Vol. 1. Aquaculture Collaborative Research Support Program. Corvallis, OR: Oregon State University.
- AquaFish CRSP. (2013). AquaFish CRSP final report 2006-2012. AquaFish Collaborative Research Support Program. Corvallis, OR: Oregon State University.
- Blackburn, W., Crawell, E., Kearns, J., MacKenzie, D.R., and Roy, A. (1999). *Soil Management Collaborative Research Support Program (CRSP): External evaluation panel*. Grant extension proposal: Annex, Vol. 3. Honolulu, HI: University of Hawaii.
- Chapotin, S.M. (2014). *Agricultural research for impact: Partnering with Feed the Future Innovation Labs*. USAID AgriLinks presentation, April 23. Washington, D.C.: United States Agency for International Development.
- CRSP. (2012). Building the technical and institutional capacity to feed the world. *CRSP Digest Project*. Washington, D.C.: United States Agency for International Development.
- Ewell, P.T., Jones, D.P., and Kelly, P.J. Conceptualizing and researching the educational pipeline. *National Center for Higher Education Management Systems*. Retrieved Oct. 29, 2014 from <http://higheredinfo.org/analyses/Pipeline%20Article.pdf>.
- Feed the Future. (2014a). Feed the Future Food Security Innovation Centers. United States Agency for International Development. Retrieved May 3, 2014 from: <http://feedthefuture.gov/article/feed-future-food-security-innovation-center>.
- Feed the Future. (2014b). Feed the Future Food Security Innovation Labs. United States Agency for International Development. Retrieved May 3, 2014 from: <http://feedthefuture.gov/article/feed-future-food-security-innovation-center>.
- Gilboy, A., Flora, C., Raphael, R., and Pathak, B. (2010). *Agriculture long-term training: Assessment and design recommendations*. Washington, D.C.: United States Agency for International Development.
- Global Livestock CRSP. (1999). *Annual Report 1999*. Global Livestock Collaborative Research Support Program. Davis: University of California-Davis.
- Colecraft, E., Lartey, A., Marquis, G., Sakyi-Dawson, O., Ahunu, B., and Butler, L. (2008). *Development of a nutrition extension course: A step-by-step collaborative process*. Research Brief 08-05-ENAM. Global Livestock Collaborative Research Support Program. Davis: University of California-Davis.
- Herdt, R.H., Kornegay, J., Lund, D., Ouatarra, M., and Stovall, J. (2006). *External evaluation panel: Five-year technical review (2002-2007) of the Bean/Cowpea Collaborative Research Support Program (CRSP)*. Prepared for USAID. Washington, D.C.: USAID.
- Hill, C., Corbett, C., and St. Rose, A. (2010). *Why so few? Women in science, technology, engineering, and mathematics*. Washington, D.C.: American Association of University Women.
- Hort CRSP. (2012). *Horticulture CRSP Regional Centers of Innovation*. Hort CRSP. Retrieved Oct. 7, 2014 from <http://hortcrsp.ucdavis.edu/main/media%20page/centers.pdf>.
- Horticulture IL. (2013). *The Horticulture Innovation Lab Trellis Fund*. Horticulture Innovation Lab. Retrieved Oct, 6, 2014 from <http://hortcrsp.ucdavis.edu/main/trellis.html>.

- Horticulture CRSP. (2011). *Annual report 2010*. Horticulture Collaborative Research Support Program. Davis: University of California-Davis.
- Horticulture CRSP. (2012). *Regional Centers of Innovation*. Horticulture Collaborative Research Support Program. Davis: University of California-Davis.
- INTSORMIL CRSP. (2012). *INTSORMIL Collaborative Research Support Program (CRSP): What is INTSORMIL?* Sorghum, Millet and Other Grains Collaborative Research Support Program. Lincoln, NE: University of Nebraska.
- INTSORMIL CRSP. (2013). *Final Report, 2007-2012*. Sorghum, Millet and Other Grains Collaborative Research Support Program. Lincoln, NE: University of Nebraska.
- Jones, R.J., Brown, K., Byerlee, D., Kramer-LeBlanc, C., Sammons, D., and Stoecker, B. (2012). *BIFAD review of the Collaborative Research Support Program (CRSP) model*. Washington, D.C.: United States Agency for International Development.
- Lechtenberg, V., Ayeni, A., Christy, R., and Kramer-LeBlanc, C. (2014). *BIFAD review of strategic human and institutional capacity development (HICD) issues and the role of USAID and Title XII under the Feed the Future programs*. Washington, D.C.: United States Agency for International Development.
- Nutrition CRSP. (2011). *Annual Report FY 2011*. Nutrition Collaborative Research Support Program – Africa. Boston: Tufts University.
- Nutrition CRSP. (2012). *Annual Report FY 2012*. Nutrition Collaborative Research Support Program – Africa. Boston: Tufts University.
- Ohio State. (2014). International programs: Innovative Agricultural Research Initiative (iAGRI). College of Food, Agricultural, and Environmental Sciences. The Ohio State University. Retrieved Oct. 29, 2014 from <http://cfaes.osu.edu/international/worldwide-projects/africa/innovative-agricultural-research-initiative-iagri>.
- Rubin, D. (2008). *Title XII: The vision, the institutions, and the activities*. Report prepared for the National Association of State Universities and Land Grant Colleges at the request of the Board for International Food and Agricultural Development. Bethesda, MD: Cultural Practice.
- SANREM CRSP. (2009). *Annual report 2009*. Sustainable Agriculture and Natural Resources Management Collaborative Research Support Program. Blacksburg: Virginia Tech.
- SANREM CRSP. (2010). *Annual report 2010*. Sustainable Agriculture and Natural Resources Management Collaborative Research Support Program. Blacksburg: Virginia Tech.
- Small Ruminant CRSP. (1991). *Annual report 1990-91*. Small Ruminant Collaborative Research Support Program. Davis: University of California-Davis.
- Soil Management. (2008). *SM CRSP final report*. Soil Management Collaborative Research Support Program. Honolulu, HI: University of Hawaii.
- Swindale, L.D., Barrett, I., Eriksen, J., Gray, R.C., Jensen, G.L., Lal, R., Marlowe, G., and Miller, C.I. (1994). *An evaluation of the USAID and universities Collaborative Research Support Programs*. Prepared for USAID. Gainesville, FL: Tropical Research and Development, Inc.

USAID. (2010). *Human and institutional capacity development handbook*. Washington, D.C.: United States Agency for International Development.

USAID. (2013a). USAID administrator launches new university partnerships to end global hunger and poverty. USAID Press Office. Retrieved April 11, 2014, from: <http://www.usaid.gov/news-information/press-releases/oct-23-2013-usaid-launches-new-university-partnerships-end-global-hunger>.

Annex: Reference details for Table 3 (Long-term degree training in CRSPs)

Small Ruminant: Data for 1979-1994 taken from evaluation of all CRSPs (Swindale et al., 1994)

Global Livestock: Data for 1998-2008 taken from annual reports (retrieved from crsps.net/resources/)

Livestock-Climate Change: No data available

INTSORMIL: Data for 1979-2011 taken from final review (INTSORMIL CRSP, 2012)

Bean/Cowpea: Data for 1980-2007 taken from final technical report (Herdt et al., 2006)

Pulse: Data for 2007-2012 taken from annual reports (retrieved from crsps.net/resources/)

Trop Soils: Data for 1981-1996 taken from evaluation of all CRSPs (Swindale et al., 1994)

Soil Management: Data for 1997-2008 taken from an external review (Blackburn et al., 1999) and final report (Soil Management, 2008)

Peanut: Data for 1982-1988, 1994, 2007-2012 taken from annual reports (retrieved from crsps.net/resources/)

Human Nutrition: n.d.

Global Nutrition: Data for 2010-2013 taken from annual reports (retrieved from crsps.net/resources/)

Pond Dynamics/Aquaculture: Data for 1982-2008 taken from evaluation of all CRSPs (Swindale et al., 1994) and final report (Aquaculture CRSP, 2008).

AquaFish: Data for 2006-2012 taken from final report (Aquaculture CRSP, 2008) and annual reports (retrieved from crsps.net/resources/)

Fisheries Stock Assessment: Data for 1985-1994 taken from evaluation of all CRSPs (Swindale et al., 1994)

Integrated Pest Management: Data for 1993-2012 taken from annual reports (retrieved from crsps.net/resources/)

Sustainable Agriculture and Natural Resources Management: Data for 1994-2012 taken from annual reports (retrieved from crsps.net/resources/)

BASIS/Assets and Market Access: Data for 1997-2012 taken from annual reports (retrieved from crsps.net/resources/)

Horticulture: Data for 2009-2012 taken from annual reports (retrieved from crsps.net/resources/)