Enabling, Managing, and Leveraging Organizational Learning for Innovation - A Case Study of
the USAID Feed the Future Innovation Lab Program Network

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Abstract

As public agencies have implemented programs to respond to natural disasters, alleviate poverty, provide food security, and address other wicked problems, the organizational structuring of public sector program management has changed in response. The federal agencies responsible for U.S. foreign policy, including the United States Agency for International Development (USAID), have embraced multi-organizational, cross-sector network collaboration as part of their core missions. The strategic transition of USAID to an increased use of network models for program implementation raises questions concerning the ability of the agency, through its partners, to foster organizational learning in this network setting. Ensuring the ability to utilize knowledge and ways of knowing generated through program activity is a critical factor to sustaining the long-term capacity of government agencies and their partners to pursue solutions for these complex global problems. The research reported in this dissertation focuses on network administrative organizations (NAOs) delegated official responsibility for the management of government-funded multi-institutional programs, to understand how organizational learning for innovation takes place in an NAO-led network. This research explored the USAID Feed the Future Innovation Labs for Collaborative Research program focusing on two comparable case studies representative of NAO-led goal-directed networks, the Integrated Pest Management and Horticulture Innovation Labs. The Crossan et al. (1999) 4I framework on organizational learning served as the primary theoretical foundation for addressing how NAOs enable, manage, and leverage organizational learning associated with the boundary work of their program team representatives to innovate as networks. In the two cases studied, the findings indicated that learning practices flowed as anticipated within and across the program network for program and administrative related knowledge, but flowed in a number of different directions for knowledge related to addressing novel problems. Additionally, the NAOs’ ability to institutionalize knowledge generated through the work of program teams and individual members followed unpredictable patterns and was influenced by the presence of knowledge and learning boundaries within the network. The research contribution includes a theorized two-part role for NAOs associated with managing situational learning on behalf of the network and a proposed expansion of the 4I framework that incorporates a network level of learning, organizational boundaries, and two new processes introduced as a result of the findings. Finally, the research concludes with a proposed preliminary framework beneficial to NAO practitioners tasked with managing organizational learning in similar goal-directed network environments.
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Scott W. Weimer

General Abstract

As public agencies have implemented programs to respond to natural disasters, alleviate poverty, provide food security, and address other wicked problems, federal agencies like the United States Agency for International Development (USAID) have embraced multi-organizational, cross-sector collaboration, through an increased use of network models for program implementation. This raises questions concerning the ability of the agency, through its partners, to foster organizational learning in a network setting. Ensuring the ability to utilize knowledge and ways of knowing generated through program activity is vital to sustaining the long-term capacity of government agencies and their partners to pursue solutions for global problems. The dissertation focuses on network administrative organizations (NAOs) delegated official responsibility for the management of government-funded multi-institutional programs, to understand how organizational learning for innovation takes place in an NAO-led network. This research explored the USAID Feed the Future Innovation Labs for Collaborative Research program focusing on two comparable case studies representative of NAO-led goal-directed networks, the Integrated Pest Management and Horticulture Innovation Labs. The Črossan et al. (1999) 4I framework on organizational learning served as the primary theoretical foundation for addressing how NAOs enable, manage, and leverage organizational learning associated with the boundary work of their program team representatives to innovate as networks. In the two cases studied, the findings indicated that learning practices flowed as anticipated within and across the program network for program and administrative related knowledge, but flowed in a number of different directions for knowledge related to addressing novel problems. Additionally, the NAOs’ ability to institutionalize knowledge generated through the work of program teams and individual members followed unpredictable patterns and was influenced by the presence of knowledge and learning boundaries within the network. The research contribution includes a theorized two-part role for NAOs associated with managing situational learning on behalf of the network and a proposed expansion of the 4I framework that incorporates a network level of learning, organizational boundaries, and two new processes introduced as a result of the findings. Finally, the research concludes with a proposed preliminary framework beneficial to NAO practitioners tasked with managing organizational learning in similar goal-directed network environments.
Dedication

I would like to dedicate this dissertation to my parents, Johanna S. and Robert S. Weimer. You were always there for me, loving me, encouraging me, motivating me, and never letting me quit at anything. It is the work ethic that you instilled in me that got me to this point. You will always be in my heart.

I would also like to dedicate this dissertation to my wife Rita and son Rylan. I would not have completed this work without your unending patience, support, and sacrifice. I will be forever grateful. I love you both.
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<tr>
<th>Acronym</th>
<th>Description</th>
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<tbody>
<tr>
<td>AOR</td>
<td>Agreement Officer’s Representative</td>
</tr>
<tr>
<td>BIFAD</td>
<td>Board for International Food &amp; Agricultural Development</td>
</tr>
<tr>
<td>CORAF</td>
<td>West and Central Africa Council for Agricultural Research and Development</td>
</tr>
<tr>
<td>CRSP</td>
<td>Collaborative Research Support Program</td>
</tr>
<tr>
<td>CRSP/IL</td>
<td>Collaborative Research Support Program/Innovation Lab</td>
</tr>
<tr>
<td>DWO</td>
<td>Developing-World Organizations</td>
</tr>
<tr>
<td>EEP</td>
<td>External Evaluation Panel</td>
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<tr>
<td>EET</td>
<td>External Evaluation Team</td>
</tr>
<tr>
<td>FFS</td>
<td>Farmer Field Schools</td>
</tr>
<tr>
<td>FTF IL</td>
<td>Feed the Future Innovation Lab</td>
</tr>
<tr>
<td>GDA</td>
<td>General Directorate of Agriculture (Cambodia)</td>
</tr>
<tr>
<td>HARVEST</td>
<td>Helping Address Rural Vulnerabilities and Ecosystem Stability</td>
</tr>
<tr>
<td>HICD</td>
<td>Human and Institutional Capacity Building</td>
</tr>
<tr>
<td>HORT CRSP/IL</td>
<td>Horticulture Collaborative Research Support Program Innovation Lab</td>
</tr>
<tr>
<td>HORT IL</td>
<td>Horticulture Innovation Lab</td>
</tr>
<tr>
<td>IARC</td>
<td>International Agricultural Research Centers</td>
</tr>
<tr>
<td>IL</td>
<td>Innovation Lab</td>
</tr>
<tr>
<td>IPM CRSP/IL</td>
<td>Integrated Pest Management Innovation Lab Collaborative Research Support Program Innovation Lab</td>
</tr>
<tr>
<td>IPM IL</td>
<td>Integrated Pest Management Innovation Lab</td>
</tr>
<tr>
<td>KISAN</td>
<td>Knowledge-Based Integrated Sustainable Agriculture in Nepal</td>
</tr>
<tr>
<td>ME</td>
<td>Management Entity</td>
</tr>
<tr>
<td>MCC</td>
<td>Mennonite Central Committee</td>
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NAO  Network Administrative Organization
NGO  Non-Governmental Organization
PAB  Program Advisory Board
PI   Principal Investigator
RFA  Request for Applications
UC Davis  University of California-Davis
USAID  United States Agency for International Development
USDA  United States Department of Agriculture
USDA/APHIS  United States Department of Agriculture Animal and Plant Health Inspection Service
VT   Virginia Tech
Chapter 1 - Introduction

Introduction

Historically, some of the most difficult global problems have fallen to government to solve. Challenging 21st century problems like terrorism, global pandemics, and climate change demand responses that cross organizational, political, administrative, and geographic boundaries (Kettl, 2006). As public agencies at all levels of government have implemented programs to respond to natural disasters, alleviate poverty, provide food security, foster scientific innovation, and deal with other wicked problems, they have also produced a body of situational knowledge from which to learn as organizations. Ensuring the ability to utilize knowledge and ways of knowing generated through program activity is a critical factor to sustaining the long-term capacity of government agencies and their partners to pursue solutions for these complex global problems.

Public sector program implementation and subsequently, organizational learning processes and practices developed as a part of administering programs, have traditionally been characterized by systems of hierarchical authority. In a hierarchical system, organizational managers operate upon an underlying structure reflected in the vertical flow of information, “up and down the chain of command” (Kettl, 2006, p. 12). In this form of organizational governance, efforts at achieving program outcomes are reflected in organizing principles based on standardization and control. Specific to learning, program and operational knowledge of the organization is regularly ‘encoded’ in routinized practices, rules and procedures (Lam, 2000). Knowledge and learning processes are often integrated centrally, authenticated by managers or
their trusted external experts and disseminated to employees through formal employee training programs and information technology vehicles (Lam, 2000).

Bureaucratic boundaries so ubiquitous in our history have gotten more difficult to maintain, however, as traditional hierarchical models of governance have not matched up with the “wicked” problems government has been tasked with solving (Kettl, 2006; McGuire, 2006). The organizational structuring of public sector program management has changed in response, transformed from a heavy reliance on bureaucratic hierarchical models to an increasing use of more collaborative and cross-sector program network management structures designed to better address complex global problems (Holton, 2008; Yun, 2006). According to McGuire (2006), collaborative public management is “becoming the prominent form of governing” exemplified by “permeable structures in which people can link across organizational functions and boundaries” (p. 34). It is “a concept that describes the process of facilitating and operating in multi-organizational arrangements to solve problems that cannot be easily solved by single organizations” (O’Leary, Gerard, & Bingham, 2006, p. 7).

Goal-directed networks, in particular, have become “extremely important as formal mechanisms for achieving multi-organizational outcomes, especially in the public and nonprofit sectors where collective action is often required for problem solving” (Provan & Kenis, 2008, p. 231; Saz-Carranza & Ospina, 2010). Provan and Kenis (2008) define this type of a network as “groups of three or more legally autonomous organizations that work together to achieve not only their own goals but also a collective goal” (p. 231). Goal-directed networks engage in a process of interaction through formal and informal means for the purpose of creating shared norms and mutual benefit (O’Toole, 1997; Saz-Carranza & Ospina, 2010) and are “set up with a
specific purpose, either by those who participate in the network or through mandate, and evolve largely through conscious efforts to build coordination” (Provan & Kenis, 2008, p. 231).

Despite the transition towards more interorganizational networked approaches to collaborative management for addressing novel problems (Hardy, Phillips, & Lawrence, 2003; Provan & Lemaire, 2012), McGuire (2006) cautions that “empirical research suggests that a clear distinction between hierarchies and collaborative management is not always accurate” and points out that a “blending of the two management approaches in practice is not uncommon” (p. 36). “Instead of a completely flat, self-organizing network,” McGuire (2006) argues, “the presence of a lead organization, acting as system controller or facilitator, is often a critical element of effectiveness in collaborative management” (p. 36). Provan and Kenis (2008) identify just this type of network governance structure in a form they call the network administrative organization (NAO), a separate organizational entity created to manage and facilitate the goal-directed activities of a network. The NAO serves as a broker for internal and external constituencies but is usually not one of the member organizations and as a result, maintains a certain level of autonomy (Provan & Kenis, 2008, p. 8). This particular form of governance is popular with public sector government funded programs where funding is managed through an NAO and with the NAO serving as the key point of contact with the funding agency to ensure that goals are met (Provan & Kenis, 2008, p. 8).

While NAOs have been studied from a governance perspective to define their structural elements (Provan & Kenis, 2008) and from a strategic perspective to explain their leadership value (Hoflund, 2012), less is known about how NAOs manage organizational learning within goal-directed networks. My research focuses on NAOs delegated official responsibility for the
management of government-funded multi-institutional programs and specifically, in understanding how organizational learning for innovation takes place under the direction of an NAO. It attempts to fill a gap in the literature by generating practical insights into learning management practices useful to public sector practitioners charged with the responsibility for directing similar NAO-led goal-directed networks, and makes a contribution to the theoretical work on organizational learning within a collaborative network setting.

**Statement of the Problem**

The federal agencies responsible for U.S. foreign policy have embraced multi-organizational, cross-sector network collaboration, as part of their core missions. The Agency for International Development, the agency in charge of U.S. development assistance, committed as part of The First Quadrennial Diplomacy and Development Review (QDDR) in 2010 to institutionalize a “new global architecture of cooperation” to address 21st century global challenges (U.S. Department of State & U.S Agency for International Development, 2010). USAID is an agency that has worked to respond to this challenge, forecasting that almost one billion people – more than one seventh of the world – suffer from chronic hunger and that the world’s population is projected to increase to more than nine billion by 2050, requiring up to a 70% increase in agricultural production to respond (Feed the Future, 2012). USAID recognized that the complex nature of development problems like this one demanded that state (U.S. and foreign governmental) and non-state actors (universities, NGOs, CSOs and multinationals) coalesce to consider shared interests and mutual objectives in order to find solutions (U.S. Department of State & U.S Agency for International Development, 2010).
The strategic transition of USAID to an increased use of network models for program implementation raises questions concerning the ability of the agency, through its partners, to foster organizational learning in this multi-institutional environment. Managing the learning process of a single organization is a constant challenge for government agencies - as it is for private companies, universities, and NGOs. When all of these entities work across boundaries in a goal-directed network for program delivery, an organizational learning challenge often grows into a network learning challenge. For NAOs leading goal-directed networks to achieve agency goals, fostering organizational learning becomes a much more complex endeavor than that faced by single organizations operating on their own in a traditional hierarchical manner.

The criticality of organizational learning in a networked environment is readily apparent in an agency like USAID. While headquartered in Washington, D.C., USAID is an intricate organization that operates directly and indirectly in over 100 countries around the world. Included in the agency’s broad mission is a focus on providing technical assistance, capacity building, infrastructure construction, humanitarian emergency assistance, food aid relief, and other development and national security initiatives (U.S. Agency for International Development, 2011). Considering its overall global reach however, USAID is not a large organization in terms of numbers of employees. Instead, it leverages support through grants and contracts using a large network of over 3,500 partners representing private voluntary organizations, indigenous groups, universities, American businesses, international organizations, foreign government partners, trade and professional associations, faith-based organizations, and other U.S. government agencies (U.S. Agency for International Development, 2011).
A specific type of USAID partnership that has received limited scholarly attention, but one that presents a rich opportunity for addressing organizational learning questions in the context of goal-directed network governance, is the agency’s relationship with its public university partners for program implementation. Cases involving USAID-university partnerships can provide a useful test-bed through which answers to questions of organizational learning in a network context can be pursued. USAID engages universities in the United States and around the world in various research and service-oriented programs that explore issues of sustainability, food production, poverty, urbanization and other focus areas for the Agency (Collaborative Research Support Programs, n.d.). Public universities represent an ideal-type collaborative organization, characterized by the tenets of professional collegiality, continuous learning, and knowledge sharing. The Feed the Future Innovation Labs for Collaborative Research program is an example of one such USAID-university partnership, an international development initiative that was instituted to take advantage of the scientific, cooperative, and applied expertise of U.S. research universities and their respective networks of collaborative partners to solve complex global agricultural problems (United States Agency for International Development. (2011).

Scarce resources are increasingly being used across the public sector to support inter-organizational networks like the Innovation Labs for Collaborative Research to help address complex global challenges. With such a critical investment of public funds in the promise of these programs, the problem of importance to scholars and practitioners of public administration is understanding how learning practices can be managed within this network to foster innovation. It is crucial to the field, therefore, to develop a better understanding of how organizations, particularly those engaged as NAOs leading publicly-funded goal-directed networks, enable,
manage, and leverage the work of their program team members to learn as organizations and
networks.

Research Question and Theoretical Foundations

Goal-directed networks involve public organizations actively establishing program
management structures and institutional processes designed to foster service delivery, technical
assistance, and policy development through cross-sector network interactions (Kapucu, 2006;
Selsky & Parker, 2005). Within these networks, government agencies are collaborating across
organizational boundaries with their public, private, university, and NGO partners in order to get
the job done (Khademian, 2002). Boundaries in this setting are important as they not only
represent potential barriers to learning; they can also offer a dynamic space where learning can
occur (Akkerman & Bakker, 2011b; Scarbrough, Swan, Laurent, Bresnen, Edelman, & Newell,
2004; Wenger, 2000). While the inter-organizational relationships found within networks can be
a locus of innovation, as Powell, Koput, and Smith-Doerr (1996) have argued, the complexity of
developing, maintaining, and leveraging relationships across geographic, organizational, and
scientific boundaries for the purpose of learning can be a significant challenge.

The network administrative organization (NAO), which represents one governance
approach to managing the complex, boundary work of goal-directed networks, is a management
structure dependent upon its program team members conducting joint problem solving,
partnership building, relationship management, and other types of inter-organizational
collaboration (Feldman, Khademian, Ingram, & Schneider, 2006; Stephenson & Schnitzer, 2006;
Thomson & Perry, 2006; Williams, 2002). The success of this network governance approach,
therefore, rests in large part on the ability of the NAOs to develop, support, and act upon the knowledge and expertise of their program team members to foster learning across the network.

The above expectation relies on two key assumptions: first, that NAO program team representatives are a source of learning and innovation for their networks; and second, that as representatives of the networked organization they are motivated, willing, and able to share the knowledge and ways of knowing forged from their work with the NAO leadership and government sponsor, within their program teams, and across the program network in which they participate. It would seem that a shift of government agencies toward more collaborative, networked approaches to program governance models like NAOs would provide an opportunity for program team members engaged in boundary work to influence learning within their home organizations and associated networks. The important problem for the field of public administration is understanding how this learning activity is facilitated, managed, and utilized by NAOs to help achieve the goals of the networks they lead. A number of scholars have found that managing knowledge within organizations can be challenging, especially in network environments where knowledge is often developed within silos so that sharing such knowledge across organizational boundaries is problematic (Marabelli & Newell, 2012; Swan, Newell, Scarbrough, & Hislop, 1999). This leads to the following research question:

*How do network administrative organizations with responsibility for leading publicly-funded goal-directed networks, enable, manage, and leverage organizational learning associated with the boundary work of their program team representatives to innovate as networks?*
Crossan, Lane and White’s (1999) 4I framework for exploring organizational learning as a dynamic process serves as the primary theoretical foundation for addressing this question. The 4I framework is used to understand learning in a complex organizational setting by accounting for the flow of knowledge between individual, group, and organizational levels using the 4I processes of intuiting, interpreting, integrating, and institutionalizing (Crossan et al., 1999). As useful as the 4I framework is for understanding organizational learning, the model is limited in its explanatory power. The framework concentrates on the learning process within a single organization while giving limited focus to the question of how organizations operating in networked environments learn. The critical element that appears to be missing in this framework is consideration for learning that takes place in the network level boundaries between organizations. I believe that the concept of learning through network interactions can be an extension of organizational learning as modeled by Crossan et al. (1999). In order to understand how organizations learn when operating in goal-directed networks, it is also important to evaluate the role of the NAO in managing organizational learning across knowledge and learning boundaries. As part of my analysis, I extend the 4I framework to include consideration for this missing boundary area between organizations in the networks in which they operate. The expansion of the 4I model will be used to explain how network administrative organizations involved in program management networks can learn from the boundary work of their program team members. Finally, I attempt to build upon the theoretical work of Crossan et al. (1999) and address a gap in the available literature by creating a preliminary practice-oriented framework for practitioners responsible for managing organizational learning in collaborative networked environments. This preliminary framework will be well suited for helping individuals tasked
with leading NAOs better understand how to enable, manage, and leverage learning from the work of their network members to learn as organizations.

A Case Study of the USAID Feed the Future Innovation Lab Program Network

I explore my research question and theoretical framework through a case study of the USAID Feed the Future Innovation Labs for Collaborative Research program. This multi-organizational development initiative is administered on behalf of USAID by a number of public university partners. USAID launched the program, originally called the Collaborative Research Support Program (CRSP) in 1975 as part of the Title XII Amendment to the Foreign Assistance Act “as a long-term mechanism to focus capabilities of U.S. land grant universities to carry out the international food and agricultural research mandate of the U.S. Government” (Collaborative Research Support Programs, n.d.). The CRSP/Innovation Labs are networked ‘communities’ of institutions working in coordination with USAID to provide development expertise and technical assistance across a broad geographic area to extend their research discoveries to foreign aid recipient audiences (Collaborative Research Support Programs, n.d.; Sorghum, Millet and Other Grains CRSP Management Entity, 2011). USAID is not alone among public-sector agencies in its strategic use of goal-directed grants and contracts in working with external network partners, as other agencies employ similar network approaches to program implementation (Provan & Lemaire, 2012).

Understanding how CRSP/Innovation Lab NAOs learn through the work of their program team members for purposes of network innovation can provide useful insight to NAO practitioners responsible for the management of similar publicly funded programs. To develop my findings, I conducted an analysis of the USAID Feed the Future Integrated Pest Management
Innovation Lab for Collaborative Research managed by an NAO management entity based at Virginia Tech and the Horticulture Innovation Lab for Collaborative Research, a similar NAO-led management entity housed at the University of California-Davis. The data collection and analysis of documentary evidence and participants interviews took place over the period of 2009-2014, a five-year span during which USAID made significant adjustments to the overall program that both management entities were required to navigate. These two programs served as exemplary cases for exploring organizational learning in NAO-led goal-directed network settings and produced a number of findings with implications for both theory and practice.

Organization of the Dissertation

My dissertation is organized into six chapters. It continues with Chapter 2 which provides a review of the scholarly literature detailing the foundation, context, and application for my study as well as an overview of the Crossan et al. (1999) 4I framework. In Chapter 3, I discuss the research design and case study method I use and the data collection and analysis strategy I employed. Chapter 4 focuses on the case study of the USAID Feed the Future Innovation Lab Program Network by exploring the Integrated Pest Management and Horticulture Innovation Lab networks in more detail. In Chapter 5 I present and discuss my findings from the study. I conclude with Chapter 6 where I highlight my contributions from the study, present additional theoretical implications of the findings, and propose a preliminary framework for NAO practitioners.
Chapter 2 - Literature Review and Theoretical Framework

Introduction

Organizational learning is an established field of scholarship that includes many seminal works, draws upon a number of contributing literatures, and is continuously being enhanced by scholars in disciplines ranging from business and education to public administration and industrial psychology. It is a diversified field of study without a dominant theory or model and one in which significant debate and argument has taken place over appropriate definition of terms and application of methods (Easterby-Smith & Lyles, 2003; Fiol & Lyles, 1985). My objective is to highlight those foundational scholarly works that have contributed to a broad understanding of organizational learning, to show the importance of those sources that have helped me develop the context for my research, and to explain further the application of specific theories to my case study research.
I believe that a gap exists in understanding how network administrative organizations (NAOs) (Provan & Kenis, 2008) enable, manage, and leverage the learning practices of their program team members to learn as organizations. I intend to show how the intersection of these related literatures can provide insight into how organizational learning takes place within goal-directed networks.

**Organizational Learning Foundational Works**

According to Easterby-Smith and Lyles (2003), the field of organizational learning gained prominence in the 1980s and 1990s as a new group of social scientists and management scholars began to debate the question of whether organizations could learn and amass knowledge. Theorists drew on the work of authors who had engaged learning questions at the individual level in an effort to illustrate how individual knowledge could be rolled up to the organizational level. Organizational learning scholars built upon the early theoretical work of Frederick Hayek (1945) and Edith Penrose (1959). Hayek’s (1945) work on organizational knowledge was written from an economics perspective and contributed in significant ways to understanding how knowledge is shared with decision-makers and how organizations deal with unorganized knowledge. Penrose (1959) is best known for her work on the importance of human capital within organizations and the impact that knowledge among a firm’s workforce has on economic competitiveness.

Additional foundational scholars include Cyert and March (1963), who viewed organizations as adaptive learning systems and found that firm decision-making behavior was driven by routines, procedures, and incremental learning in response to environmental considerations and external shocks (as cited in Poole & Van de Ven, 2004, p. 114), Cangelosi
and Dill (1965) highlighted the tension between the notion of individual versus organizational learning and found that organizational adaptation was a result of response to different stresses and Argyris and Schon (1978) attempted to create a distinction between those organizations with the capacity to learn and those without such an ability. Several other scholars have influenced practitioners in this field as well, including Peter Senge (1990), who is credited as the first in this field to use the term ‘learning organization’ to define a systems approach to learning at the organizational level. Nelson and Winter (1982) looked at different levels of tacit learning from an economic perspective, while Nonaka and Takeuchi (1995) described a ‘knowledge creating company,’ as one that could transform tacit knowledge into explicit knowledge and establish the enabling conditions for organizational knowledge creation.

Within the organizational learning literature, there is no clear agreement on the question of how organizations learn. The interaction among individual, group, and organizational levels of learning and the debate surrounding this dynamic, has been a key thread throughout the foundational literature of the field (Easterby-Smith, Crossan, & Nicolini, 2000). Those theorists who put precedence on individual-level learning see the individual as the central figure necessary to the accumulation and distribution of knowledge within an organization. Often called Cartesian learning because of its grounding in the philosophy of Rene Descartes, or cognitive learning, individual-level learning assumes that the “individual analytical thinker is primary” and “knowledge is best acquired through reason” (Cook & Brown, 1999, p. 384). Simon (1991) argued that “all learning takes place inside individual human heads; an organization learns in only two ways: (a) by the learning of its members, or (b) by ingesting new members who have knowledge the organization didn't previously have” (p. 125). This Cartesian tradition, argue Cook and Brown (1999), represents the “conventional understanding of knowledge in our
culture” and “the idea that knowledge, particularly anything that might pass as rigorous knowledge, is something that is held in the head of an individual and is acquired, modeled, and expressed most accurately in the most objective and explicit terms possible” (p. 384).

In contrast to the Cartesian view of learning, Polanyi (1966) addressed differences between explicit and tacit knowledge, challenging the notion that only knowledge “explicitly” codified in formal ways was to be considered legitimate (Easterby-Smith & Lyles, 2003). A fact of human knowledge, Polanyi (1966) claimed, is “that we can know more than we can tell” (p. 4). He argued that not all knowledge could be explained in well-defined routines, written procedures, or texts (an important consideration for organizations) (Polanyi, 1966). The tacit component of knowing how to do something, the unexplainable, was as much an integral component of knowledge as the explicit (Easterby-Smith & Lyles, 2003; Polanyi, 1966).

According to Stenmark (2000), “tacit knowledge is knowledge that cannot be easily articulated and thus only exists in people's hands and minds, and manifests itself through their actions” (p. 10). Knowing how to ride a bicycle or pitch a baseball, but having difficulty explaining the activity to someone else, is a simple example of why tacit knowledge can be so difficult to assess and share with others (Polanyi, 1966). The challenges of working with tacit knowledge are magnified within an organizational context where its intangible nature makes it difficult to capture, store, and disseminate (Stenmark, 2000, p. 9). Despite this challenge, tacit knowledge represents a considerable asset to leverage for both private and public sector organizations. Private-sector firms with tacit knowledge in particular areas are seen to have a competitive advantage as the innate knowledge and abilities of their employees may not be replicable by peer organizations (Barney, 1991; Easterby-Smith & Lyles, 2003). Riege and Lindsay (2006) argue that in an effort to “create more innovative systems that connect people to information and
knowledge,” a large number of public-sector organizations have embraced management practices “that concentrate on the capture and application of knowledge, especially tacit knowledge, to leverage organizational learning and enhance organizational competencies” (p. 25).

**American Pragmatism – Foundations of Practice-Based and Situated Learning**

Organizational learning scholars have drawn heavily on the philosophy of the American Pragmatists and in particular, the works of John Dewey, whose related concepts of experience and inquiry are foundational to the streams of organizational learning literature focused on practice-based and situated learning (as cited in Easterby-Smith & Lyles, 2003). As a term, pragmatism was coined by Charles Sanders Peirce where it was a philosophy developed and popularized by William James and ultimately expanded by George Herbert Mead, but is most often associated with the extensive body of philosophical works written by John Dewey (Easterby-Smith & Lyles, 2003). Developed in the late 19th and early 20th centuries, it is a philosophy informed by experience, practice, and the assumption that individuals are active participants in their social worlds (Simpson, 2009). “Pragmatism is an account of the way people think,” Menand (2001) wrote, “the way they come up with ideas, form beliefs, and reach decisions” (p. 351). It is also a philosophy grounded in action. Pragmatists consider the question of “what makes us decide to do one thing when we might do another thing instead?” (Menand, 2001, p. 351) and fostered the belief “that it is through our participation that we continuously construct and re-construct the social meanings that shape our thoughts and actions” (Simpson, 2009, p. 1333).

Dewey engaged the concept of “learning by doing” through his writings on experience and inquiry, a concept that serves as the foundation for the experiential and practice-based
learning perspectives of modern scholars (as cited in Easterby-Smith & Lyles, 2003). He argued that “to ‘learn from experience’ is to make a backward and forward connection between what we do to things and what we enjoy or suffer from things in consequence” (Dewey, 1916, p. 164). “Under such conditions,” he claimed, “doing becomes trying; an experiment with the world to find out what it is like; the undergoing becomes instruction-discovery of the connection of things” (Dewey, 1916, p. 164). Dewey’s position on experience ran counter to the conventional understanding that learning was primarily a cognitive exercise. He argued that “there is no such thing as genuine knowledge and fruitful understanding except as the offspring of doing” and that “the analysis and rearrangement of facts which is indispensable to the growth of knowledge and power of explanation and right classification cannot be attained purely mentally-just inside the head” (Dewey, 1916, p. 321). For Dewey (1916), “practice falls of necessity within experience … doing proceeds from needs and aims at change” (p. 310). “If a person wished to find out something”, Dewey (1916) argued, “they would have to alter conditions” (p. 321).

Dewey’s concept of inquiry is directed at the context for learning through experience where “inquiry is the controlled or directed transformation of an indeterminate situation into one that is so determinate in its constituent distinctions and relations as to convert the elements of the original situation into a unified whole” (Dewey, 1938, pp. 104-105). Indeterminate situations represent a mismatch between current expectations and realities (Bruce, 2008). They can be episodes of disequilibrium, instability, imbalance, or breakdowns in the ongoing activities of some systems (Burke, 1994; Evans, 2000). Evans (2000) argues that indeterminate situations are “confused, obscure, or conflicted” engendering a “real doubt” for which “inquiry is the means or method to reduce doubt and restore balance to a problematic situation” (p. 314). Situations are also mutually constituting events in which people are active participants. Individuals can change
Elkjaer (2004) calls this a “transaction between individual(s) and environment; it is the continuous and mutual formation of the two, and as such experience is both a process and a product” (p. 420).

Elkjaer (2004) argues that experience and inquiry “contribute to the definition of what happens in participation, i.e. in the meeting between learner(s) and the everyday organizational life and work practice” (p. 420). Bruce (2008) stresses that the “controlled or directed transformation of indeterminate situations is simply what we do as purposive organisms” and that “learning is our capacity to reflect upon that transformation and to realize that we can achieve a unified whole when faced with similar situations in the future” (para. 4). Learning through experience and inquiry are how we become knowledgeable (Elkjaer, 2004).

In an related stream of the literature, advocates of group and organizational level learning believe that learning is socially situated, taking place beyond the cognitive individual-level and occurring in the interaction between and among people, through the transmittal of organizational histories and narratives, and within the routines, rules, and procedures of organizational systems (Fiol & Lyles, 1985). Hedberg (1981) states that “although organizational learning occurs through individuals, it would be a mistake to conclude that organizational learning is nothing but the cumulative result of their members’ learning … organizations do not have brains, but they have cognitive systems and memories (as cited in Fiol & Lyles, 1985, p. 804). Scholars such as Hedberg (1981, as cited in Fiol & Lyles, 1985), Cook and Brown (1999), Crossan et al., (1999), and Feldman et al. (2006) believe that while cognitive development is important to learning, behavioral change through action can lead to insights, inform understanding, and create new
ways of knowing. In describing learning activity through the telling of war stories by a group of copier technicians, for instance, Cook and Brown (1999) and Orr (1996) found that while individuals were the conduit to sharing knowledge, the group members would validate that knowledge through their own experience. The knowledge shared by group members was held in common by the group and “individuals and groups each do epistemic work that the other cannot” (Cook & Brown, 1999, p. 386). Consistent with this line of thinking, Berends, Boersma, and Weggeman (2011) point out that the literature suggests “organizational learning is an inherently social process” (p. 1038). They infer that the development of knowledge occurs through a range of structured practices that “are realized by employing social rules and resources, which gives them a recurring nature (Berends, Boersma, & Weggeman, 2011, p. 1052).

The foundational works described above provide a point of departure for my study of organizational learning. Many of the debates around levels of learning, cognitive versus behavioral approaches, explicit and tacit knowledge, and the value of situated and practice-based learning through experience and inquiry, have run their course and are now considered to be broadly accepted (Easterby-Smith et al., 2000). They provide a place to plug into the field and a jumping-off point for additional research into new questions around organizational learning (Easterby-Smith et al., 2000). In the next section, I explore literature that sets the context for my study. The literature focused on structural and cultural perspectives of organizational learning describes how knowledge is produced, retained, and shared by individuals and organizations. I then explore the link between organizational and network learning by investigating literature from the network management, network collaboration, and network learning fields.
Structural and Cultural Perspectives on Organizational Learning

Another area of differing views among organizational learning scholars is the question of how learning can be engineered in an organizational setting. Moynihan and Landuyt (2009) point out that there is a tension in the literature between emphases on cultural and structural routes to learning for organizations. A structural approach is focused on organizational routines, processes, and formal mechanisms that can foster organizational learning. Researchers study how learning by individuals is acquired and utilized by the organization through formal procedures (Moynihan & Landuyt, 2009). A number of authors have taken positions associated with the structural approach to organizational learning. These scholars include Simon (1991), referenced earlier for his staunch stance on the primacy of learning by individuals, Huber (1991), who examined structural antecedents to learning that included knowledge acquisition, information distribution, information interpretation, and organizational memory, and Cohen and Levinthal (1990), who studied the impact of absorptive capacity on organizational learning. In addition, Coopey (1995) looked at the power dynamics of structure on organizational learning and Lipshitz, Popper and Oz (1996) developed a model of organizational learning mechanisms that they argued would help managers build learning organizations.

The cultural perspective (also described as the social-constructionist approach) to organizational learning includes authors who broadly subscribe to the view that learning takes place through conversations and interactions between people, through sharing of norms and intersubjective meaning-making, that organizations can learn through their enacted routines, and that learning is nearly always contextual (Easterby-Smith, Crossan, & Nicolini, 2000; Moynihan & Landuyt, 2009). Cook and Yanow (1993) looked at how organizational culture manifested in
group activity influences learning through the creation of intersubjective meaning among employee groups. They argue that organizations learn through the activities of their employees using cultural artifacts and that learning at the organizational level entails harnessing, adapting, and maintaining over time the collective know-how (Cook & Yanow, 1993). Brown and Duguid (1991) explored in detail the social nature of learning and information sharing in the workplace. They claimed that an organizations’ blind reliance on canonical work instructions, manuals, and other structural processes often does not reflect the valuable practices of its members which have been developed from the ground up (Brown & Duguid, 1991). Orr (1990), through his study of copier repair technicians, sought to understand “learning through doing” among organizational teams and discovered that informal work-around practices were often much more effective than formal, institutionalized and codified manuals. Lave and Wenger (1991) and Wenger (1998) conducted extensive work on a framework for understanding organizational learning that encompassed situated contextual learning through what they described as communities of practice. Participation in a community of practice involves becoming a practitioner of the community, an insider, as interaction with members of that community create the context for developing shared meaning, ways of knowing unique to that community, and learning episodes specific to unique situations (Wenger, 1998).

Metaphors can be useful for understanding these two perspectives. Sfard (1998) argues that metaphors “enable conceptual osmosis between everyday and scientific discourses, letting our primary intuition shape scientific ideas and the formal conceptions feed back into the intuition” (p. 4). Sfard (1998) and Elkjaer (2004) present similar metaphors while Cook and Brown (1999) use different language but address similar concepts. The acquisition metaphor most closely aligns with the structural perspective on organizational learning. It views the
individual acquisition of knowledge and skills, the mind, as a container to be filled up with information and knowledge as substance that can be easily transferred person to person (Elkjaer, 2004; Sfard, 1998). Cook and Brown (1999) refer to this as the epistemology of possession. Knowledge is something explicit that people can possess and it privileges individual over group. Knowledge is thought of as something we use in action but it is not considered action itself (Cook & Brown, 1999, p. 387).

In contrast to the acquisition metaphor, Sfard (1998) and Elkjaer (2004) reference the metaphor of participation, which closely aligns with the cultural perspective on organizational learning. Elkjaer (2004) argues that “within this metaphor, learning is understood as participation in communities of practice – as a movement from newcomer to old-timer … the participation metaphor takes learning out of the individual mind and formal education settings and places it into the everyday organizational life and work” (p. 420). Cook and Brown (1998) refer to this as the epistemology of practice. Knowing is seen as action, it is found in individual and group activities and takes ways of knowing as its focus (Cook & Brown, 1998). Within the epistemology of practice, Cook and Brown (1998) characterize knowledge “as a tool at the service of knowing” and “not as something that, once possessed, is all that is needed to enable action or practice” (p. 388). In other words, knowing will not take place until the knowledge already possessed is acted upon through practice (Cook & Brown, 1998, p. 388).

The literature on structural and cultural perspectives of organizational learning helps set the context for my case study by linking individual and organizational-level learning concepts and metaphors that help explain how learning may be directed within an organizational setting. In the next section, I highlight several areas of network research that look at key network
processes and structures, including management, collaboration, and governance, for a better understanding of organizational learning in relation to goal-directed networks.

**Network Management, Collaboration, and Governance**

Kettl (2000) argues that over the last generation, government has undergone a transformation of governance in its processes and institutions. Agencies acting on behalf of the public interest increasingly involve sharing responsibility with other levels of government, non-profit organizations, private firms, and other non-governmental actors (p. 488). As populations world-wide have increased and wicked problems have gotten bigger and more complex, governments are increasingly being challenged in their efforts to provide public services to their citizens. This change has resulted in a rapid increase of non-governmental, cross-institutional networked actors enlisted to help design, deliver, and evaluate programs previously administered by government institutions alone (Holton, 2008; Yun, 2006). There has also been a deliberate strategy to avoid increasing the size of the government while expanding its program portfolio that has been justified under the auspices that the private sector could deliver certain programs cheaper and faster than the government could (Kettl, 2000, pp. 488-492). In place of traditional government institutions, we have seen the emergence of many different types of networks for such as public-private partnership networks focused on rural economic development (Agranoff & McGuire, 2001a), multi-jurisdictional government-led emergency preparedness networks for disaster response and relief (Kapucu, 2006) and in some cases, even self-organizing networks that assume the traditional problem-solving and implementation roles of top-down, hierarchical governmental institutions (Peters & Pierre, 1998, p. 225). Distinguishing features of networks include interdependency and collaborative leadership. Problems are not easily solved and the
joint interest in the project will not be achieved, unless interdependent actors pursue the solution
strategically and collaboratively (Agranoff & McGuire, 2001a, p. 676).

The study of networks in public administration is not a new phenomenon or a practice
exclusive to the discipline. Networks are explored in fields as wide-ranging as environmental
science, business, healthcare, physics, information technology, and anthropology (Holton, 2008;
Provan, Fish, & Sydow, 2007). The variance in networks within just one field, international
relations for example, includes such types as commercial, advocacy, friendship, imperial,
informational, professional, religious, and terrorist (Holton, 2008). Provan et al. (2007) focus
their study of the network literature on whole networks, “multiple organizations linked through
multilateral ties … and connected in ways that facilitate achievement of a common goal” (p.
482), to “understand such issues as how networks evolve, how they are governed, and,
ultimately, how collective outcomes might be generated” (p. 480). Saz-Carranza and Ospina
(2010) find that networks have been studied by looking at structural characteristics and network
participant behaviors and relationships. They argue that the bulk of the scholarly literature on
networks has been directed towards the structural dimensions of networks, often focusing on
elements of form and function, rather than network behavioral dimensions such as individual and
group actions aimed at “coordinating and controlling joint action” (Saz-Carranza & Ospina,
2010, p. 330). While these core concepts are often analyzed in isolation, in practice they are
closely linked, as Sandstrom and Carlsson (2008) illustrated in their study linking policy
outcomes with network structure and network performance.

Structure and behavior have also been linked in a number of studies focused on the
governing of collaborative goal-directed networks (Milward & Provan, 2006; Provan & Kenis,
and literature exploring the relationships of network members to network management (Agranoff & McGuire, 2001b; Saz-Carranza & Ospina, 2010). Networks offer the “potential for organizational learning and innovations to take place but, simultaneously, makes these processes much more complex” (Kallio & Lappalainen, 2015, p. 141). Management activities associated with these networks include promoting collaboration, trust-building, dealing with power infrastructures in the collaboration of members, defining membership, and many elements of setting objectives (Saz-Carranza & Ospina, 2010). Collaboration occurs when individuals, groups, and organizations join in a process to address a problem collectively (Thomson & Perry, 2006), work strategically to develop organizational capacities through the transfer or pooling of resources (Hardy et al., 2003), and “co-labor, to cooperate to achieve common goals, working across boundaries in multisector relationships where cooperation is based on the value of reciprocity” (O’Leary et al., 2006, p. 7). Trust is probably the most important dimension of the collaborative process. While trust alone will not guarantee collaborative success, the absence of trust will nearly always result in the failure of a collaboration network (Thomson & Perry, 2006, p. 28). Trust is crucial to boundary work as well and being able to navigate the boundaries between organizations is an important part of ensuring the success of collaborative networks (Stephenson & Schnitzer, 2006). The application of boundary work literature to my study will be discussed later in the chapter.

The governance of collaborative goal-directed networks is a specific area of the literature that has received limited scholarly attention (Provan & Kenis, 2008; Saz-Carranza & Ospina, 2010) but an important one for the context of my study, especially as it relates to questions of organizational learning. Exploring network governance is necessary to gain an understanding of the processes and context within which organizational learning takes place in networked
environments. Network governance is “the means for achieving direction, control, and coordination” of “autonomous individuals or organizations on behalf of interests to which they jointly contribute” (Lynn, Heinrich, & Hill 2000, p. 235). Scholars have explored the inherent relationships in various tensions characteristic of network governance such as efficiency versus inclusiveness, internal versus external legitimacy, flexibility versus stability, and unity versus diversity (Provan & Kenis, 2008; Saz-Carranza & Ospina, 2010). In public-sector networks, government coordination and control can vary considerably, from the significant involvement of a federal agency actively controlling the policy making process within an advocacy coalition framework for example (Ellison & Newmark, 2010), to limited involvement and influence of the government agency, operating instead as more of an equal member of the network (Peters & Pierre, 1998, p. 226). Borzel (1998) argues that “networks present themselves as a solution to coordination problems common with modern societies” and that the “horizontal self-coordination” exhibited in some networks is analogous to hierarchy in response to increasingly challenging interactions among actors (p. 260). These self-governing networks may not share that same legal-rational authority of hierarchical forms of governance, instead gaining their authority through some mutual interdependent relationship and/or shared set of goals (O’Toole & Meier, 1999). Agranoff and McGuire (2001b) argue that there are cohesion factors present in networks that are equivalent to the legal-rational authority of hierarchies including trust, common purpose, mutual dependency, and managerial leadership (p. 297). Networks contain autonomous entities with distinct aspirations, operational goals, and organizational characteristics (Saz-Carranza & Ospina, 2010). Saz-Carranza and Ospina (2010) argue “these networks must somehow be governed to ensure coordinated action to achieve such goals” (p. 329).
Provan and Kenis (2008) define governance as the “use of institutions and resources to coordinate and control joint action across the network as a whole” and present three models of governance through which actions of network members are facilitated - participant-governed, lead organization-governed, and NAO-governed (p. 3). The first form they describe is the participant-governed network, a shared governance model where every organization interacts with the other members of the network in making decisions, managing internal and external relations, and participating in activities towards achieving the collective goal (Provan & Kenis, 2008, p. 6). As networks grow in complexity and size though, the decentralized, collective self-management of the participant-governed approach can become problematic. The second model of network governance, the lead organization-governed network, takes advantage of a strong organizational member of the network that provides organizational administration, facilitation of activities, and brokering services on behalf of internal and external constituencies (Provan & Kenis, 2008, p. 7). The third form of governance identified by Provan and Kenis (2008) and first introduced in Chapter 1, is the network administrative organization (NAO). Instead of self-governance by all member organizations or relying on a single lead organization to direct the activities of the network, the NAO governance model leverages a separate organizational entity set up to manage and initiate the goal-directed activities of the network in collaboration with members (Provan & Kenis, 2008, p. 8).

My case study is focused on the USAID Innovation Labs for Collaborative Research, goal-directed networks led by university entities in which some employ the network administrative organization form of governance. The various streams of literature highlighted above provide the necessary context to help investigate network management, governance, and
collaboration in these types of networks. However, little scholarship has been directed at organizational learning processes within NAO-led networks, a gap which I hope to fill.

In the next section, I build on the foundational works of organizational learning and the contextual organizational learning literature, by exploring the application of network-level organizational learning, boundary work, and practice theory literature to my study.

**Network-Level Organizational Learning**

Network learning as a concept has been explored in the literature from different perspectives depending on whether learning is viewed as taking place by the network or within the network among its member organizations. Knight (2002) and Knight and Pye (2005) for instance find that network learning is “learning by a group of organizations as a group” (Knight, 2002, p. 428). In this view, network learning is “seen as more than the sum of the learning of individuals, groups, and organizations that constitute the network” (Knight, 2002, p. 437), but instead, a fourth level of learner (after individual, group, and organization levels), where network learning would entail changes in network attributes like structures for collaboration and processes for the creation of shared narratives (Knight, 2002, p. 437). Knight (2002) argues that “if through their interaction, a group of firms change the group’s behavior or cognitive structures, then it is the group of organizations that is the ‘learner’, not just the individual organizations within the group” (p. 428).

Houldsworth and Alexander (2005) sought to examine the concept of network learning by applying Knight’s (2002) and Knight and Pye’s (2002) frameworks to understand how learning emerged through participation in the European SME e-learning network (Houldsworth
The authors found that the project was an example of learning within a network but did not represent an example of the network learning as a whole. (Houldsworth & Alexander, 2005, p. 216). The evidence collected, Houldsworth and Alexander (2005) argue, did not demonstrate learning and changing within the network itself, a key element of the Knight (2002) and Knight and Pye (2002) positions. The authors found instead that the evidence more closely aligned with a number of alternative themes from the organizational literature including “collaborating and learning in networks, notably around culture, the need for a common focus and agenda, and the need for strong facilitation and influence” (p. 216). Houldsworth and Alexander (2005) noted in particular the importance of “personal capacities for collaboration” (Knight & Pye, 2002, p. 216), the absence of which in this case, they argue, may have caused some frustration and slow progress of the project. The authors also highlight “the need to take a strong and decisive stance and provide direction,” an approach they question, would “seem to sit uneasily with some of the ideals of participation and negotiation associated with collaborative working” (Houldsworth & Alexander, 2005, p. 216).

The scholarly literature on organizational learning processes also ties to network-level learning. Müller-Seitz (2012) for instance, looks at absorptive capacity within a network context. Absorptive capacity is an organizational learning theory that argues the ability of an organization to take on new knowledge is dependent on the level of existing knowledge within that organization (Cohen & Levinthal, 1990; Inkpen & Tsang, 2007; Müller-Seitz, 2012). The author studied an inter-organizational semiconductor network called SEMATECH and found that absorptive capacity did extend to the network level, was enhanced through physical convening of its members via structured conferences, and solidified through formal road-mapping practices by its network administrative organization to advance shared network goals (Müller-Seitz, 2012).
Powell et al. (1996) who studied research and development networks operating the biotechnology industry similarly found that knowledge is a source of competitive advantage, but that competition in a network environment can no longer be seen as a zero-sum game (p. 143). Instead, because knowledge is widely dispersed among network members and all required knowledge cannot be produced or institutionalized within a single organization, reciprocal learning by members operating as part of networks of learning is essential (Powell et al., 1996, p. 143). Inkpen and Tsang (2007) who studied learning in strategic alliance networks, also stress the importance of absorptive capacity finding that “learning in strategic alliances involves the creation, transfer, and absorption of knowledge” (p. 486). “Access to knowledge via an alliance,” they argue, “does not guarantee acquisition … thus, while learning-partner receptivity and learning intent involve the general desire to learn, absorptive capacity concerns the ability to learn” (Inkpen & Tsang, 2007, p. 489).

Much like learning at the individual, group, and organizational levels has been described, the acquisition metaphor (Elkjaer, 2004; Sfard, 1998) has been applied at the network learning level. Larsson, Bengtsson, Henriksson, and Sparks (1998) argue that “interorganizational learning can be achieved by transferring existing knowledge from one organization to another organization, as well as by creating completely new knowledge through interaction among the organizations” (p. 289), while Dyer and Nobeoka (2000) explored learning processes within a supplier network facilitated by the powerful auto manufacturer Toyota, to understand how knowledge-sharing took place with and among, the company’s suppliers. The authors were able to identify several key institutionalized processes/routines which influenced interorganizational and network learning (Dyer & Nobeoka, 2000). These included the creation of a supplier association to develop ties among members, an internal consulting division to assist in solving
operations problems encountered by Toyota and its network members, problem solving and voluntary learning teams to assist one another with productivity and quality improvements, inter-firm employee transfers designed to spread individuals with knowledge and experience around the network and regular performance feedback and monitoring (Dyer & Nobeoka, 2000).

**Boundary Work**

Boundaries are fundamental to public sector programs as they have served as a central part of the administrative process by defining the limits of organizational responsibilities and functions (Kettl, 2006). The traditional hierarchical authority inherent in bureaucratic government programs has often reinforced these organizational boundaries. In the 21st century, however, political processes complicate administrative response, hollowed out governing has control issues, and the nature of addressing wicked problems through vertical structures is problematic with flows of people, information, and resources taking place across boundaries (Kettl, 2006; Weber and Khademian, 2008; Yip, Ernst, and Campbell, 2011). The pursuit of network goals in collaboration with entities beyond the traditional hierarchical boundaries of government organizations, including individuals, nonprofits, businesses, and other agencies, as well as new forms of organizing, such as cross-functional teams, virtual workgroups, and cross-sector partnerships, has made the need for learning from boundary interactions particularly important (Schneider, 2009; Yip et al., 2011). The challenge for learning in this setting as Powell et al. (1996) argue, is that “the canonical formal organization, with its bureaucratic rigidities, is a poor vehicle for learning” where instead, learning for innovation is more likely to be found in the boundaries between organizations (p. 118).
According to Quick and Feldman (2011), “simply sustaining boundaries is effortful” and describe boundary work as “the practices for managing boundaries,” … “to erect, maintain, relocate, or bridge them” (p. 3). This section of the literature centers on boundary work by exploring studies focused on boundary organizations, the individuals working within those organizations in boundary spanning roles, and the boundary objects that they use in the conduct of their work practices.

Guston (1999) presented the concept of the boundary organization as “one route to stabilization” to help address situations involving contentious boundaries (p. 90). Boundary organizations are formed to foster collaboration between actors and are typically made up of individuals with different backgrounds and experiences who come together to work as a group across boundaries and can assume a formal administrative structure or be operate as a virtual team charged with addressing a common goal or performing some task or function that cannot be performed alone (Feldman et al., 2006; Guston, 1999, 2001; Kettl, 2006; Schneider, 2009; Star & Griesemer, 1989). One of the unique characteristics of boundary organizations is that they involve participants in the work of the group, without the participants involved sacrificing their own organizational identity or losing accountability to their home organization (Feldman et al., 2006; Guston, 1999, 2001). This ability to remain accountable to your home organization while still conducting work in the interactions within and across a boundaries, is one of key the strengths of boundary organizations (Guston 2001).

Boundary organizations have been featured in a number of different disciplines. In the public administration literature, Feldman et al. (2006) identified examples of boundary organizations that included a neighborhood technical assistance center designed to create a
problem solving partnership between a university and community residents and the National Organic Standards Board, a self-regulating organization designed to address issues of food production, while Schneider (2009) identified grant making by the federal Office of Juvenile Justice and Delinquency Prevention as the catalyst for creating collaborative boundary organizations among grant participants and shared research dissemination. In biological science, Star and Griesemer (1989) presented one of the seminal works on boundary organizations through their study of the Berkeley Museum of Vertebrate Zoology, a boundary organization established to connect museum professionals with a large network of amateur collectors to develop a common understanding of processes and methods around specimen acquisition and classification. Additional examples of boundary organizations included Stephenson and Schnitzer (2006) who explored humanitarian relief coordination among international nongovernmental development organizations, Provan and Milward (1995) who compared interorganizational collaborative networks for mental health delivery services, and Perrone, Zaheer, and McEvily (2003) who studied the boundary organizational relationships between purchasing managers and customers focusing on elements of trust and role definition.

Individuals involved in conducting boundary work as agents of an organization, or serving in external-facing roles on behalf of their organizations that require interaction across boundaries, are sometimes called boundary spanners. The role of the boundary spanner is a specialized one that may include, but is not limited to, developing contacts and relationships with boundary spanners in other organizations, convening meetings and dialogue around boundary issues, and serving as a mediator when conflict arises while carrying out boundary activities (Carlile, 2004; Williams, 2002). Williams (2002) identifies a number of key traits that boundary spanning individuals should possess including, good interpersonal networking skills, political
awareness, entrepreneurial thinking, sensitivity and emotional intelligence, and ability to build and gain trust with other boundary actors. According to Feldman & Khademian (2007), boundary spanning individuals serve an informational role as brokers (receiving and disseminating different types of information), as translators (reformulating ways of knowing so as to be understood), and as synthesizers (needing to understand other ways of knowing in order to foster the creation of totally new ways of knowing) (Feldman & Khademian, 2007). Boundary spanners are also involved in relational work that involves developing and cultivating the personal connections between those people who need to work together, building trust, and fostering relationships to encourage people to create mutual understanding (Feldman & Khademian, 2007).

In terms of organizational learning, boundary spanning individuals are in a unique position to generate new knowledge that they accumulate from operating within and between organizational boundaries. Often, individuals involved in boundary work bring a diverse base of knowledge, that when combined with others offering similar knowledge diversity, allows for new knowledge and ways of knowing to be created and shared (Feldman et al., 2006; Latour, 2005; Schneider & Ingraham, 2007). Boundary spanners well positioned to utilize their own expertise and personal relationships for mediating meaning across boundaries, to develop the absorptive capacity of their own organizations, and to leverage knowledge generated through boundary interactions for purposes of innovation (Cohen & Levinthal, 1990).

One of the ways that boundary organizations and individuals serving in boundary spanning roles mediate meaning is through the use of boundary objects. The boundary object concept was introduced by Star (1989, Star & Griesemer, 1989) as way to conceptualize using
artifacts, mechanisms, experiences, and activities as mediums for bridging intersecting practices (Akkerman & Bakker, 2011b) and creating common understanding among individuals or groups representing different domains of knowledge (Quick & Feldman, 2011). Boundary objects can be pictures, prototypes, grant applications, or other artifacts that “can serve the purpose of crossing the boundaries between different ways of knowing” (Feldman et al., 2006, p. 95). Something as simple as a paper form can be a boundary object through which individuals coming from different knowledge backgrounds, job roles and at times, organizations, coalesce around a common object to develop shared meaning. Nicolini (2011) described the use of a medical questionnaire used by doctors and nurses in delivering telemedicine as a boundary object that brought doctors, nurses, and patients together in ways that were different than would be possible in a face-to-face setting, while Feldman et al. (2006) described the use of disposable cameras as boundary objects in a neighborhood renewal project as a way to involve residents in the planning process by having them become activity involved in taking pictures as part of the research phase informing the public forums (p. 95). Additionally, several scholars addressed the important role that boundary objects could play in fostering learning across communities of practice, project teams, and organizational boundaries. For instance, Carlile (2002) explored the use of boundary objects as a way to help translate and transform organizational knowledge across knowledge domains in product development settings, Wenger (2000) characterized the existence of a common language as a boundary object referencing discourse around six sigma terminology at a manufacturer, while Orr (1996) described the informal conversations among copy repair technicians, which served as a boundary objects for creating new work practices associated with repairing copy machines. Marabelli and Newell (2014) argue that “the important point about the boundary object concept is that it emphasizes how practical knowing comes from engagement
with material objects, not just from cognitive processes” (p. 490). This characterization of knowledge and knowing through engagement with boundary objects demonstrates the importance of learning through practice, a theoretical area explored in the next section.

**Practice Theory**

Practice theory is a body of literature with origins in anthropology (Bourdieu, 1972) and philosophy/sociology (Dreyfus, 1991; Giddens, 1979; Lyotard, 1988; Taylor, 1985) (as cited in Schatzki, 2012). “Theories assume an ecological model,” according to Gherardi (2009), “in which agency is distributed between humans and non-humans and in which the relationality between the social world and materiality can be subjected to inquiry” (p. 115). Schatzki (2012) argues that commonalities exist among the major theorists of practice and include the idea that a practice is a social phenomenon, that a practice is an organized collection of different people’s activities, that the key features of human activity are tied to practices and that the foundation of human activity include difficult-to-describe ‘nonpropositional bodily abilities’ like know-how, habits, and skills (Schatzki, 2012, pp. 13-14). A critical element of practice theory, Feldman and Orlikowski (2011) offer, is the relationship between episodes of situated action and the social world where that action occurs (Feldman & Orlikowski, 2011). Feldman and Orlikowski (2011) identify three core principles of practice theory, “that situated actions are consequential in the production of social life that dualisms are rejected as a way of theorizing, and that relations are mutually constitutive” (p. 1241).

Gherardi (2009) is critical of the fact that the term practice is often used synonymously with the term ‘routine’ and that it is employed as a generic way to articulate what people do without accounting for its function as a “generative source of knowledge” (p. 115). Schatzki
(2012) defines a practice as “an open-ended, spatially-temporally dispersed nexus of doings and sayings” (p. 14) on the premise that knowledge, meaning, human activity, and sociality are elements of the total nexus of interconnected human practices (Schatzki, 2001, p. 2). An individual’s engagement within this nexus of interconnected practices constitutes knowledge (Marabelli & Newell, 2012; Nicolini, 2011). Practices are not descriptions of our activities, of what we have done in the past, or what we are doing now, rather, they are mutually constituted in who we are and what we know (Marabelli & Newell, 2012). Practice theorists see knowledge as an activity connected through events as actions where knowledge and knowing are ongoing (Hopwood & Manidis, 2013).

Marabelli and Newell (2012) find that “the practice perspective of knowledge has emerged as an important alternative to the dominant structural/cognitive perspective that sees knowledge as a commodity or resource that can be transferred across individuals, groups, and organizations” (p. 19). Knowledge, they argue, is not limited to what can be found inside human heads or encoded in structural routines and rules external to the individual, but instead is more accurately described as a knowledgeability manifested through practices (Marabelli & Newell, 2012, Orlikowski, 2006). The term knowledgeability emphasizes conceptualizations of knowledge that include the emergent (always in the making from everyday activities), the embodied (associated with tacit and experiential learning), the embedded (situated in the context of our work), and the material (bound up in the material forms, artifacts, spaces, and infrastructures through which humans act) (Orlikowski, 2006, p. 460). Knowledgeability is “continuously re-constituted in and through the practices we engage in,” Marabelli and Newell (2012) argue, “it is not … that our knowledge allows us to practice but rather that our practice is evidence of our knowledgeability; the knowledge cannot be separated from the practice” (p. 19).
Insights like these, Feldman and Orlikowski (2011) claim, “have led to an understanding of knowing in practice as the knowledgeability that is continually enacted through ongoing action” (p. 1423).

The application of practice theory to questions of organizational learning is appropriate because practice-based studies converge in their focus on the production and consumption of knowledge and the reproduction of that knowledge (Gherardi, 2009). “In organization studies,” Gherardi (2009) argues, “the influence of practice theorists has been seen as an epistemology for the study of working practices and the kind of practical and ‘hidden’ knowledge that supports them” (p. 116). Feldman and Orlikowski (2011) add that “practice recognizes the centrality of people’s actions to organizational outcomes and reflects an increasing recognition of the importance of practices in the ongoing operations of organizations” (p. 1240). This recognition of the importance of practice within the field of organizational studies has helped to lend credence to the use of practice as unit of analysis. The growing focus on learning-in-working through the study of situated work practices can offer future operational findings for researchers and practitioners. Being able to answer questions concerned with how learning takes place through work practices may lead to the discovery of new approaches for sustaining and fostering learning processes within and across organizations (Easterby-Smith, Crossan, & Nicolini, 2000).

A Process Approach to Organizational Learning – the 4I Framework

One of the more commonly cited theoretical models available in the scholarly literature is the Crossan, Lane and White (1999) 4I framework for understanding organizational learning as a dynamic process (Crossan, Maurer, and White, 2011). At the time it was published, the 4I model helped to fill a gap among available organizational learning theories by providing new
perspectives on the tension between exploration and exploitation of knowledge and the linkage with overlapping stages of learning at the individual, group, and organizational levels (Crossan et al., 1999). Although the primary interest of the authors for their study was to understand how strategic renewal occurred at the enterprise level of an organization, the model they developed for describing the learning/renewal process has been applied by a number of scholars to other research problems. Jones and Macpherson (2006) used the 4I framework to help understand how small and medium enterprises (SMEs) lacking internal resources facilitate strategic renewal. Holmqvist (2004) explored the dynamics of exploitation and exploration in the context of product development. Berson et al. (2006) built on the framework to study leadership constructs and processes of organizational learning at different levels of analysis and Lawrence, Mauws, Dyck, and Kleysen (2005) integrated the element of power and its implications on learning into the model.

The four I’s that make up the Crossan et al. (1999) framework are intuiting, interpreting, integrating, and institutionalizing. The I’s represent organizational learning processes that align in some instances, overlap with corresponding structural levels of analysis that include individual, group, and organizational levels. Completing the model are the processes of exploration, which the authors associate with assimilating new learning they describe as feed forward and exploitation, -- using what has already been learned -- as feedback mechanisms (Crossan et al., 1999, p. 532).
Figure 2 illustrates Crossan et al.’s 4I framework in greater detail. The solid arrows in figure 2 show a progressive flow of learning between processes. The first stage of the learning process, intuition, takes place at the individual level and encompasses a person’s preconscious recognition of a pattern or some incongruity in a pattern based on their experience (Crossan et al., 1999, p. 525). An individual within this stage develops new insights and ideas based on her personal experience (Schilling & Kluge, 2008) and makes novel connections that foster opportunities for innovation (Berends & Lammers, 2010). Importantly, Crossan et al. (1999) make it clear that this stage of the learning process can only take place at the individual level, as groups and organizations cannot exhibit intuition in the same way as an individual person (Crossan et al., 1999). The next stage of the model is interpretation, a process whereby individuals attempt to explain their thinking through words and actions to others (Schilling & Kluge, 2008). The verbalization of ideas and insights encompasses the use of language devices.
such as symbols, stories, and metaphors (Crossan et al., 1999). Interpretation moves ideas from the preverbal to the verbal and extends to the group level when multiple individuals engage in collective sensemaking through conversations and dialogue (Berends & Lammers, 2010; Crossan et al., 1999, p. 525). Integration, the next process, occurs at the group level and involves the creation of shared understanding and meaning between multiple individuals. The integration stage often begins as informal conversation or dialogue and extends to the taking of coordinated action and the mutual adjustment of group members own thinking (Crossan et al., 1999, p. 525). Finally, Crossan et al. (1999) argue that learning becomes institutionalized at the organizational level when common ways of knowing begin to take form and shared learning at the group level becomes more routinized in organizational systems, structures, procedures, and culture (Berends & Lammers, 2010). Institutionalization involves the embedding of learning that has taken place at the individual and group levels into the fabric of the organizational structure to ensure that current and future action occurs along strategic and organizationally sanctioned lines (Crossan et al., 1999, p. 525). It is important to note that although presented in progressive, sequential stages, the four micro-processes of the 4I framework are just as likely to interact dynamically as they are to occur in a linear manner (Berends & Lammers, 2010, p. 1047; Crossan et al., 2011).

The last two components of the framework, the feed-forward and feedback processes of exploration and exploitation, which are shown as solid arrows in figure 2, demonstrate the dynamic connection of the 4I processes to individual, group, and organizational levels of learning (Crossan et al., 1999). Exploration involves the process of seeking new knowledge and explaining how new ideas and actions “flow from the individual to the group to the organizational level” (Crossan et al., 1999, p. 532). Exploitation, on the other hand, is about “affecting how people act and think” as organizations incorporate what has been learned into
structures, systems, strategy, procedures, and services that impact the groups and individuals within an organization (Berends & Lammers, 2010; Crossan et al, 1999, p. 532). The dotted lines in figure 2 represent this newly institutionalized knowledge being fed back into the group and individual levels of the organization. The Crossan et al. (1999) 4I framework provides considerable value to the study of organizational learning processes and a useful model for helping to address my research question.

Conclusion

The literature presented in this chapter provides a foundation upon which to better understand organizational learning in an NAO-led goal-directed network. The foundational works included in the chapter represent some of the seminal scholarship in organizational learning and along with the American Pragmatism literature, helped to ground my overall study. The contextual literature meanwhile, focused on structural and cultural perspectives of organizational learning along with works addressing network management, collaboration, and governance. These two areas of literature helped to illustrate some of the notable organizational learning perspectives and offered differing viewpoints associated with organizational learning structures, behaviors, processes, management, and governance approaches. I explored the application of specific areas of the organizational learning literature by drilling down into works on network-level learning, boundary work, and practice theory. I concluded the chapter with a description of the Crossan et al. (1999) 4I framework which served as the core theoretical foundation for study. In the next chapter, I discuss the research design and methods for my study.
Chapter 3 – Research Design and Methods

Introduction – Case Study Method

As more public services are delivered using goal-directed networks made up of public, private, and nonprofit sector organizations, it becomes increasingly important for scholars and practitioners to understand how organizational learning takes place in these settings. In particular, limited research has been conducted on network administrative organizations (NAOs) managing goal-directed networks and the relationship that this network governance structure has to organizational learning concepts. I begin to address this gap with the objective of creating a preliminary framework that would serve as a useful tool for practitioners tasked with leading NAOs and a platform for the further study of organizational learning within goal-directed networks.

I elected to use a case study approach for this research based on a number of strengths articulated in the qualitative methods literature. First, a case study design allows for detailed empirical investigation of issues within their natural context, it is strengthened by the use of data triangulation as a technique and benefits from the application of theory to guide data collection and analysis (Yin, 2014, p. 16-17). As Yin (2003) indicates, “the case study method allows investigators to retain the holistic and meaningful characteristics of real life events such as … organizational and managerial processes,” which are a focus of my study (p. 2). Second, case studies allow the researcher to investigate the case in depth, scrutinize its contents, and detail ordinary experiences to gain insight on a particular issue (Stake, 1998, p. 88). Stake (1998) contends that “case studies are of value in refining theory and suggesting complexities for further
investigation, as well as helping to establish the limits of generalizability” serving as a “reflection on human experience” (p. 104). George and Bennett (2005) meanwhile, argue that “whereas statistical studies run the risk of conceptual stretching by lumping together dissimilar cases to get a larger sample, case studies allow for conceptual refinements with higher level of validity over a smaller number of cases” (p. 19). Because “case studies require a detailed consideration of contextual factors” they allow the researcher “to identify and measure the indicators that best represent the theoretical concepts the researcher intends to measure” and achieve the potential for high levels of conceptual validity (George & Bennett, 2005, p. 19).

Finally, the case study approach allows for in-depth, interpretive analysis of problem dynamics within a targeted research setting (Eisenhardt, 1989) and can also be a useful method when the aim of the research study is greater understanding of specific situations within particular contexts (Yin, 2014). This case study represents an empirical inquiry of real-life events set within the situated context of a goal-directed network (Yin, 2014).

I have enhanced the quality of my research design by using several tactics identified by Yin (2014) and George and Bennett (2005) that address construct and conceptual validity, as well as the reliability of the study. First, I have focused on achieving construct validity in my study by using multiple sources of evidence in a triangulating manner and engaging key informants from the Innovation Labs to review my case analysis for accuracy (Yin, 2014, p. 45). Second, I have attempted to create high levels of conceptual validity by identifying analytically equivalent phenomena across the different contexts represented in my review of the two Innovation Lab programs (George & Bennett, 2005). I looked to compare equivalent episodes of learning taking place within both programs to understand similarities and differences in their learning practices. Reliability refers to the operations of the study and the ability of other
researchers to repeat study procedures to achieve similar results (Yin, 2014). By using a systematic case study protocol and database for data collection (Yin, 2014) along with documenting my coding strategies and incorporating the use of memos in my data analysis (Sbaraini, Carter, Evans, & Blinkhorn, 2011), I believe I have met the threshold for study reliability.

A case study can be limited in its validity, however, because of concerns over the external validity of data drawn from small-N examples and a perceived lack of generalizability for its results (Jensen & Rodgers, 2001; Kennedy, 1979; Stake 1978; Yin, 2014). Although the generalizability of study results to a broad population has merit, a “full and thorough knowledge of the particular,” such as what is produced in a detailed case exploration, can allow for findings to be applied in a much more targeted manner to comparable single case examples with similar contexts (Stake, 1978, p. 6). While generalizing findings to a broad population as is done with statistical studies is not appropriate for small-N case studies such as the one I have conducted, theoretical or analytical generalization is possible where “analytical generalizations” or “lessons learned” can apply beyond the setting and context of this specific case (Yin, 2014, p. 40). To help strengthen the external validity of my study, I have selected a case study that employs an embedded design (Eisenhardt, 1989; Yin, 2014). An embedded design is an approach that incorporates subunits within the analysis and one that is well suited for studying a public program network with large numbers of funded projects (Eisenhardt, 1989; Yin, 2014).

The Feed the Future Innovation Lab program is a large, multi-organizational agricultural development initiative administered by a network of university partners on behalf of USAID. Each Innovation Lab university management entity administers its own international, cross-
sector network of partners to implement specific program objectives. An exploration of the Innovation Lab program affords an opportunity, therefore, to explore select university management entities operating as network administrative organizations on behalf of their program networks. The embedded case study approach can provide a view into the practices of the NAO itself, including its relations with USAID and the NAO’s interactions with a broad network of public, private, and NGO global partners involved in implementing the program, significantly increasing the potential validity of the study.

Drawing on the existing literature and my early exploration of the Innovation Lab programs, I entered into this research study with a number of expectations about the key elements of organizational learning within goal-directed networks. I formed an initial set of these expectations as a way to summarize and synthesize my early analytical observations with key concepts that I chose to apply in my analysis (Miles, Huberman, & Saldana, 2014).

First, learning practices are likely to be institutionalized within the individual Innovation Lab management entity and disseminated through various methods and mediums among its Innovation Lab network partners.

Second, organizational boundaries are a contributing factor in how a network administrative organization learns through the work of its team members.

Third, capacity building knowledge and best practices are readily shared between Innovation Labs through their director level interactions.

These expectations formed a foundation for the study allowing me to compare findings from the case with the current literature on organizational learning, practice theory, and
networks. As I collected and analyzed additional data, I revisited the expectations based on new interpretations of the data. Towards the completion of the study, I used a cross-case analysis to analyze data collected for the IPM and Horticulture Innovation Lab programs and re-evaluated instances within the case that did not fit the previously predicted patterns (Miles et al., 2014, p. 100).

Case Selection

University partnerships represent a special effort within USAID to address challenging agricultural research and food security issues by leveraging the expertise of top U.S. universities and their developing country institutional research partners (United States Agency for International Development, 2013). The USAID university partnership known as the Collaborative Research Support Program (CRSP) was launched as an international development initiative through the 1975 Title XII Amendment to the Foreign Assistance Act, eventually becoming formalized around priority agricultural research themes between the years 1977-1979 (Board for International Food and Agricultural Development, 2012). The CRSP program involved a multinational network led by American universities that specialized in agricultural research, technology diffusion and knowledge transfer (Sorghum, Millet and Other Grains CRSP Management Entity, 2011). These universities worked closely with developing-country agencies, U.S. agribusiness, private voluntary organizations (PVOs), developing-country colleges and universities, NGOs, USAID missions, and other U.S. federal agencies to achieve their program objectives (Sorghum, Millet and Other Grains CRSP Management Entity, 2011).

The U.S. Government’s global hunger and food security initiative known as Feed the Future grew out of a commitment of financial support made by President Obama during the 2009
G-8 Summit in Italy, where he “called on global leaders to reverse the decades-long decline in investment in agriculture and strengthen global efforts to reduce poverty, hunger and undernutrition” (United States Government, 2015). In 2013, USAID re-branded the ten active CRSPs operating at that time as Feed the Future Innovation Labs for Collaborative Research “as part of a larger strategy designed to integrate the many diverse aspects of its Feed the Future initiative” (Digest Project, 2015). Later that year, ten additional Innovation Labs were announced and as of early 2015, the number of Innovation Labs receiving funding had grown to twenty-four (United States Government, 2015).

USAID designated fifteen universities as Innovation Lab lead institutions, with thirteen of them sharing similar characteristics with one another because of their history as land grant universities. As land grant institutions, they would share a common commitment to research efforts that could be applied within the communities in which they worked and employ faculty and administrative leaders, who in principle, should have engaged in collaboration on a regular basis through common professional associations such as the Association of Public Land Grant Universities (APLU). The USAID Innovation Lab program was also selected as a case for study because its grants are large (some more than $10 million each), its funding is multiyear (generally 5 or more years), and the university lead institutions for each of the Innovation Lab programs involved many partners operating within collaborative networks for research and capacity building (Digest Project, 2015). Each lead university employed a program director to manage its individual grant responsibilities and serve as the liaison with USAID administrators (Sorghum, Millet and Other Grains CRSP Management Entity, 2011). Several of the universities had taken the added measure of establishing dedicated administrative organizations to manage the implementation efforts for their program(s). Known as management entities, these
organizations were good examples of the network administrative organization (NAO) form of governance described by Provan and Kenis (2008). They were created to manage and facilitate the goal-directed activities of the network, serving as a broker for internal and external constituencies, and acted as the key point of contact with the funding agency to ensure that network goals were met (Provan & Kenis, 2008, p. 8). Select management entities operating as network administrative organizations were the focus of my study.

Conducting a detailed examination of all twenty-four Innovation Lab lead universities and their corresponding network partners would have generated too much data to code and analyze in a reasonable period of time. Such a broad investigation was not a necessity for the purposes of this study. Instead, I focused my data collection and analysis on two of the Innovation Lab management entities, the Virginia Tech Integrated Pest Management program (IPM) and the University of California-Davis Horticulture (HORT) program, because structurally they fit the characteristics of network administrative organizations as defined by Provan and Kenis (2008). I elected to perform the most intensive data collection and analysis on the Virginia Tech led IPM program, a decision based on several factors. First, the IPM program had been managed by Virginia Tech since 1993 and many of the individuals involved with the program at the time of data collection had institutional knowledge of its long history (IPM Innovation Lab, 2013). Second, as an employee of Virginia Tech’s Division of Outreach and International Affairs, I had access to the IPM program team, which helped me to secure agreement from several key leaders to conduct interviews. Finally, I learned from informal conversations with the IPM and Sustainable Agriculture and Natural Resource Management (SANREM) program leaders that management of the Innovation Labs occurred very differently among universities. The management entity at Virginia Tech, for instance, was structured as a
network administrative organization (NAO) to lead the program. I was particularly interested in looking at how organizations that utilized this governance structure to administer collaborative programs like the Innovation Labs, learned through their team members’ boundary interactions. One of the other universities that operated a similar NAO program management infrastructure to Virginia Tech was the University of California-Davis with its management of the Horticulture Innovation Lab. As a second program example, I conducted less intensive data collection and analysis for the UC-Davis led program to provide a comparison to the data drawn through my study of the Virginia Tech IPM management entity. Interestingly, both the Virginia Tech IPM Innovation Lab and the UC-Davis Horticulture Innovation Lab shared common network partners. I interviewed representatives who had interacted with both management entities and learned of a number of similarities and differences in their experience working with each.

USAID does a majority of its contract work through private firms and NGOs which could have made the university-led Innovation Lab initiative less representative than other USAID programs. Nevertheless, the Innovation Lab program is a relevant case for several reasons. First, each Innovation Lab could be classified as a boundary organization, a type of management network formed to induce collaboration among a number of government and non-government actors (Feldman et al., 2006; Guston, 2001; Star & Griesemer, 1989). Second, characteristics of the Innovation Lab network -- for example, geographic diversity, large funding allocations, and long program duration -- were representative of the complex programs delivered by USAID and its partners. Lastly, the Innovation Lab network included organizations interacting in an arena of collaboration among university agents and USAID management principals. This made the Innovation Lab case an excellent subject of study for understanding organizational learning in a
networked environment and for gauging the influence that program team members had on that learning and knowledge integration.

**Focus on Operationalizing Learning in Innovation Lab Capacity Building Work**

While the focus on the IPM and Horticulture Innovation Labs allowed me to provide a richer, thicker, description of organizational learning practices within these two management entities, the nature of their work in different scientific areas and target countries presented some difficulties in conducting cross-case comparisons. In order to gain a greater understanding of organizational learning through collaboration within these two Innovation Labs, I targeted for detailed analysis the specific cross-cutting initiative of ‘capacity building’ that they each shared. As a required deliverable of the USAID program funding, individual Innovation Labs were expected to build institutional and individual capacity among the organizations, local populations, and network leaders with whom they interacted (Feed the Future Innovation Lab for Collaborative Research on Horticulture, 2015; IPM Innovation Lab, 2013). Capacity building can be defined as the knowledge and experience needed to carry-on sustainable development activities once programs end. Examples of capacity building efforts by the Innovation Labs included the training provided for project administration by in-country stakeholders, developing the academic experience among graduate students for the application of research in the field, teaching farmers new agricultural techniques and methods at the local level, sharing best practice with partnering organizations, and collaborative efforts to develop and launch future solutions (Feed the Future Innovation Lab for Collaborative Research on Horticulture, 2015; IPM Innovation Lab, 2013).
Traditionally, the Innovation Labs measured the success of their capacity building efforts in two primary ways. First, by measuring the numbers of local leaders who pursued and completed academic degrees in their home country or overseas as a result of direct Innovation Lab assistance and second, by assessing the formal training and educational programs launched by the Innovation Lab within the various countries in which they were providing assistance (Feed the Future Innovation Lab for Collaborative Research on Horticulture, 2015; IPM Innovation Lab, 2013). Since lessons regarding individual graduate study or training models and practices could be common between the two Innovation Labs, my expectation was that capacity building knowledge and best practice would be readily shared between the two Innovation Labs through their director level interactions. As a result of these interactions, I also expected to see learning practices related to capacity building efforts institutionalized within the individual Innovation Lab management entity and disseminated through various methods and mediums among its Innovation Lab network partners.

Data Collection

As a result of its long history, the CRSP/Innovation Lab initiative produced rich documentary data over the course of its existence. In the first phase of my data collection, I focused on collecting documentary material related to the CRSP/Innovation Lab programs. I first collected historical documents related to the establishment of the CRSP program to understand the original intent behind this USAID initiative. Documents included narrative accounts, program reports, websites, and government documents. I then collected Innovation Lab-specific data for the IPM and Horticulture Innovation Labs by sampling documentary sources from 2009-2014, a time period that coincided with the IPM Phase IV and the Horticulture Innovation Lab
Phase I rounds of funding. While Virginia Tech had been managing the IPM program for nearly 20 years and UC-Davis had only been involved with the Horticulture Innovation Lab since 2010, this time period for sampling documents was selected to allow for cross-case comparison in a period when both the IPM and Horticulture Innovation Labs were required to operate under similar USAID reporting mandates, rules, and procedures. I collected a cross-section of program materials including research reports, procurement documents, technical committee minutes, media releases, and other documents that provided insight into organizational learning processes and evidence related to collaboration and knowledge sharing among each management entity and its partners. I also purposively sampled documentary evidence related to USAID and the two target Innovation Lab programs to understand the collaborative environment between these university network administrative organizations and USAID. The sources included official USAID publications, meeting minutes, governing board reports, correspondence between USAID personnel and Innovation Lab program leaders, research reports, and publicity materials for the projects.

Public relations stories and program outcome narratives were collected from institutions collaborating as part of the IPM and Horticulture Innovation Lab networks using a similar sampling approach as the documentary evidence above. Artifacts like those created when organizations publicized their project efforts offered a good opportunity to investigate CRSP/IL program work in a way that was less likely to be found in official reports. These materials generally were geared towards broad consumption and used as a way to maintain interest and foster continued stakeholder support. An indicator of whether and what an organization is learning can be reflected in how it changes the way it tells its story over a particular period of time and how it documents action and impact through its official publications. Material was
retrieved from the websites of USAID, the Innovation Lab lead institutions, Innovation Lab university partners, from the USAID’s Development Experience Clearinghouse digital library, and from additional documentary repositories available through websites of the Organisation for Economic Co-operation and Development (OECD) and the Association of Public and Land Grant Universities.

I conducted several informal conversations with individuals who had detailed knowledge of the CRSP/Innovation Lab programs and participated as an observer at the June 24, 2011 Board for International Food and Agricultural Development (BIFAD) public meeting in Washington, DC. The informal conversations with CRSP/Innovation Lab program administrators were useful in understanding the internal workings of the CRSP/Innovation Lab program and provided me with various perspectives on how universities and USAID were collaborating at the time. Attending and observing the BIFAD meeting was also very useful for planning my dissertation research as I was able to observe how CRSP leaders interacted with their USAID program funders and board members. This event coincided with launch of the Feed the Future initiative and it was informative to watch how CRSP leaders were positioning their body of work to ensure relevance within this new overarching government-wide program. There was a concern in the CRSP community that resources would be diverted to FTF programs at the expense of CRSPs. As indicated above, the CRSPs were ultimately re-branded as part of the FTF efforts by USAID.

These introductory conversations demonstrated to me that a collection of documentary evidence alone would not be sufficient to address my research questions. Therefore, the second phase of my data collection included a period of in-depth interviewing. I conducted a total of
nineteen face-to-face and telephone interviews with key CRSP/Innovation Lab university program personnel, representatives from CRSP/Innovation Lab network members, and funded researchers associated with each management entity. Interviewing is a useful method for corroborating what has been discovered from documentary sources as well as understanding what the actors who helped create or perceive these documents think and what meaning they ascribe to them (Tansey, 2007).

In order to select the interviewees for my study, I employed a non-probability sampling approach using a combination of purposive and snowball sampling. Purposive sampling is appropriate when the target population is known to the researcher and that population fits the criteria of interest for the study (Tansey, 2007). This is the case with the CRSP/Innovation Lab university management entity, network partners, and USAID program directors where all of these individuals were known or could be located. The snowball technique was used to uncover additional important individuals to interview. Snowballing is a way to draw on the network of an interviewee for additional interview referrals as well as determining influential actors or hidden populations who may not be known to the interviewer (Tansey, 2007). I used the snowball method with the university program directors and principal investigator researchers. Through that approach, I learned of additional contacts among their own program network with whom they interacted and who I could contact.

The interviewing itself was semi-structured using an interview protocol approved by the Virginia Tech Institutional Review Board (see Appendix 1). Questions directed at interview subjects were designed to uncover background information and work role details for each interviewee, existing relationships with his or her government or CRSP/Innovation Lab network
peers, personal perspectives on knowledge sharing and collaboration, and the interviewee’s perceived understanding of the linkage between their work and the organizational-level learning that resulted. Additional questions were added as the conversations dictated and when specific examples warranted a greater examination in one area or another. For the interviews, I elected not to audio-record them as all of my interview subjects were still actively involved in various roles with the CRSPs/Innovation Labs and I felt that they would speak more freely about organizational learning practices if I was not recording the session. Instead, I took notes throughout the session and would transcribe those notes shortly after concluding the interview to ensure the best possible capture of their responses and my raw reflections. Certainly this introduced a degree of error in my data collection and inference making, but I believed the positive benefit of getting interview subjects to openly share their perspectives on CRSP activities outweighed the potential inaccuracies from not creating audio-based transcripts.

Data Analysis:

For the data analysis, I utilized a combination of qualitative analysis techniques to help interpret and understand meaning present among the data. I used a combination of Qualitative Document Analysis (QDA) for the documentary materials, qualitative data coding methods for the interview data, and grounded theory techniques such as memo-writing to help organize my analytical thinking.

To analyze the documentary data collected for the study, I utilized techniques drawn from Qualitative Document Analysis (QDA) to uncover patterns and themes in the textual and visual data that could be clustered into categories for further analysis vis-à-vis other data sources. QDA, also called Ethnographic Content Analysis, is an approach to document analysis designed to be
systematic and analytic, but not rigid like traditional coding practices (Altheide, 1987). I used QDA methods to identify the presence of organizational rules, routines, processes and patterns related to knowledge creation, knowledge sharing, and collaboration that were developed or initiated by USAID, CRSP/Innovation Lab management entities and program team members. An initial set of categories was used to guide the analysis of documents while allowing other categories to emerge through a process of constant discovery and regular comparisons of situations, meanings and influences (Altheide, Coyle, DeVriese, & Schneider, 2008). I looked to identify indicators of collaboration and learning within USAID and CRSP/Innovation Lab program materials based on similar indicators of these behaviors drawn from the literature. I anticipated that in addition to the categories drawn from the theoretical literature, a number of new analytical categories would emerge in the documentary research and for which I would have an opportunity to confirm or refute during the interview phase.

Following completion of all the interviews, I used a systematic, but flexible, process of coding and comparing for the interview data. I first revised the pre-interview categories that I had created from my informal conversations with CRSP/Innovation Lab personnel and recorded these changes using Nvivo 10 to incorporate any additional themes related to those early categories that emerged during the interviews (see Appendix 2). I then coded the interview notes utilizing provisional, descriptive, process, and In Vivo coding methods to break down the descriptive and inferential information into smaller components and categorize similar data chunks (Miles et al., 2014). Provisional coding helped me build an initial list of codes relevant to my research questions based on the organizational learning literature and descriptive coding methods allowed me to create categories from words and short phrases in the data (Miles et al., 2014). I used process coding, which employs gerunds to connote action in the data, to understand
how learning was taking place over time and as part of certain episodic events in the CRSP/Innovation Labs and developed additional themes by using In Vivo coding to reflect the interview subject’s own words and emphasis in their language (Miles et al., 2014).

As an effort to create more explanatory pattern codes from the data, I took a second pass and compared these first-round categories and themes across the data sources looking for relationships between the categories and comparing them with references from events, experiences, and conversations of participants drawn from the interview data (Sbaraini et al., 2011). Pattern codes can consist of categories or themes, causes/explanations, relationships among people, and theoretical constructs (Miles et al., 2014). Similar to the approach taken in analyzing the documentary evidence, I employed a cross-case analysis (Eisenhardt, 1989) to qualify these codes against my interview notes for evidence of organizational learning practices employed by team members of the two CRSP/Innovation Lab programs and mapped out these resulting pattern codes using Nvivo 10.

Lastly, a key component of my analysis was the use of analytical memo writing (Miles et al., 2014; Sbaraini et al., 2011). This grounded theory technique is used to capture reflections, impressions, and thought processes of the researcher about “the meaning of codes” and to record thoughts about processes in the data, similarities and differences among cases and codes, and to raise and address questions that can later be transformed into findings (Sbaraini et al., 2011, p. 5). I wrote memos after some of the interviews where I had heard interesting responses that made me consider a perspective on learning I had not encountered before. I also used memos to record detail about certain codes that were not self-explanatory by their labels. The use of analytical memos was particularly useful in performing the cross-case comparison of the IPM and
Horticulture Innovation Labs. I had the opportunity to travel to the offices of each Innovation Lab and made notes regarding my observations of the “office operating environment” of each management entity. Since these observations were not included in the interview data, recording them as part of analytical memos and stored in my Nvivo 10 database allowed me to capture the information in a way that I could access for compiling my insights later.

In summary, I utilized the interview process to identify evidence of learning practices being created and shared among and between CRSP/Innovation Lab management entity personnel, their CRSP/Innovation Lab institutional research partners, and USAID funders within the program network. There was a limited opportunity for direct participant observation with my study so the use of interpretive data drawn from the interviews was crucial to my findings. Through within-case and cross-case analysis, I linked data analyzed from the interviews and relevant examples drawn from the documentary research in a triangulated manner to develop qualified patterns in the data (Miles et al., 2014). Taken as a whole, the data analysis was then used in concert with the Crossan et al. (1999) 4I organizational learning framework to help address my research questions and begin to form my own preliminary analytical constructs.

**Study Limitations**

While I made a concerted effort to strengthen the construct validity, conceptual validity, and reliability of the research design, there were several limitations present in the study. First, despite the embedded nature of the case study design where I investigated two programs operating within a networked environment, the study was still reliant on a small number of examples which impacted the overall external validity of the work. To address this limitation, I made every attempt to be thorough and consistent in my data collection and analysis, to identify
like concepts across the Innovation Lab programs for cross-case comparison, and be as accurate as possible in my findings. Generalizing to a broader population from this single case study is not advisable, but generalization to theory about the underlying conditions and mechanisms under which organizational learning occurs that I uncovered through this case is a possibility (Yin, 2014).

A second limitation of the study was related to the time period for which I collected data. I elected to compare the IPM and Horticulture Innovation Labs by collecting and analyzing documentary materials created and used in the programs during the years 2009-2014. For IPM, this time period corresponded to Phase IV of that project while the same period equated to Phase I for the Horticulture Innovation Lab. The disparity in experience among the two management entities could be seen as a threat to conceptual validity of the cross-case comparison between the projects (George & Bennett, 2005). This is a valid concern as one could make the claim that the IPM management entity would be more established than its Horticulture peer and as a result, its network relationships better developed and refined for the purposes of learning. I selected these two Innovation Labs for study because unlike some of the other Innovation Labs that directed their efforts out of academic departments, the IPM and Horticulture Innovation Labs utilized a network administrative organizational structure to implement their projects. I think that the similarity in governance structure between the two outweighed the potential limitation of experience and actually created some interesting and unexpected findings as a result. Additionally, the re-branding of the CRSPs under the Feed the Future food security umbrella as Innovation Labs, created some administrative and program management challenges that each management entity experienced for the first time.
Finally, the interviewing process included two possible limitations, the impact of not recording interviews and the potential for my personal bias to influence the interviewing itself. First, I elected not to record and transcribe the interviews for my study. I felt strongly that I would receive more candid and open feedback from my interview subjects if I was not recording their direct comments. All my subjects were actively engaged in either leadership positions or positions dependent on funding directed from those leaders. While I tried to capture what was said in interviews as accurately as possible and recorded my thoughts immediately after the interviews, by not audio-recording and transcribing the sessions, I introduced a level of error in capturing these notes. This put a heavy reliance on inferring meaning from my field notes, a potential limitation according to Kennedy (1979), because of a lack of “accepted rules for drawing causation and generalization inferences from the data” (p. 663). Second, because I used a semi-structured interviewing technique where my standard questions often led to more probing inquiries, there was potential for me to inject my own bias into the process. As an employee of Virginia Tech within the Division of Outreach and International affairs, I brought to the conversation a certain level of knowledge and opinion concerning the university policies and procedures that affected programs of this type. This university administrative background had the potential to bias my interviews for the IPM Innovation Lab more so than the Horticulture program. I recognized that this was a potential source of bias and approached all of my subjects without any preconceived notions of how they operated within their respective universities, avoided offering my own opinion to responses that I received, and made particular effort not to ask leading questions when I sought follow-up during the interviews.
Conclusion

In this chapter, I have discussed my use of a case study approach to research organizational learning in a goal-directed network environment and detailed the data collection and analysis strategies I employed for developing findings from the cases. As two NAO-led, multi-organizational, cross-sector, government-funded program networks, the IPM and Horticulture Innovation Labs for Collaborative Research programs served as robust sources of data for addressing my research question. I also described a special focus on the human and institutional capacity building work that each of the CRSP/Innovations Labs conducted. This common goal to provide HICD as part of each networks’ activities, allowed for a cross-case comparison around this issue which resulted in some interesting insights. In the next chapter, I will explore the Crossan et al. (1999) 4I framework as a way to understand organizational learning in a network context.
Chapter 4 – Case Study

Introduction

“Feed the Future, the U.S. Government’s global hunger and food security initiative, is pairing American ingenuity and expertise with some of the best and brightest minds across the globe through its 24 Feed the Future Innovation Labs. A unique network supported by over 60 top U.S. colleges and universities along with many partner country research and educational institutions, the Feed the Future Innovation Labs are on the cutting edge of efforts to research, develop and take to scale safe and effective technologies that address current and future challenges posed by a changing climate and the need to feed a growing global population. The Feed the Future Innovation Labs also include short- and long-term training to support sustainability of these efforts.” (Snapshot: Feed the Future Innovation Labs, 2015)

The passage above, quoted from a 2015 USAID marketing publication promoting the importance of USAID’s Feed the Future Innovation Lab initiative, highlights the great potential of bringing a university-led network together to address complex global development problems. Many colleges and universities are well positioned to apply substantial institutional resources to a project in support of research and innovation goals, while faculty researchers who lead the technical projects can leverage their own discipline-specific personal networks in the execution of their work. Not reflected in the passage, however, is the inherent complexity that comes along with leading the activities of a goal-directed network like those operating as part of the Feed the Future initiative. The colleges and universities responsible for managing Feed the Future Innovation Lab programs are complex organizations of their own, often hampered at times with legal and institutional rules and structures that can stymie their ability to respond rapidly in a
collaborative network setting. Likewise, Feed the Future international development partners such as international research centers, national research organizations, and nongovernmental organizations, may have varying agendas and pressing local community needs that don’t necessarily align with the broad objectives of the initiative. Even at the individual level, the participating research scientists may be faced with competing demands and incentive structures that must be accounted for in directing their involvement in the project.

The Integrated Pest Management Innovation Lab (IPM CRSP/IL) led by Virginia Tech and the Horticulture Innovation Lab (Horticulture CRSP/IL) directed by the University of California-Davis, are two of the 24 Feed the Future Innovation Lab programs funded by USAID. In each of these two cases, the university officially serves as the organization contractually responsible for administration of its respective Innovation Lab program. In practice, each Innovation Lab program functions as its own network with an organizational unit established by the university to manage partner relationships and guide the activities of the network. In addition to the lead university, both the IPM CRSP/IL and the Horticulture CRSP/IL, include among their particular project teams other U.S. research universities, foreign agricultural research centers, NGOs, and even commercial companies. The network level interaction among all of these partners is directed by the lead university operating as the management entity (ME), with responsibility, among other things, for administering the overall Innovation Lab budget, awarding funding to sub-recipients, ensuring implementation goals are met, and conducting program evaluation. Virginia Tech with the IPM CRSP/IL and UC Davis with the Horticulture CRSP/IL, both elected to organize their management entities as stand-alone organizational units within their respective university structures. These management entity models exemplify the network administrative organization (NAO) governance structure identified by Provan and Kenis
Understanding how IPM CRSP/IL and Horticulture CRSP/ILs management entities operating as NAOs enable, manage, and leverage organizational learning associated with the boundary work of their program team representatives to innovate as networks, can help inform the organizational leaders tasked with responsibility for implementing the Feed the Future Innovation Labs and provide insight to the broader field of practitioners involved with similar goal-directed networks.

In this chapter, I explore the IPM and Horticulture CRSP/Innovation Lab cases in greater detail. For each case, I identify the major goal-directed activities for each CRSP/Innovation Lab during the study period of 2009-2014 and describe the CRSP/Innovation Lab organizational structures to support these efforts. I then delve into the boundary work of the ME, identifying examples of organizational learning involving program team members and highlight ME efforts to institutionalize learning. Not all efforts at organizational learning are positive, and so I point out some of the challenges to learning that the labs faced during the study period. Finally, in an effort to compare and contrast the two cases more directly, I explore the human and institutional capacity building practices for both CRSP/Innovation Labs to understand how team members learned of these practices and evaluate how the MEs employed these practices towards achieving important USAID Feed the Future program goals.

**Integrated Pest Management CRSP/Innovation Lab**

According to its official website, “the Integrated Pest Management Innovation Lab, or IPM IL (formerly the IPM CRSP), is a large, multi-year effort supported by USAID to introduce and maintain IPM best practices and foster sustainable farming systems in sixteen developing countries” (IPM Innovation Lab Website, 2016). The IPM CRSP/IL leverages the expertise of its
university and international research partners in the development of agricultural strategies that offer farmers in target countries “a holistic approach to reducing damage caused by pests without harming the environment” and address “cross-cutting issues such as gender, health, nutrition, equitable use of resources, and agricultural education” (IPM Innovation Lab Website, 2016). In 2015, Virginia Tech successfully competed for a continuation of funding from USAID to support the Phase V of the IPM CRSP/Innovation Lab initiative, one which introduced several new IPM projects and extended funding for a limited number of ongoing efforts (IPM Innovation Lab Website, 2016). While the IPM program has been managed continuously by Virginia Tech since 1993, I collected data for the period of 2009-2014, a date range which corresponded to Phase IV of the program.

*IPM CRSP/Innovation Lab – Major goal-directed activities - 2009-2014*

In 2009, the IPM CRSP as it was then known, launched a new project phase (Phase IV) focused on creating regional IPM Centers of Excellence (regional programs) and cross-cutting global projects around critical IPM themes (IPM Annual Report, 2009-2010). The ME tasked the new IPM projects with “maximizing the impact of IPM packages as well as scaling up local successes to national, regional (Africa, Asia, and Latin America/Caribbean) and global stakeholders” (IPM Annual Report, 2009-2010, p. 2). Serving again as management entity for the IPM CRSP/IL, Virginia Tech released a Request for Applications (RFA) in 2009 and eleven projects were selected by an external evaluation panel:

- Six regional IPM programs were awarded. They included a program in Central Asia focused on the development and delivery of ecologically-based IPM packages for field and vegetable cropping systems led by Michigan State University, an IPM program on
science for agricultural growth in Latin America and the Caribbean led by a principal investigator from Virginia Tech, a regional program for the east African countries of Kenya, Tanzania and Uganda led by Ohio State University, an initiative in support of a West African consortium for IPM Excellence led by another PI from Virginia Tech, a regional program for south Asia led by Penn State University and an ecologically-based participatory IPM effort in Southeast Asia led by Clemson University (IPM Annual Report, 2009-2010).

- The five global programs awarded included an effort led by Virginia State University for abating the weed Parthenium, which was doing significant damage in eastern Africa, the development of an international plant diagnostic network led by Ohio State University and three global themed projects led by PIs from Virginia Tech, a program focused on identifying effective IPM of plant disease caused by viruses, IPM impact assessment, gender equity knowledge, and capacity building (IPM Annual Report, 2009-2010).

In year 2 of the IPM CRSP/IL, the IPM ME reported continued progress in addressing core project goals by “developing and implementing approaches to integrated pest management to reduce agricultural losses due to pests, minimize damage to natural ecosystems, and avoid pollution and contamination of food and water supplies” (IPM Annual Report, 2010-2011, p. 1). IPM packages (to be discussed later in the chapter) were developed for a wide range of crops across the program regions and the ME was successful in sharing knowledge about the work of the IPM CRSP/IL through a number of workshops and trainings, reporting that “nearly 16,000 students, technicians, scientists, farmers, extension agents, and industry professionals participated in short-term training programs in all regional and global theme projects” (IPM Annual Report, 2010-2011, p. 2). The ME was particularly proud of an international workshop it
helped to organize in partnership with Tamil Nadu Agricultural University in India, where local scientists shared their contextual knowledge about the selection and production of biocontrol agents with their peer scientists from developing countries (IPM Annual Report, 2010-2011).

The 2011-2012 IPM CRSP/IL annual report included a number of positive developments made during the year with the IPM global cross-cutting initiatives. First, the ME noted an economic impact study completed as part of the impact assessment global theme project, showing that “analyses of a dozen technologies implemented through the IPM CRSP/IL in different parts of the tropical world have resulted in a benefit of twenty-five dollars for each dollar spent … when all the technologies developed, transferred, and implemented are taken into account, the ratio is closer to $200 in benefits for each dollar spent” (IPM Annual Report, 2011-2012, p. 2). Second, the ME overcame a major hurdle in its global theme project, targeting the invasive weed Parthenium spreading across East Africa, where USAID’s biosecurity office had approved an Environmental Assessment to evaluate the release of a certain type of beetle that could naturally combat the weed (IPM Annual Report, 2011-2012). The 2011-2012 year also saw a cessation of project activities at the request of USAID in Uzbekistan and Kyrgyzstan in the Central Asia area and the Dominican Republic in the Caribbean, but an addition of Cambodia in the Southeast Asia project region (IPM Annual Report, 2011-2012).

In 2012-2013, the ME and its project team partners spent considerable time at in-country, regional, and international events, disseminating knowledge amassed from IPM activities, and hosted a number of trainings and workshops that drew participants from across the IPM CRSP/IL regions (IPM Annual Report, 2012-2013). The ME announced a trial release of the Zygogramma bicolorata beetle in Ethiopia, the natural enemy of the invasive Parthenium weed, along with a
major impact assessment study on the biological control of the papaya mealybug in India that documented an economic benefit of $500 million to $1.34 billion (IPM Annual Report, 2012-2013). USAID also announced during this year that the IPM CRSP would be officially renamed the Feed the Future IPM Innovation Lab for Collaborative Research, in response to USAID’s efforts to consolidate its food security development initiatives under one program umbrella.

By the final year of the IPM Phase IV, the program was operating in six different regions around the globe, with the IPM ME reporting a number of new efforts to promote integrated pest management practices to existing and emerging partners in developing and developed countries (IPM Annual Report, 2013-2014). Knowledge sharing about IPM came directly from the work of the CRSP/IL developed over the previous four years and was disseminated to a growing network of internal and external stakeholders. Internal network stakeholders, for example, participated an IPM CRSP/Innovation Lab program-wide workshop held in Uganda attended by ME staff, IPM CRSP/IL project team leaders, USAID mission personnel, and USAID leadership from Washington. The event served as an opportunity to review the activities of the IPM CRSP/IL during the ten-year award period, for the project PI leaders to review their individual project “accomplishments and challenges” and for the group to “identify successes and lessons learned” (IPM Annual Report, 2013-2014, pg. 7). In an effort to reach a growing external stakeholder audience, the IPM CRSP/IL conducted a series of workshops to share knowledge about particular technologies or warn of specific pests. For instance, the IPM CRSP/IL hosted a workshop on invasive species identification and management for work in tropical regions that attracted a diverse participation from partner international agricultural organizations across Central Asia, South America, and eight countries in Africa, including countries where IPM projects were not taking place (IPM Annual Report, 2013-2014). In India, the IPM CRSP/IL
hosted a workshop on seed-borne diseases of vegetable crops attended by representatives from private companies, government agencies, Indian universities, and scientists from several IPM target countries (IPM Annual Report, 2013-2014). The IPM ME reported additional dissemination work during the year, including a workshop on the production and use of Trichoderma in Nepal, a workshop on the biocontrol and management of Parthenium in Ethiopia, and symposium on a particularly destructive pest called the Tomato Leaf Miner in Kenya (IPM Annual Report, 2013-2014). Work across CRSP/Innovation Labs also increased during the final year of the Phase IV project, with the IPM ME reporting that it had established collaborative projects with two other CRSP/Innovation Labs, the Sorghum and Millets CRSP/IL for addressing a pest in Niger and the Peanut and Mycotoxin CRSP/IL, for combatting a pest in Uganda (IPM Annual Report, 2013-2014).

IPM CRSP/Innovation Lab – Organizational Structure

Between 2009-2014, the Integrated Pest Management CRSP/Innovation Lab (IPM CRSP/IL) initiative was led by a management entity (ME) created at Virginia Tech within the Office of International Research, Education, and Development and physically based at the university’s main campus in Blacksburg, Virginia.
The ME staff consisted of a director, an administrative principal investigator, associate program director, financial coordinator, communications director, gender specialist, and web developer. All of these individuals with the exception of the two regional consultants, held full-time appointments as administrative/research faculty or staff within the university. The ME team was responsible for the administrative and technical leadership of the IPM CRSP/IL program and its work was critical to the success of the overall initiative. On the administrative side, the ME served as the fiscal agent for the IPM CRSP/IL on behalf of USAID and was the primary organizational contact for the USAID agreement officer’s representative (AOR). The ME was responsible for all CRSP/IL reporting, monitoring, and evaluation efforts, allocated funding to
sub-projects, ensured adherence to USAID and university policies, maintained CRSP/IL institutional partner relationships, facilitated and coordinated logistics for meetings, workshops, and trainings, provided leadership within the university organization on international development efforts and publically represented the CRSP/IL through a variety of integrated marketing and communications. In terms of technical leadership, one of the major responsibilities of the ME was to facilitate the creation and approval of the annual work plan for the project. The work plan was a roll-up of all the individual project plans submitted by project principal investigators (PIs) and reflected IPM CRSP/IL efforts taking place within and across regions. This document, created in collaboration with ME staff, principal investigators, and host-country partners, was vetted by the IPM Technical Committee and approved by the AOR. The ME was responsible for making sure that the results of individual project research efforts were having their intended impact with farmers, that technical results were shared with USAID and among the CRSP/IL network partners, that human and institutional capacity building efforts (HICD) were achieving their target outcomes, and funding investments were being maximized through cross-project resource sharing, regional deployment of technologies, and technology transfer outside of the CRSP/IL with the nongovernmental and privates sectors (IPM Innovation Lab EET Report, 2013).

Mentioned earlier, the IPM CRSP/IL Technical Committee was a larger body tasked with providing scientific direction to the research agenda of the CRSP/IL and its sub-project recipients, review and approval of sub-project work plans and reports, and strategic direction on research specific issues faced by the program. The group included key ME staff, all of the principal investigators (PI) leading IPM sub-projects and cross-cutting initiatives, the USAID AOR, a representative from the US Department of Agriculture (USDA), and select participation
from collaborating international research centers and universities involved with IPM (IPM Annual Report, 2013-2014).

The IPM CRSP/IL included two advisory bodies within its organizational structure as well, the Program Advisory Board (PAB) and the External Evaluation Panel (EEP). Made up of key program stakeholders representing active U.S. consortium partners involved with managing the IPM CRSP/Innovation Lab projects, the PAB was the top policy-making body for the IPM CRSP/IL. The group also included USAID’s Agreement Officer’s Representative (AOR), select designees from host country institutions, a rotating member from a collaborating international agricultural research center, and senior leadership from Virginia Tech’s ME who served in a non-voting capacity. The PAB provided the ME team with strategic direction, recommended program adjustments, quality control, evaluation of funding and resource adequacy, and direction for program activities affecting US and host country impact (IPM Innovation Lab EET Report, 2013, p. 15). The External Evaluation Panel (EEP) consisted of a group of scientific experts retained by the ME to provide external review and assessment of the performance of regional and cross-cutting IPM projects. The EEP researcher team played an important role within the IPM structure by providing independent evaluation of the scientific merit and program management of the individual projects. Evaluation reports released by the EEP addressed competitive sub-awards and research collaboration with host countries by issuing recommendations on the “retention, addition, elimination, and/or modification of IPM CRSP/IL component projects” (IPM Innovation Lab EET Report, 2013, p. 15).

Organizational partners supporting principal investigators with responsibility for leading IPM projects included universities such as Michigan State, Clemson, Penn State, Ohio State, UC
Davis, and Virginia State. In 2009-2014, the IPM CRSP/IL counted among its collaborating
partners additional U.S.-based universities such as Kansas State, Montana State, North Carolina
State, Oregon State, Purdue, Florida, Georgia, and Washington State. Additionally, the ME
actively collaborated with USAID, USDA, and the Association of Public and Land Grant
Universities (APLU), 27 Non-U.S.-based universities, government organizations, and NGO
partners, 4 private sector firms, and 7 International Agricultural Research Centers (IARC) (IPM

Organized into regional projects, the projects within IPM Phase IV addressed the needs
of a specific area and of global themed projects, which targeted worldwide pest management
challenges (IPM Annual Report, 2013-2014). Regional projects often focused on the
development of IPM packages supporting vegetable and other high value crops such as coffee
and cacao. Regions included Latin America and the Caribbean, Central, Southeast, and South
Asia, and East and West Africa. Countries served by Phase IV of the IPM CRSP/IL included
Honduras, Guatemala, Ecuador, Tajikistan, Bangladesh, India, Nepal, Indonesia, the Philippines,
Cambodia, Kenya, Tanzania, Uganda, Ghana, Senegal, and Mali. Global themed projects cut
across the regions and included plant disease diagnostics, work with invasive plants like
Parthenium and their control, gender equity in IPM, and economic impact assessment (IPM

Associate awards are another funding mechanism by which the ME could extend its
work in a more targeted fashion. Sometimes the original CRSP/Innovation Lab award needed to
be amended to enable a new activity requested by USAID missions, bureaus, or other offices. An
emerging need may have justified a supplemental funding award to address a specific country or
region-specific problem (CRSP Guide, 2005). The IPM CRSP/IL ME worked very closely with USAID missions throughout its program history, regularly visiting the mission personnel, leveraging existing NGO and private sector partners for implementation, and bringing readily fungible technologies to local farmers. The External Evaluation Team (2013), an external group of experts organized by USAID to independently review the CRSP/IL programs, found that the IPM CRSP/IL had received the most funding from associate awards of all of the CRSP/Innovation Labs highlighting associate awards made in January 2013 by the missions in Bangladesh, Indonesia, and Nepal worth over $1.59 million and a 2010 award from the mission in Mali of $2.5 million (p. 34). The EET argued that “these awards have meant that the IPM CRSP/Innovation Lab can develop more technologies to reach more farmers than would have otherwise been the case” (IPM Innovation Lab EET Report, 2013, p. 34).

*Boundary work of the ME - three learning episodes involving program team members*

Through my case study research, I identified three noteworthy examples of organizational learning that occurred through the work of the IPM CRSP/Innovation Lab network management entity and its project teams during the study period. These were the development and application of IPM packages for high-value crops; the research and technology transfer of the beneficial fungus, Trichoderma; and the dissemination of project knowledge, within, across, and outside of, the IPM CRSP/Innovation Lab target countries and regions.

*The IPM Package*

The first example of organizational learning associated with the boundary work of the management entity staff and program team representatives involves the creation, testing, and
deployment of IPM packages. The IPM CRSP, as it was known in 2009 at the beginning of Phase IV of the program, continued its focus on the development of IPM packages, a collection of technologies and practices designed to address “problems faced by farmers from the time of planting seeds to the harvesting of a crop” (2011-2012 Annual Report, p. 1). An IPM package is a seed to harvest treatment that when adopted by the farmer, or those working with the farmers, can greatly improve the chance of increased crop yields and result in a better quality product (Subject S5, personal communication, August 7, 2014). Subject S8 explained that the CRSP/ILs had originally conducted individual field experiments, on a bug, a single plant, etc. to identify pests and develop strategies to address them. IPM packages offered a different approach to integrated pest management - a cradle to grave solution for the farmers, to include a full season, technology bundles, economics, gender roles, market, site selection, field prep, etc. (Subject S8, personal communication, August 22, 2014). As part of the work plan creation process and technical committee reviews, the IPM CRSP/IL ME collaborated with and counseled the Program PIs and regional program team scientists on plans for the development and testing of IPM packages during the program year (for example, IPM CRSP Technical Workplan, 2011). PIs would identify target countries for testing existing IPM packages in new environments, detail plans for developing new IPM packages for certain crops, and describe continued evaluation of IPM packages already in use. Subject S5 explained, “eggplant, for example, is damaged through soil-based disease that attacks the root stock, the plants get so-high and collapse … we came up with an IPM package of grafting disease resistant root stock which allows the plant to then maintain its structure” (Subject S5, personal communication, August 7, 2014). However, subject S5 cautioned, “this doesn’t solve all the problems though, and PIs are expected to address all the
potential issues through harvest, to create the IPM package, so that farmers can then tackle the problem” (Subject S5, personal communication, August 7, 2014).

An IPM package often starts with various treatments for soil and seeds such as the use of coconut pith for growing seedlings and Trichoderma to reduce soil fungal diseases (USAID Partnering with Feed the Future Innovation Labs, 2014). The package also introduces physical controls such as root stock grafting, sticky traps, and pheromones; cultural controls like using host-free periods for fields; and biological controls such as releasing parasitic and predatory insects of the target pest or invasive species (USAID Partnering with Feed the Future Innovation Labs, 2014). IPM packages were developed for a significant number of crops and regions during the study period. Looking at just the 2010-2011 program year, for example, the IPM CRSP/IL developed packages for tomato, wheat, and potato in Central Asia; tomato, okra, onions, in South Asia; tomato, peppers, and naranjilla in Latin America; tomato, passion fruit, coffee in West Africa; and tomato, cabbage, and potato in West Africa (2010-2011 Annual Report).

One way that IPM scientists developed this expertise was through active field testing and rigorous experiments looking at the impact of IPM packages on specific crops in targeted regions. The following example describes scientific testing conducted on the effects of an IPM package for reducing fruit borer and white fly infestation on tomato crops in Bangladesh:

“Two treatments, one consisting of an IPM package and the other of farmers' practice, were laid out in three replications in plots of 15m x 15m using a RCB design. IPM treated plots were separated from the non-IPM plots (farmers' practice) by about 200m. The IPM package treatments consisted of (a) planting of TLCV- resistant tomato line TLB-182; (b) manual destruction of pest-infested fruits; (c) weekly release of egg parasitoid, T.
evanescens, at the rate of 1g parasitized eggs/ha/ week and weekly release larval parasitoid, B. hebetor, at the rate of 800-1000 adults/ha/week; and (d) use of Helicoverpa pheromone bait trap at 10m apart. The treatment of farmers' practice consisted of planting of TLCV-susceptible tomato ((variety BARI Tomato-2) and spraying of synthetic pyrethroid insecticide (Cymbush 10EC) at the 1ml per liter of water every three day days. Data were recorded on white fly numbers, virus incidence, fruit borer infestations, yields and pest management costs. Compared to farmers' practice that consisted of pesticide applications only, the use of IPM package was highly effective in reducing the infestations of fruit borer by 83%, white fly by 84% and virus infection by 88%. As a result, plots receiving IPM treatments produced 43% higher yield and the pest management cost was half as that of farmers' practice (Table 4). The results including those of the past years confirm that pesticide-free tomato crops can be profitably produced by deploying IPM practices that will improve tomato production as well as farmers' economic gains.” (IPM Report 2009-2010, p. 43-44).

Other ways that IPM scientists learned about the effectiveness of the IPM packages were through collaboration with their network partners and by working with and listening to the farmers themselves. In terms of working with partners, Subject S8 referred to the approach where “the content of an IPM package was compiled collaboratively with the in-country scientists, then packaged, refined with feedback, compared against other packages, to make more effective” (Subject S8, personal communication, August 22, 2014). Subject S8 further argued that “local scientists understand life cycle … they understand pesticides, resistances,” and shared that (IPM PIs) “engage as many people as we can … we work with in-country experts, and learn over time” (Subject S8, personal communication, August 22, 2014). Working directly with
farmers through farm trials turned out to be a considerable source of learning for the PIs, ME leaders, and the farmers themselves. Subject S11 provided the following example from an interaction with farmers in East Africa describing their resistance to the use of “staking,” a physical control and component of many IPM packages:

“When the farm trials are conducted, each step, we are consulting and working with the farmers. The trials are where the farmers can learn from other farmers. One example is staking to help keep the fruit off the ground. The scientists recommended this approach but the farmers didn’t like to stake. It had to do with the cost of the bamboo stakes. We asked why they use bamboo and not some other wood, and the farmers shared that they had to use bamboo because the termites wouldn’t eat it like they would the other wood. This is an example why it is the interaction between the scientist and farmer that is most important. At the end of the day, the goal is to have a pre-identified package that will work for the local context.” (Subject S11, personal communication, October 22, 2014).

The Technology Transfer of Trichoderma

The second example of organizational learning that I identified from my research of the IPM CRSP/Innovation Lab, was the technology transfer of Trichoderma, a bio-pesticide technology that served as a key component of several IPM packages. Trichoderma is a fungus that happens to attack bad fungi found on plants and in soil. During the study period, IPM scientists discovered that Trichoderma could be effectively employed to counter a number of fungal diseases attacking vegetable crops in countries as varied as India, Indonesia, the Philippines, and Honduras (IPM Innovation Lab 10 Year Report, 2014, p. 21). Often included as part of a more comprehensive IPM package, Trichoderma has been employed to treat seedlings
before planting, to produce longer, stronger, and drought-resistant roots, and mixed with compost to protect against soil-borne diseases (IPM Innovation Lab 10 Year Report, 2014, p. 21). Trichocompost and Tricho-leachate (a liquid by-product of Tricho-compost) field-testing was an integral part of the IPM CRSP/IL South Asia Regional Program as early as 2009, with research results “conforming to earlier studies confirming that IPM practices with organic soil amendments will enrich the soils with higher abundance of beneficial nematodes, which will eventually protect the crop plants from the attack of harmful nematodes and animals, and help produce better crops with higher yields” (IPM Annual Report 2009-2010, p. 47). As a result of this research, the IPM management entity began sharing knowledge on the benefits of Trichoderma across regional programs. In the 2011-2012 IPM annual report, the ME reported the delivery of two workshops, one in Tanzania and one in Cambodia, on the use of Trichoderma for control of soil fungal diseases and vegetable production (IPM Annual Report 2011-2012). A year later, the ME reported that its program team members had presented on Trichoderma at the Entomological Society of America’s Annual Meeting (IPM Annual Report 2012-2013). In its 2013-2014 Annual Report, the ME highlighted a workshop in Nepal on the production and use of Trichoderma, where both instructors and presenters were from developing countries (IPM Annual Report 2013-2014).

As with many development projects, actually getting technologies to the end users at scale, the farmers in this case, was an important factor in why the technology transfer of Trichoderma represented such a learning challenge to the IPM CRSP/IL network. With Trichoderma, the IPM IL ME reported several examples where the management entity was able to leverage prior learning to expand the production and distribution of the technology by working with university, private sector, and NGO network partners. The IPM CRSP/IL ME, USAID, the
Board for International Food & Agricultural Development (BIFAD), and the IPM CRSP/IL External Evaluation Team, all pointed to a belief that private sector companies and NGOs had a much broader reach and could make a bigger impact in scale through partnership versus the IPM CRSP/IL team acting alone (IPM Innovation Lab EET Report, 2013; Subject S5, personal communication, August 7, 2014; Subject O1, personal communication, April 8, 2015). Subject S5 stated that the management entity had worked during the study period with value chain companies and NGOs to help with the implementation of IPM technologies to a broader audience of end-users. This work involved training and technical assistance for company technicians who would “then take the technologies directly to the farmer” (Subject S5, personal communication, August 7, 2014). For instance, in Bangladesh, the IPM CRSP/IL management entity employed a “train the trainer” approach in partnership with the Mennonite Central Committee (MCC), which then prepared end-users to use technologies such as grafting, pheromone application, and the use of Trichoderma (Subject S7, personal communication, August 11, 2014).

While developing the distribution network for Trichoderma was viewed as critical, the other part of the technology transfer process involved working with companies in the IPM target countries who could produce the technology at scale. As Subject S5 stated, “training on the use of trichoderma fungus as a technology is no good if farmers can’t get the fungus” (Subject S5, personal communication, August 7, 2014). An example of technology transfer for Trichoderma production came from Nepal where the ME worked through an associate award with the USAID mission to train the technicians of the USAID value chain KISAN project in IPM technologies (USAID Partnering with Feed the Future Innovation Labs, 2014). Through this work, the IPM CRSP/IL ME identified a private biopesticides company, Agricare, that the ME assisted in
improving the quality of its manufactured Trichoderma products. Agricare further promoted the sale of those products in Agrovets retail outlets across Nepal (Subject S9, personal communication, September, 29 2014; USAID Partnering with Feed the Future Innovation Labs, 2014). This was a model that the IPM ME reported was working in Nepal and was beginning to work in Cambodia with other partners (Subject S5, personal communication, August 7, 2014). The innovation of this technology transfer model was shared across the IPM CRSP/IL network by the management entity and leveraged for other technologies and crops. For instance, grafting technology was used for eggplant varieties in Bangladesh, where disease resistant root stock was grafted with the scion of desirable eggplant varieties (Subject S2, personal communication, August 14, 2013). According to Subject S2, “the practice was picked up at an IPM CRSP meeting, taken into the training stage, and commercialized with a Bangladeshi company” (Subject S2, personal communication, August 14, 2013). As further evidence of organizational learning for innovation, “some US colleagues wrote a grant to transfer knowledge to US tomato usage … [where] NC State now gives farmers training through their Extension office” (Subject S2, personal communication, August 14, 2013).

Dissemination of Project Knowledge

A third example of organizational learning that I identified taking place within the CRSP/Innovation Labs involved the dissemination of project knowledge. The learning examples above have already discussed the core CRSP/Innovation Lab program goal of research dissemination to end-user farmers in target Feed the Future countries (IPM Annual Report 2009-2010). The IPM package example showed how these packages were designed to meet target country and region-specific agro-climatic conditions to achieve reductions in pests and to
increase crop yield, including the sharing of that knowledge in the field. The IPM ME reported in 2011, for instance, that “successful implementation of IPM packages requires the wide dissemination of these practices through local farmer groups and government and non-government organizations” (2010-2011 Annual Report, p. 2). Significant importance was placed on sharing of the IPM package knowledge to end-users by USAID, which made research dissemination, to in-country partners and end-users, one of the key evaluation measures applied to the IPM CRSP/IL as a condition of project funding (IPM Annual Report 2010-2011). The Trichoderma example illustrated how the production and distribution of Trichoderma could have real and discernable impacts on small-scale farmer methods and results. I described how the production of this technology and the knowledge of how to use the technology effectively, was disseminated within IPM CRSP/IL target countries and regions through private-sector partner relationships and via technology transfer.

In addition to supporting efforts to achieve this primary dissemination objective, USAID and the CRSP/IL management entity, along with the CRSP/IL project team scientists, were committed to sharing knowledge gained through their project work with more audiences than just end-user farmers in target countries and regions. The IPM CRSP/IL program team was intent on achieving broader impacts by deploying the lessons learned developed through its’ target-country/region work, across regions being served by the IPM CRSP/IL and reaching more IPM network and external stakeholders, including disseminating research results and project knowledge with members of the broader scientific community. Bartsch, Ebers, and Maurer (2013) argue that while project-level knowledge can be a source of learning and innovation, making project-based knowledge available to the whole organization represents a major organizational learning challenge (p. 239). Bartsch et al. (2013) add that “these difficulties arise
due to the unique and discontinuous nature of project-based work,” a situation that creates boundaries that can “hinder the transfer and use of valuable knowledge gained within particular projects by subsequent projects and/or the project-based organization as a whole” (p. 239). While the IPM and Horticulture CRSP/IL program networks operated as more than single project-based organizations, the NAO management entities were responsible for enabling, managing, and leveraging the knowledge being generated from the project teams. The MEs relied on the regional, global, and country-specific project teams to share knowledge generated from their local-level work. Organizational learning was exemplified in learning how to disseminate local project knowledge in this geographically dispersed project-based context. The following instances demonstrated different ways that CRSP/ILs MEs and project teams were able to overcome barriers and share project-based knowledge within and across the program networks.

Each IPM package was developed for a high-value crop growing in a specific country or region, but early in the study period IPM CRSP/IL leaders and scientists began to explore whether lessons learned in one target country or region could be leveraged in another. In the 2009-2010 IPM CRSP Annual Report, the ME commented that “while each country has its own specific mix of pests and agro-climatic conditions, many pest problems are similar around the world …. [T]echniques developed in one country have been transferred to other countries with efforts to adapt to local conditions” (IPM Annual Report 2009-2010, p. 2). Regional and global dissemination of IPM technologies became another important measure of project impact monitored by the ME team and its outside evaluators (IPM Innovation Lab EET Report, 2013). In its 2010-2011 Annual Report, for instance, the IPM management entity highlighted the development of an IPM package for tomato in India, a technology viewed as having the potential for wide dissemination across regions (IPM Annual Report 2010-2011). The IPM External
Evaluation Team referenced additional examples of cross-region research dissemination, citing “the technology of creating a host-free period for tomato in West Africa for management of white flies and white fly-transmitted viruses,” which the evaluators pointed out “came from the Dominican Republic and was incorporated into an IPM package for tomato growers in Mali” (IPM Innovation Lab EET Report, 2013, p. 32). The EET team also pointed to a grafting technology, which had “been transferred from Bangladesh to India, Nepal, Uganda, Kenya, Honduras, Ecuador, and even the U.S. (Ohio) from information exchange platforms such as annual planning meetings, workshops, and seminars where partners from different regions gather” (IPM Innovation Lab EET Report, 2013, p. 32). By the end of the study period, the ME was reporting numerous examples of research dissemination and knowledge sharing across IPM regions (IPM Annual Report 2013-2014).

Project knowledge and research results important to internal and external network stakeholders represented a key source of knowledge for the CRSP/IL network members. Learning how to best disseminate this knowledge across the network was another occurrence of organizational learning that I found taking place within the USAID CRSP/Innovation Lab initiative. Stakeholders included in-country university and national research center partners, international scientific bodies investigating regional and global level problems, and members of the broader scientific community, such as fellow university research scientists who were doing work in similar disciplines and/or geographic regions. Research dissemination and knowledge sharing activity would often take the form of conferences, symposia, invited workshops, face-to-face training, and online webinars. International conferences and symposia were sometimes hosted by the IPM CRSP/IL management entity, but more often than not, were attended by an IPM CRSP/IL scientist or an ME leader who would present at the event. Across the study period,
the ME reported IPM CRSP/IL participation in the International Symposium in Memphis, International IPM Mesoamerican Conferences in Honduras, the Entomological Society of America’s Annual Meetings, and the Global Forum for Innovations in Agriculture in the United Arab Emirates, to name a few (IPM Annual Reports 2009-2010; 2010-2011; 2011-2012; 2013-2014). Workshops were a vital mechanism to share knowledge with IPM CRSP/IL stakeholders. Over the study period, the ME reported hosting a regional workshop on the Tomato Leafminer held in Senegal in collaboration with the USAID West Africa office, USDA/APHIS, and CORAF, coordinating a Plant Disease Diagnostic Training in Phnom Penh, Cambodia in partnership with GDA and HARVEST Fintrac (USAID Value-Chain Project), and conducting a workshop on invasive species identification and management in the tropics, with a focus on bacterial wilt and papaya mealybug in Senegal (IPM Annual Reports 2009-2010; 2010-2011; 2011-2012; 2013-2014). The IPM CRSP/IL ME team also participated in several USAID webinars, over the study period to promote IPM technologies to a global, online audience (IPM Innovation Lab 10-year Report, 2015). Echoing the importance of knowledge sharing with program stakeholders, the IPM External Evaluation Team reported in 2013, that “once an IPM package has been developed, researchers and extension specialists from other institutions within the country often are invited to IPM CRSP/IL events. These visits are arranged in venues ranging from workshops, planning meetings, symposia, and field trips taken to see demonstration plots” (IPM Innovation Lab EET Report, 2013, p. 32). In fact, the EET shared their praise for the overall knowledge sharing effort, “the IPM IL has done a good job in disseminating research at regional and global levels, to multiple audiences, and in diverse forums” (IPM Innovation Lab EET Report, 2013, p. 32).
Challenges to Learning

While the examples of organizational learning referenced above can be lifted up as success stories for the IPM CRSP/Innovation Lab Management Entity, not all attempts at learning within and across the boundaries of the IPM CRSP/IL network resulted in knowledge being shared and institutionalized as effectively within the program network. I identified several instances, which I describe as learning challenges, occurring in the work of the IPM CRSP/IL ME and its project teams during the study period that required closer examination.

Earlier in the chapter, I mentioned that each CRSP/Innovation Lab program was subject to regular review from an External Evaluation Panel retained by the ME and a periodic review from an External Evaluation Team assigned by USAID. In response to a question I asked during interviews, “how, if at all is knowledge shared from the evaluations and used to change direction and behaviors of the IL project team?”, Subject S4 responded, “the technical committee reviews the evaluations and makes some adjustments … this occurs less now under the new system where the technical committee no longer has the authority to disperse funding” (Subject S4, personal communication, October 31, 2013). What Subject S4 was referencing was a prior USAID approach for evaluation of the CRSPs/ILs where a small group of scientists were embedded as evaluators for the 5-year life of the project and recommendations were acted upon by the technical committee who had the authority to allocate funding directly to sub-awardees (Subject S4, personal communication, October 31, 2013). Under the current evaluation model, and the model in place during the study period, program evaluation was conducted by a team of scientists who were not associated with the daily activities of the CRSP/IL projects and who reported their findings to USAID and the ME for action, not the CRSP/IL technical committee.
According to Subject S4, this lack of an embedded evaluation team created a learning challenge. Under the old model, “the management entity knew where the problems were and could work with this embedded team to raise those problems to USAID, putting more emphasis to get them fixed … the embedded teams knew enough about the projects as well where they could anticipate and see the problems too” (Subject S4, personal communication, October 31, 2013). An approach that relies solely on the feedback of evaluators who are embedded with the project team, however, raises its own set of potential problems, as an embedded team can be seen as being too closely associated with program outcomes, and the personal relationships developed over time with ME personnel and project scientists may be viewed as problematic for the evaluation team tasked with producing an objective evaluation. Understanding how feedback from the IPM CRSP/IL project activities flows back to the ME can help the ME team, external evaluators, and USAID funders, diagnose barriers to knowledge sharing that may be preventing organizational learning on the part of the CRSP/IL.

Another learning challenge involved the Open Data directive coming from the US government, a mandate requiring all research data generated from federally funded research projects be made available in publicly-accessible databases (United States Agency for International Development, 2017). Subject O1 commented that while “USAID as an agency doesn’t yet know what they want,” the “ILs need to learn to work through the problem with the agency” (Subject O1, personal communication, April 8, 2015). Subject O1 commented that learning would come through mutual engagement by both USAID and the CRSP/ILs in dealing with the issue, adding “this is typical of a new problem we have that will require thinking, learning is to engage and help develop solutions, not just disengage, it will be interesting to see which labs will help solve this” (O1). While the issue was in reference to a response required on
the part of the CRSP/ILs to the directive on open data, the broader learning challenge implicated here was an apparent need for more collaboration between USAID and the CRSP/ILs and in particular, an openness on the part of the CRSP/ILs to learn from this collaboration.

In addition to the open data issue, I found additional instances in the data where a lack of collaboration between network partners created a challenge to organizational learning within the CRSP/IL projects. One example came from the IPM CRSP/IL External Evaluation Team in its 2013 report, where the EET encouraged the CRSP/ILs to expand existing partnerships to include federal research organizations and local international universities as way to increase the number of partners who would have access to the knowledge disseminated by the CRSP/IL. The EET reported that “more effort is needed here to make a greater impact in partner countries of the IPM IL approach utilizing the PIPM method of on-farm adaptive research” (IPM Innovation Lab EET Report, 2013, p. 32). Another example involved a perceived lack of collaboration between the work of the CRSP/ILs and the other development efforts of the USAID missions. Subject O1 shared that USAID missions were having trouble keeping track of CRSP/IL projects taking place in their respective countries, that little collaboration was taking place between the CRSP/ILs and the mission, or with other USAID development contractor-led projects (Subject O1, personal communication, April 8, 2015). “More projects should be collaborating, it is easier to keep track of integrated projects, than those that stand alone,” Subject O1 commented (Subject O1, personal communication, April 8, 2015). While the IPM CRSP/IL’s integration with a USAID mission project in Nepal was held up earlier as a successful episode of learning, Subject O1 commented that “the missions want to see ILs interwoven with value-chain contractor projects so that there is no distinction … that is how the new IPM IL was designed” (Subject O1, personal communication, April 8, 2015).
Horticulture CRSP/Innovation Lab

In 2009, the Horticulture Collaborative Research Support Program, as it was named at the time, was launched to address a number of development opportunities and challenges brought forward in a 2005 Global Horticulture Assessment report produced by a team led by the University of California-Davis at the request of USAID (Global Horticulture Assessment, 2005; Horticulture CRSP Annual Report 2010). The authors of the report argued that a focus on horticulture production by “underdeveloped and emerging-economy countries” represented an opportunity to “meet domestic food needs and diversify income sources” with the goal of making improvements in “human health, and farmer household economic and social advancement” (Global Horticulture Assessment, 2005, pg. 1). The Assessment concluded that these goals could be met through “research and development investments” and the “application of the full range of development instruments including infrastructure and institution building, technology transfer and development, creation of an enabling environment, technical training programs, research and capacity building” (Global Horticulture Assessment, 2005, pg. 60). The report also recommended that USAID establish a Horticulture Collaborative Research Support program modeled after the other CRSP programs in existence at the time, with a focus on building partnerships with international horticulture centers and that the CRSP to establish itself as “a center for knowledge generation, capacity building and integration” (Global Horticulture Assessment, 2005, pg. 60). After an open competition, USAID awarded UC-Davis, Cornell University, University of Hawai‘I, and North Carolina State University, a cooperative agreement for the new Horticulture CRSP/IL, with UC-Davis serving as the management entity for the project network (Horticulture CRSP Annual Report 2010). Guiding the purpose of the new CRSP/IL was an overarching goal “to reduce poverty and hunger of the rural poor in developing
countries through horticulture,” with horticulture being viewed as having “the capability to provide a diverse cropping system, provide healthy and nutritious food, and to provide an increased income to smallholder farmers” (Horticulture CRSP Annual Report 2010, pg. 1). Major objectives for the management entity included developing the CRSP/IL’s ability to scale-up newly developed technologies to increase smallholder participation in markets, build local scientific and technological capacity, and facilitate the development of policies that improve horticultural trade (Horticulture EET Report, 2013, p. 7)

The management entity at UC Davis resided in the College of Agricultural & Environmental Sciences, under the Department of Plant Sciences and the International Programs Office of the university (Horticulture Innovation Lab Website). Established with its own guiding principles and functional organizational hierarchy, the UC Davis ME served as a type of network administrative organization (NAO) for the Horticulture CRSP/Innovation Lab program network. Another interesting feature of the Horticulture CRSP/Innovation Lab ME is the way in which it is organized around functional roles that included the strategic apex directorate, operations management, support management, and program management and collaborative research activities (Horticulture CRSP Annual Report 2012-2013, p. 85-86). The strategic apex directorate was responsible for project planning, allocating resources, defining strategic priorities, setting agendas, adjusting direction, and mobilizing partners. It included the Horticulture CRSP/Innovation Lab director, senior leaders from the university hierarchy, International Advisory Board, USAID agreement officer representative, the External Evaluation Team, and technical support staff to the director (Horticulture CRSP Annual Report 2012-2013, p. 85-86). The operations management function was delegated authority to coordinate between and within the functional areas of the ME, as well as ensuring alignment of project activity with
guiding principles and the bi-directional transfer of information to/from individual projects. The Operations management staff included the Horticulture CRSP/Innovation Lab associate director, “leaders” in the areas of technology and innovation and communications and information transfer, which were two thematic areas of focus for the overall project, and graduate student support (Horticulture CRSP Annual Report 2012-2013, p. 85-86). Finally, the support management function provided workflow assistance in the form of accounting, financial management, and human resources, while the program management and collaborative research activities consisted of analysts and experts consulted for guidance on individual projects and aspects of the horticulture value chain. According to the ME, there was “significant informal and formal communication, and team formation that crosses the flexible boundaries across the units” (Horticulture CRSP Annual Report 2012-2013, p. 86).

To address the Horticulture CRSP/Innovation Lab program goals, the ME distributed program funding across a series of targeted, variable length projects. These included, Immediate Impact Projects (IIPs-$150,000 for one year), Exploratory Projects (EP-$75,000 for one year), Pilot Projects (PP-$500,000 for three years), Continuation Projects (CNP-$250,000 for two to three years), Comprehensive Projects (CP-$1,000,000 for three years), and Focus Projects (FP-$100,000 for one to two years) (Horticulture Innovation Lab External Evaluation Team Report, 2013, p. 7). The Horticulture CRSP/Innovation Lab approach stood in contrast to the Integrated Pest Management CRSP/Innovation Lab funding model, with project investments made in broader, 5-year cycles and often at higher levels of funding (IPM Annual Report, 2009-2010). The Horticulture CRSP/Innovation Lab supported Trellis projects, a special type of short-term, small-scale, project conducted with in-country development organizations around small technical problems. The Trellis projects were engagements specifically designed to provide US graduate
students with international experience and served as beneficial to participating organizations who could get a rapid response to challenging issues and exposure to well-trained students (Horticulture Innovation Lab External Evaluation Team Report, 2013). The IPM CRSP/Innovation Lab did not have an equivalent type of project to the Trellis program.

Another area of distinction between the two CRSP/Innovations Labs surrounds what constituted a “global theme” for each program network. In the case of the IPM CRSP/Innovation Lab, the “global theme” label classified a set of separately funded projects seen as having the potential for application across multiple regions. Examples included work on invasive species, plant virus diagnostics, and economic impact analysis (IPM Annual Report, 2009-2010). The Horticulture CRSP/Innovation Lab meanwhile, used the “global theme” terminology to describe “three needs in horticulture” that served as guideposts for the work of the program network (Horticulture CRSP Annual Report 2010). These global themes included, technological innovation, with project activities focused on developing innovative “leapfrog” technologies, gender equity, to breakdown constraints placed on women growers, and improved access to information and research capacity creating access to reliable information, training, and management tools to enhance human and institutional capacity building (Horticulture CRSP Annual Report 2010; Horticulture Innovation Lab Brochure, 2014).

In the new CRSP/IL’s first annual project report, the management entity described 15 individual projects launched during the year, in 20 countries, across Africa, Latin America, and South and Southeast Asia (Horticulture CRSP Annual Report 2010). The CRSP/IL project activities focused on addressing the horticulture value chain through a number of efforts including, empowering women and creating income-generating opportunities, reducing
malnutrition by increasing household production of beneficial crops, disseminating technical knowledge generated from the work of the CRSP/IL and its’ partner institutions, increasing on- and off-farm income, reducing postharvest loss, and contributing to a policy environment for agribusiness growth (Horticulture CRSP Annual Report 2010, pg. 2-3). The first year sustainable crop production projects included measures to deploy rapid diagnostic tools for Phytophthora and improving perishable fruit postharvest quality in Central America and sustainable production of specialty horticultural crops in Ghana, Zambia and Kenya (Horticulture CRSP Annual Report 2010). Projects dedicated to postharvest technology, nutrition, and food safety included the development of a technology for solar drying of mango and tomato in Tanzania, biological-based postharvest quality maintenance and disease control for mango and papaya in Sri Lanka, and cool rooms and cool transport for small-scale farmers in India, Honduras, and Uganda (Horticulture CRSP Annual Report 2010). The management entity also reported creating an enabling environment that supported an ornamental plant industry in Honduras, improving market access for emerging South African rooibos farmers and developing a new technology for postharvest drying and storage of horticultural seeds from India and Nepal (Horticulture CRSP Annual Report 2010).

The second year of the Horticulture CRSP/Innovation Lab included a transition and expansion in the makeup of the program portfolio. The ME shifted from 15 one-year Immediate Impact Projects, to a portfolio consisting of 10 one-year Exploratory Projects, 5 three-year Pilot Projects, and 10 six-month Trellis Fund Projects (Horticulture CRSP Annual Report 2010-2011). Participation in the network also broadened, with the ME reporting that 15 U.S. universities had engaged in leading projects, collaborating with 125 in-country researchers and local partners, across 34 countries (Horticulture CRSP Annual Report 2010-2011, pg. 2). By the end of the
In 2010-2011 project year, the ME had focused delivery of all its projects in Feed the Future target countries, an emerging initiative that was beginning to drive agricultural funding resources for USAID (Horticulture CRSP Annual Report 2010-2011). The new exploratory projects were designed for researchers who had the ability and interest to tackle a development problem, but not the team or background in a particular country to ensure long-term program success (Horticulture CRSP Annual Report 2010-2011, p. 95). Exploratory projects included, for instance, establishing a mobile phone enabled extension center in India, Sri Lanka, and Nepal, assessing fruit and vegetable production and promotion potential in Zimbabwe, and deploying GIS technologies and training in Malawi to identify horticulture market opportunities (Horticulture CRSP Annual Report 2010-2011). The five long-term pilot projects built on upon the work and results of select immediate impact projects launched in year 1 of the CRSP/IL and were designed to meet FTF priorities. Project examples included opening a regional postharvest training and technical support center in Rwanda to serve Sub-Saharan Africa, developing a market network for ‘food-safe’ vegetables in Cambodia and Vietnam, and developing a participatory extension model in Uganda and Democratic Republic of Congo for smallholder farmer production (Horticulture CRSP Annual Report 2010-2011). The Horticulture CRSP/IL ME also reported advancements in two thematic areas, information access and innovative technologies. In response to the information access theme, the 2010-2011 CRSP Annual Report highlighted measurable increases in search activity and project information sharing via the CRSP website (p.15). In the area of new technologies, the ME identified a number of noteworthy technologies, including the distribution of zeolite beads, solar drying techniques, low-cost cool rooms, and pest-exclusion nets that were developed and tested through collaborative research with in-country partners (Horticulture CRSP Annual Report 2010-2011, p. 21).
In the third year of the Horticulture CRSP/IL, UC-Davis reported continued progress toward program goals among its research portfolio, which then included seven long-term projects (pilot and comprehensive) and five focus and continuation projects (Horticulture CRSP Annual Report 2011-2012, p. 1). The ME announced that two Regional Centers of Innovation launched as part of existing international research centers to service the development assistance needs of multiple countries (Horticulture CRSP Annual Report 2011-2012, p. 1). These included regional centers at Kasetsart University in Thailand and Zamorano University in Honduras (Horticulture Innovation Lab Website). Another major goal-directed activity of the Horticulture CRSP/IL was the development of public-private partnerships, which extended the reach of the core ME staff and project principal investigators by involving non-CRSP/IL partners in applying CRSP/IL technologies. Highlights included a food safety project for tomato between Hanoi University of Agriculture and the private company Hapro to prepare products for export, a partnership between the Horticulture CRSP/IL, a project involving the Tanzanian company, A to Z Textiles, to produce pest exclusion nets, and a project involving the Horticulture CRSP/IL, Rutgers University, Kenya Agricultural Research University, the World Vegetable Center, and the New York company Store It Cold, LLC to produce an technology called Cool-Bot, to address a post-harvest loss problem prevalent in a number of developing countries (Horticulture CRSP Annual Report 2011-2012, p. 8).

In 2012-2013, the fourth year of the Horticulture CRSP/IL funding period, the ME reported management of 17 active research projects in 20 Feed the Future target countries and the establishment of a third Regional Innovation Center at the Kenya Agricultural Research Institute, in Thika, Kenya (Horticulture CRSP Annual Report 2012-2013, p. 17; Horticulture Innovation Lab Website). Activities of the CRSP/IL were beginning to make an impact as shown
by some of the results reported by the ME. These included a 75% technology adoption rate by
pest-exclusion net project participants in Benin, improved production and incomes among
Zambian farmers, and development of a postharvest training center that had produced 36 trainers
who instructed over 16,000 farmers (Horticulture CRSP Annual Report 2012-2013, p. 17). Also
notable during the project year, the ME released a publication titled, “Technology Toolbox for
Horticultural Development,” detailing a collection of technologies tested and shown to be
effective in smallholder farmer horticulture activities (Horticulture CRSP Annual Report 2012-
2013, p. 541). These six technologies included a chimney solar drying processing technique for
fruits and vegetables to extend shelf life, a solar pump system for irrigation, the Cool-Bot cold
storage system, facilitated solarization approach to weed and pest reduction, pest-exclusion nets,
and seed drying beads (Horticulture CRSP Annual Report 2012-2013, p. 543-549). Similar to the
IPM CRSP, the Horticulture CRSP was renamed the Feed the Future Innovation Lab for
Collaborative Research on Horticulture and would begin to use the new name in official
documents in fiscal year 2014 (Horticulture Innovation Lab External Evaluation Team Report,
2013).

In the last year of the Horticulture CRSP/Innovation Lab’s initial five-year funding
period, the ME reported several successful project outcomes from the 16 active projects.
Examples included an intensive effort to incorporate sweet potatoes in the food value chain in
Ghana to alleviate Vitamin A deficiency, creation of farmer savings groups in Cambodia that
invested in local cooperative infrastructure, and an expansion in the use of the chimney solar
dryer technology across the Horticulture CRSP/Innovation Lab geographic footprint, with
additional testing being completed in Uzbekistan, Kenya, Pakistan, and Bangladesh (Horticulture
Innovation Lab Annual Report 2013-2014). The Horticulture CRSP/Innovation Lab engaged in
training efforts through its projects that reached 6,750 farmers, 70% of whom were women, thereby making great strides towards its gender equity core project goal (Horticulture Innovation Lab Annual Report 2013-2014, p. 10).

Creating multiple project research models and building external partnerships was a consistent goal of the Horticulture CRSP/Innovation Lab throughout the five-year study period. In total, the ME recounted support for 40 research projects, involving 15 U.S. universities and over 100 organizations identified as partners (Horticulture Innovation Lab Annual Report 2013-2014, p. 10). According to the 2013-2014 Annual Report, the Horticulture CRSP/Innovation Lab trained over 32,000 people during the five-year period and supported over 400 students (p. 63). The Horticulture CRSP/Innovation Lab was funded for a second five-year project phase with UC Davis selected to continue as management entity for the program network.

I identified several examples of organizational learning occurring during the study period that involved Horticulture CRSP/Innovation Lab program team members working at the boundaries of the network. These included the work of project leaders to develop a U.S. market for fresh flowers in Honduras, an initiative to advance seed drying practices in India, Nepal, and Thailand, and management entity efforts to promote knowledge sharing to support learning across the program.

Launched as one of the first immediate impact projects (IIP) in the Horticulture CRSP/IL’s initial funding year, the effort to build an ornamental plant industry in Honduras involved working with host country collaborators and smallholder producers to identify bottlenecks in a grower-to-market environment (Horticulture CRSP Annual Report 2010, pg. 43; Subject CA4, personal communication, January 28, 2014). This project was classified by the
management entity as part of the “enabling environment” project priority area, highlighting its goal of creating the capacity among Honduran farmers to produce and deliver to market a saleable product. Early on, the project PIs identified several technical issues that impeded their ability to transport flowers to their target market in the United States (Subject CA4, personal communication, January 28, 2014). One of these issues, keeping the flowers cool postharvest, led the project PIs towards a collaborative relationship with another CRSP/IL project focused on cool storage and transport in the developing world, where affordable refrigeration was often unavailable. The relatively low-cost and simple to operate, Cool-bot thermostat/room air conditioner system, was developed for refrigerating small-scale storage rooms and turned out to be effective in helping the Honduran flower producers increase the shelf life of their product from 4 days to the required 2 weeks necessary to meet market demand (Horticulture CRSP Annual Report 2010, pg. 37; Subject CA4, personal communication, January 28, 2014). The informal knowledge sharing about technologies that could help with the spoilage problem faced by this CRSP/IL actually led to a more formal arrangement between the two CRSP/IL projects where the Honduran location became a testing site for the Cool-bot project (Subject CA4, personal communication, January 28, 2014). Despite the achieving many of the project’s goals, there were still barriers within this project that made organizational learning more challenging. As Subject CA4 discussed in the interview, one partnership involving local Honduran university partners was limited in its value because funding could not be easily transferred due to institutional barriers and data collection formats and reporting requirements from the ME and USAID did not account for the local context where production data would have been more relevant (Subject CA4, personal communication, January 28, 2014).
Another example of organizational learning through project work came from a project focused on testing the effectiveness of a new technology for postharvest drying and storage of horticultural seeds. Zeolite desiccant beads, a manufactured product used in the petroleum industry, was tested in India, Nepal, and Thailand for its ability to dry different types of vegetable seeds in varying conditions (Horticulture CRSP Annual Report 2010, pg. 53). Through the execution of the project, subject CA2 indicated that they “learned that high humidity” was “the main problem within the concept of the dry chain” whereas “temperatures” were “the problem in the cold storage chain” (Subject CA2, personal communication, January 27, 2014). In developing countries, Subject CA2 added, “cold storage can be a problem in areas where power is unreliable,” and drying seeds could keep them alive longer in hot, humid, conditions (Subject CA2, personal communication, January 27, 2014). Project leaders also discovered in their testing that even if seeds are dried, they might still be susceptible to insects, if they are not stored in the right type of packaging (Subject CA2, personal communication, January 27, 2014). The PIs reached out to a colleague at another university doing work with cowpeas and found the use of a basic hermetic packaging could stop the insects by eliminating oxygen and moisture (Subject CA2, personal communication, January 27, 2014). “The problem is scale,” Subject CA2 added, “they still have to have hermetic packaging” (Subject CA2, personal communication, January 27, 2014). This constraint, along with the overall cost of purchasing and recharging the beads, can be prohibitive for the smallholder farmer, who according to Subject CA2 are “people who can’t even afford a tarp to lay out their seeds” (Subject CA2, personal communication, January 27, 2014). Project leaders worked with the ME and USAID to leverage what they had learned in the pilot phase of the project, sharing knowledge about the packaging needs and promoting a central message, “get it dry, keep it dry” (Subject CA2, personal communication, January 27, 2014).
Details about the project research results and learning outcomes were disseminated back to the ME through conversations and reports, shared via presentations at the Horticulture CRSP/Innovation Lab annual meeting, made available on a special project website, and discussed in a workshop designed to reach outside audiences (Horticulture CRSP Annual Report 2010, pg. 53; Subject CA2, personal communication, January 27, 2014). Subject CA2 expressed frustration that they didn’t have a budget to promote what they were learning in the countries they were working, instead depending on contractor partners and their networks to get the word out (Subject CA2, personal communication, January 27, 2014). According to Subject CA2, the “biggest challenge for the researcher is building and identifying the networks” (Subject CA2, personal communication, January 27, 2014).

Finally, some of the efforts on the part of the Horticulture CRSP/Innovation Lab management entity to enable, manage, and leverage learning within the program network during the study period are worth highlighting. One of the key responsibilities of the management entity was to enable knowledge sharing and collaboration within and beyond the CRSP/Innovation Lab network. This included structural measures such as weekly meetings that PIs could join, PI trainings on administrative issues, and annual meetings set by the ME where project PIs and international collaborators came together in the U.S. and in target countries to learn from the work of others (Subject CA5, personal communication, October 27, 2014). The ME enabled knowledge sharing through a number of required project reports as well. The CRSP/Innovation Lab was required to provide USAID with an annual report and the ME asked that PIs report to the management entity twice a year (Horticulture CRSP Annual Report 2010; Horticulture Innovation Lab External Evaluation Team Report, 2013; Subject CA1, personal communication, January 27, 2014). ME leaders relied on PIs to highlight if there were changes and in turn, the
ME communicated feedback from USAID. According to Subject CA1, this feedback was usually not enough to restructure the work plan, indicating that it was probably because of the short duration of the projects (Subject CA1, personal communication, January 27, 2014). The ME also enabled learning at the boundaries of the network by trying to link PIs with other CRSP/ILs, serving as a network broker, to foster new project collaboration. PIs and ME leaders indicated that inter-CRSP collaboration was challenging, as the structures of these projects often did not align; they operated on different project schedules and the funding associated with them differed (CA1; CA2; CA5). Nearly everyone interviewed shared in some way that collaborating across organizational borders with other CRSP/ILs was a missed opportunity. These projects often operated in the same regions and countries as their own work, but there were structural issues that needed to be overcome to make this happen including incentives, dedicated funding, and available time to take on these projects in addition to everything else being asked of the ME and PIs (CA1; CA2; CA3; CA4; CA5; O1).

The Horticulture CRSP/Innovation Lab created a technical information management system to store research results and manage knowledge produced by the project teams. This web-based software stored extension materials, blueprints, and documents divided into strategy, operational, and technical categories (Horticulture CRSP Annual Report 2010; Subject CA1, personal communication, January 27, 2014). The ME was also working to understand how money could flow better to partner countries and determine better methods to transfer information back to the projects (Subject CA1, personal communication, January 27, 2014). The ME had responsibility for administering the USAID monitoring and evaluation process on behalf of the individual projects. USAID required reporting on 50+ indicators for each project, sometimes with indicators changing year to year. One PI shared that the USAID report had 225
questions for a one-year project and there was not enough time to answer these well (Subject CA4, personal communication, January 28, 2014). I asked how USAID leveraged the information gathered using these indicators and those I asked were not sure how the data were utilized. A key role for the ME often came down to serving as the go between for USAID and the project PIs to help navigate shifting monitoring and evaluation requirements and to translate the urgency of these requests and impact on project activities (Subject CA1, personal communication, January 27, 2014; CA5).

The Horticulture CRSP/Innovation Lab ME leveraged knowledge from the work of the project teams in a variety of ways. The ME had responsibility for meeting the overall goals and objectives of the program network and structured annual reports to document how individual projects met or fell short of meeting project targets, whether the global themes established at the beginning of the funding period were being achieved, and how project learning was being leveraged across projects or to explore new project areas (Horticulture CRSP Annual Reports 2010-2014). The ME worked with project PIs to evaluate changes in a project over time and made necessary adjustments (Subject CA2, personal communication, January 27, 2014). The ME synthesized information from workshops or packages coming along from projects plan for the next year’s activities. Subject CA1 stated, though, that they still needed to know how to make best use of all these things being collected from projects (Subject CA1, personal communication, January 27, 2014). Another way that the ME leveraged project knowledge was to share learning practice across projects. One example of this was the Cool-bot technology discussed earlier, which was being used in seven different projects (Subject CA1, personal communication, January 27, 2014). Another example was a photo-voice workshop technique introduced by one of the project PIs as a trust-building way to collect data on what was important to individuals and
used by the ME as an exemplar model for other program workshops (Subject CA3, personal communication, January 28, 2014). Lastly, the ME’s approach to funding one-year immediate impact and exploratory projects, allowed for investments to be made based on knowledge created in those initial project “proof-of-concept” years. While this negatively affected those projects not selected to continue beyond their pilot year, it provided the ME with a capability to minimize start-up risk and maximize limited project funding by investing in projects that had a higher likelihood of success (Horticulture Innovation Lab External Evaluation Team Report, 2013).

**Human and Institutional Capacity Building in the IPM CRSP/IL and Horticulture CRSP/IL**

In a 2008 report on Title XII (amended 2000), the legislation that funded the Collaborative Research Support Programs, Rubin highlighted that its “declaration of policy” stated that the “United States should mobilize the capacities of the United States land-grant universities, other eligible universities, and public and private partners of universities” to carry out a range of activities, including research, human and institutional capacity-building, extension, the application of agricultural sciences to improve human health, nutrition, environment, and rural income problems (Sec. 297)” (Rubin, 2008, p. 3). Rubin (2008), citing Sherper (2004), argued that this section of text indicated that the law sought to “mobilize” the “capacities” of U.S. land-grant universities and those of their networks, to engage, among other things, in human and institutional capacity building (HICD) to achieve program goals (Rubin, 2008, p. 3). Given the importance that the law placed on HICD efforts of the Collaborative Research Support Programs/Innovation Labs, it is not surprising then, that both the IPM CRSP/IL and Horticulture CRSP/IL management entities placed a high premium on HICD and
devoted considerable resources to the planning, implementation, and monitoring and evaluation of their respective HICD work.

In this section, I describe some of the HICD activities of the two CRSP/ILs that make up my case study, highlighting areas where they are similar and identifying those instances where they employed different strategies. In the interviews, I conducted, and official documents I analyzed, there were more areas of similarity than difference, which illustrated the impact of the Title XII legislation on goal setting for these programs, as well as the consistency of expectations for the MEs from USAID as the project funder. I found interesting examples, though, where the two Labs had taken differing approaches to meeting USAID requirements, situations where outside stakeholders held opinions that ran counter to those operating within the program and instances where team members maintained views in contrast to their colleagues in the other Lab undertaking similar work.

*IPM CRSP/Innovation Lab HICD*

Human and institutional capacity building was a fundamental component of the Feed the Future Innovation Lab initiative and a core strength of the IPM CRSP/IL in particular. A 2013 external evaluation team report noted that the IPM CRSP/IL ME allocated 40% of its resources towards HICD versus 20-25% for other Innovations Labs (IPM Innovation Lab EET Report, 2013, p. 26). In the IPM CRSP/IL, HICD consisted primarily of long-term training, short-term training, and targeted efforts directed at institutions to develop their capacity for conducting agricultural development work (IPM Innovation Lab EET Report, 2013).
The focus on HICD began with development of the annual work plan for each IPM CRSP/IL regional and global project, with principal investigators required to develop HICD goals and associated outcome metrics described as a “plan for institutional capacity-building and long-term training” (for example, IPM CRSP Technical Workplan, 2011, p. 48). Individual IPM projects reported annually to the ME on progress made toward achieving HICD goals, with the ME reporting at the end of the fiscal year on behalf of all the IPM CRSP/IL projects, as well as its own HICD activities, to USAID as part of the annual report (for example IPM Annual Report 2010-2011, p. 150-177).

Long-term training in the IPM CRSP/IL focused primarily on developing the research abilities of U.S. and host country students (primarily graduate students) and partner university scientists, by providing mentorship opportunities, lab and field experiences, publishing opportunities, and targeted professional training through knowledge sharing events. The IPM ME was consistent in how it described this activity, providing the following characterization of long-term training in the five annual reports issued during the study period:

“The IPM CRSP provides long-term training to build the capacity of host country scientists who will have major responsibilities for crop protection in their home countries. Training is also made available to young U.S. scientists who plan for careers in international crop protection and development work. While addressing a global knowledge base in U.S. universities, the training addresses specific host country IPM questions, opportunities, and constraints. These programs are designed to meet the needs of host country scientists by integrating with IPM CRSP research carried out by the researchers based at the U.S. universities” (IPM Annual Report 2010-2011, p. 150).
The IPM CRSP/IL ME prominently reported long-term training results by tabulating the number of students receiving support towards their degree pursuits and reporting on this information in its annual report to USAID, as well as in other promotional pieces issued out of the program. Over the course of the study period, the ME documented 289 PhD and Masters level graduate students and 81 undergraduate students who participated as part of the program network activities (IPM Annual Reports 2009-2014). One interview subject succinctly illustrated the importance of this program goal by commenting, “the only reason why my department is involved is the long term benefit to students” (Subject S4, personal communication, October 31, 2013). Another important feature of the ME’s long-term capacity building effort was that students trained included burgeoning host-country scientists, not just U.S. students. The ME demonstrated this commitment by reporting on the number of U.S versus host-country universities producing students. In 2009-2010, for instance, the ME reported that supported students represented 6 U.S. universities and 11 host-country universities, a ratio that held relatively stable over the course of the study period (IPM Annual Reports 2009-2014). Subject S5 indicated that “graduate programs consist of host country students studying in the US or other countries at reputable universities [where] host country students can do the whole program in the US or a sandwich program with classes in the US and thesis in country” (Subject S5, personal communication, August 7, 2014). The External Evaluation Team recognized the commitment to formal education in its 2013 report, indicating, “a highlight is the large number of graduate students and scientists who received training in various U.S. and partner institutions and the number of graduate degrees awarded under the current funding cycle” (IPM Innovation Lab EET Report, 2013, p. 12).
Unlike long-term capacity building where the ME messaging was uniform and the understanding among ME leaders and PIs was consistent, the way that short-term capacity was described by those I interviewed and in the documents I surveyed varied. Officially, the IPM CRSP/IL ME described short-term capacity building as follows:

“The IPM IL provides short-term training to build the capacity of host country institutions, scientists, students, extension agents, and others directly involved with crop protection. Specialized symposia, training events, and technical workshops are conducted in the U.S. or in program host countries and are designed to build the capacity of host country scientists and graduate students. The program also trains growers on proper identification of plant diseases and pests and sound management practices through seminars, workshops, field days, field demonstrations, and Farmer Field Schools (FFS). IPM components and packages are also disseminated to growers using this approach. These activities are facilitated by U.S. and host country scientists, technicians, graduate students, and communication specialists” (IPM Annual Report 2011-2012, p. 140).

A number of respondents reinforced the importance of this training for growers and for partners who served the growers, as key targets for short-term capacity building. Short-term capacity building involved “people having the skills to be able to do something that is new” (Subject S7, personal communication, August 11, 2014) and included “taking technology to the farmers” and [training] “the value chain technicians who take the technology to the farmers” (Subject S5, personal communication, August 7, 2014). For instance, Subject S5 referenced farmer field days, the use of mass media for sharing training about technologies, and a 3-4 day biopesticide training, targeting scientists (Subject S5, personal communication, August 7, 2014).
Another respondent stressed that short-term capacity building was about “training people with skills so that they can get jobs, get higher income for themselves and their families, and ultimately help their country (Subject S6, personal communication, August 7, 2014). Subject S5 discussed working through others as another way to reach the target audience, arguing, “we need to go through the US scientists to build the capacity of host country scientists, who in turn work directly with the farmers” indicating that “this is counter to what USAID often does in going directly to the farmers” (Subject S5, personal communication, August 7, 2014). The IPM CRSP/IL collected several metrics related to short-term capacity building including, activity type, number of activities, individual participation in activities, and participant gender. In the 2010-2011 year of the IPM CRSP/IL for example, the ME and its project PIs delivered 37 workshops, 124 trainings, 7 meetings, 4 surveys, 36 field day demonstrations, and 20 seminar/conferences. In total, nearly 16,000 participants attended one or more of these activities (IPM Annual Report 2010-2011)

The third category of capacity building undertaken by the IPM CRSP/IL during the study period was institutional capacity building. Here, the ME promoted institutional capacity building as a long-term effort to help create the physical facilities, practices, processes, and knowledge base at an institutional level, which could sustain ongoing IPM research and development work, long after the USAID funded program efforts ended. One example of IPM CRSP/IL institutional capacity building work involved the creation of a facility to aid in the abatement of Parthenium, an invasive weed mentioned earlier in the chapter. The IPM CRSP/IL described this effort in an August 2013 promotional piece, “the IPM Innovation Lab has assisted the Ethiopian Institute of Agricultural Research in establishing a quarantine facility to evaluate biocontrol agents, and trained a dozen faculty and staff in the biological control of weeds” (IPM Innovation Lab
Capacity-Building, 2013, p. 1). This facility, the publication indicated, represented the only locally-owned and operated, internationally approved, quarantine facility of its kind on the continent outside of South Africa capable of testing biocontrol agents (IPM Innovation Lab Capacity-Building, 2013). Another example of institutional capacity building fostered by the IPM CRSP/IL was institutionalizing the “Participatory IPM method” with its partner institutions (IPM External Evaluation Report, 2013). Participatory IPM is a process that takes research out of the labs and into the farmers’ fields where adaptive research experiments and trials take place in collaboration with the farmers themselves. This was a new approach that deserved “kudos,” according to the IPM External Evaluation Team which led to “highly practical IPM packages of practices for a wide range of crops in partner countries” (IPM External Evaluation Report, 2013, p. 30).

Beyond the official publications, CRSP/IL ME leaders and PIs largely echoed the importance of the “institutional” component of the IPM CRSP/IL human and institutional capacity development (HICD) mission, but differed on the best approaches and strategies to achieve these goals. One respondent for instance, elevated the importance of institutional capacity building over individual capacity building. Subject S11 argued that, “the cornerstone is institutional capacity building because the only thing that is sustainable is institutional, not human beings … individual capacity building helps sustain institutions … we want to build capacity so that local institutions can carry on the work after the project is over (Subject S11, personal communication, October 22, 2014). Another respondent shared that “The biggest contribution [in capacity building] is on the host country institutions [and] the national agricultural research organizations … helping with experiments, reports [and] publishing with international scientists” (Subject S3, personal communication, October 28, 2013). Others
respondents focused their comments on the individual involved in capacity building efforts, inferring that by focusing on the individual, you could build institutional level capacity. For example, Subject S5 stated, “we make sure that our approach is not to train just the best candidate in a country, but to train the best individual in the institution in the country … rather than focus on an individual who might be the best qualified but is not working at an institution, we focus on the person who is already working in the institution as there is a much better chance that they will return to that institution to implement what they learned” (Subject S5, personal communication, August 7, 2014). Subject S9 offered a similar view, stating, “if we sponsor a scientist for a PhD, when they return to their local institution, this builds both human and institutional capacity (Subject S9, personal communication, September, 29 2014), while Subject S4 commented, “it is important the CRSPs train other scientists … this builds up the in-country universities and national research organizations (Subject S9, personal communication, September, 29 2014).

It is clear from the USAID and IPM CRSP/IL official documents that human and institutional capacity building was an important goal-directed activity of the program network. The documentary evidence showed that potential PIs learned of the ME’s HICD expectations in the initial call for proposals issued by the ME at the beginning of the funding period (IPM Annual Report 2009-2010. This knowledge was shared by the PIs with their own teams as HICD measures and metrics were included as part of each individual project’s technical work plan (for example, IPM CRSP Technical Workplan, 2011; Subject S3, personal communication, October 28, 2013) and reported back to the ME through trip reports, conversations with ME leaders and formally as part of the annual reporting process (for example IPM CRSP Trip Report Bangladesh, 2013; Subject S10, personal communication, October 21, 2014). IPM CRSP/IL
annual reports further demonstrated the organizational learning around HICD program practices, presenting individual project outcomes and rolling up those achievements to provide USAID with a summary account of all HICD efforts (IPM Annual Reports 2010-2014; IPM External Evaluation Report, 2013). The ME shared knowledge about HICD practices and results internally with PIs during annual gatherings and technical committee meetings (IPM CRSP Technical Committee Meeting 2012 Meeting Minutes; Subject S5, personal communication, August 7, 2014). The ME and program PIs also engaged in actively promoting the HICD efforts of the CRSP/IL externally through academic publications, marketing publications, and presentations at scientific meetings and conferences (IPM Innovation Lab Capacity-Building, 2013; Digest Project, 2016; Integrated Pest Management Innovation Lab Website, 2016).

_Horticulture CRSP/Innovation Lab HICD_

Capacity building in the Horticulture CRSP/IL was similar in many ways to the HICD activities conducted with the IPM CRSP/IL. Both networks placed importance on building the capacity of individuals, as well as institutions, and each lab ME reported their efforts to USAID on an annual basis with data generated from the formal project reports submitted by PIs and through informal conversations and knowledge sharing, which occurred during ME sponsored meetings and workshops.

One area of difference between the two labs was the type of approach that each ME employed in working with students and the experiences associate with those efforts. As detailed above, the IPM CRSP/IL associated long-term capacity building success with formal graduate degree attainment along with student research experiences leading to publications. In the Horticulture CRSP/IL, conversely, the ME placed a greater degree of emphasis on experiential
learning for students as a way to develop their individual capacity. In 2011, the ME introduced the Trellis Fund program, releasing a Request for Proposal to the NGO and development research community soliciting small-scale, $2,000 technical assistance project opportunities within the target Feed the Future countries (Horticulture CRSP Annual Report 2010-2011). These projects enabled “developing-world organizations (DWOs) to empower smallholder farmers with new information as well as build longstanding relationships between DWOs and U.S. researchers” (Horticulture IL Annual Report 2013-2014, p. 13). The ME started modestly with ten projects in the initial year of the Trellis program and by the end of the funding period, had supported over 40 projects reporting in 2013-2014 alone, and 15 graduate students had trained over 2500 farmers on new practices and technologies introduced by the Horticulture CRSP/IL (Horticulture IL Annual Report 2013-2014, p. 62). Funding for graduate student degree study was a component of the Horticulture CRSP/IL program (Horticulture IL External Evaluation Report, 2013), but was not featured or promoted at the same level as experiential opportunities for students in annual reporting.

Both CRSP/ILs devoted considerable resources to institutional capacity building within their respective program activities. The distinction between the two labs was in how each lab deployed those resources. In the IPM CRSP/IL, the majority of institutional capacity building resources were focused on developing physical research facilities, processes, and methods to empower host-country university and national research organization partners, with the knowledge and tools to sustain the research-oriented activities started by the ME and U.S. based PIs. The IPM CRSP/IL approach involved building relationships over many years, with host country institutions investing in themselves and in their human capital over time. The Horticulture CRSP/Innovation Lab, meanwhile, focused its institutional capacity building efforts
on building infrastructure that would support technical assistance, short-term educational offerings, and technology transfer. Regional Innovations Centers anchored this strategy. Located in Kenya, Honduras, and Thailand, and serving the East Africa, Central America, and Southeast Asia regions respectively, the Regional Innovations Centers provided Horticulture CRSP/IL leaders and PIs with physical hubs that could bring stakeholders together to address regional horticulture problems. As the ME described in the 2013-2014 Annual report, “the centers each serve as a regional repository for horticultural technologies and knowledge, provide training programs, facilitate the evaluation and adaptation of horticultural technologies, and develop mechanisms for sharing ideas within and across borders (Annual Report 2013-2014, p. 67). In addition to providing a forum for crop testing, product demonstration, and technology training, Horticulture CRSP/IL annual reports showed that Regional Innovation Centers had engaged private companies, NGOs, and other academic institutions in various types of capacity building activities (Horticulture IL Annual Report 2013-2014, p. 67).

Capacity building within the Horticulture CRSP/IL was not limited to the Trellis Fund and Regional Innovation Centers, though; it was an expectation of every project. The focus on capacity building started with the management entity, which positioned capacity building as a “pillar” of its activities, reporting at the ME level to USAID on short-term trainings, student projects, and partner engagement (Horticulture IL Annual Report 2013-2014, p. 63). The Horticulture CRSP/IL focused specifically on individual capacity building for women, as women represented the primary smallholder horticulture farmers in the target countries and “were considered the primary “cliente” of all Horticulture CRSP/IL projects” (Horticulture CRSP Annual Report 2009-2010, p. 2). The ME expected principal investigators to focus project resources on capacity building activity as well, requiring each project to report annually on
progress toward capacity building goals. Subject CA2 commented on building capacity through the work of the project:

“We have a number of clients, farmers, partners, undergraduate students, people analogous to graduate students, faculty at our institutional partners, and university partners - each comes with its own set of knowledge and skills. At each juncture, you need to figure out how they need to do their job and help them add to the skills and abilities needed at each part of the project” (Subject CA2, personal communication, January 27, 2014).

Despite the focus on capacity building, for the Horticulture CRSP/IL the depth of capacity building was at times limited by the duration of projects and scarcity of financial resources restricting the ability of project PIs to engage in broader outreach. This was certainly the case for the one-year Immediate Impact Projects, where one respondent shared this sentiment, “for the local farmers, you won’t change their life in one year … you will maybe change the way they see things and do things (Subject CA4, personal communication, January 28, 2014). Another respondent referenced the 1-year rapid impact projects, noting, “the older CRSP model was more long-term … it was about trust and relationships … research is long term, it takes years … what are you going to do in a year?” (Subject S11, personal communication, October 22, 2014). The Horticulture CRSP/IL External Evaluation Team seemed to recognized some of these resource limitations, writing in their 2013 report “there is a real need to focus attention on strengthening the ability of host country universities to train future generations of scientists, but given the scarce resources allocated to the Horticultural CRSP/Innovation Lab and the number of horticultural crops and problems in the sector, it would not be appropriate for a major shift in
funding from the Horticultural CRSP/Innovation Lab to be used in an attempt to embrace major institutional capacity building programs” (p. 63). The EET argued instead for using the broader network to assist with capacity building, indicating “the best option would be to continue embracing in-country collaborators and partners and involve them fully in proposal generation, research planning, implementation, data collection, analyzing, interpreting, giving workshops and seminars of deliverables and writing up for publication” (Horticulture External Evaluation Team, 2013, p. 63).

Capacity building was a critical element for both the IPM CRSP/IL and the Horticulture CRSP/IL programs. Each ME devoted considerable effort towards building human and institutional capacity through country-specific projects, regional projects, global themed projects, and Regional Innovation Centers. The MEs for both program networks were also dedicated to promoting and sharing knowledge about the capacity building work taking place, communicating regularly internally to USAID, Program PIs, partners, and project stakeholders, and externally to the host-country collaborators, end-users, and the larger development community. Overall, capacity building activity represented a robust area of organizational learning for both CRSP/ILs and was also a source of learning for the management entities themselves. While learning associated with capacity building was rarely shared between ME directors across CRSP/ILs, the management entities did learn as organizations through their capacity building work. Knowledge associated with fostering consistent messaging about the CRSP/ILs’ capacity building efforts with internal and external stakeholders, as well as learning in the form of best practices, routines, processes, and techniques for conducting, measuring, and reporting capacity building activities, was institutionalized within the NAO and disseminated back out the program network partners.
Conclusion

This chapter included a detailed description of the IPM and Horticulture Innovation Labs, two of the USAID Feed the Future Innovation Lab programs for agricultural development. I described how each CRSP/IL program network was led by a management entity operating as a network administrative organization. Over the study period, these two university-based MEs actively engaged with their program team members to fulfill a wide range of strategic and project-level objectives in countries and regions around the world. Throughout the chapter, I identified examples of organizational learning involving program team members and discussed efforts on the part of the NAOs to learn as organizations and networks through that work. I concluded the chapter with a comparison of each Labs’ human and institutional capacity building activities, a program goal common to each CRSP/IL, in order to understand the similarities and differences in how each ME facilitated and learned from this work. In the next chapter I provide a more thorough discussion of the findings and conclude the chapter with a summary of their theoretical implications.
Chapter 5 – Findings

Introduction

In this chapter, I present and discuss the findings from my research. Divided into four categories, these findings refer back to my original expectations issued in earlier chapters and compare what I expected to see with observations from the data. The first set of findings explores knowledge sharing within the CRSP/IL program networks, comparing the results from the data against my predictions based on the Crossan et al. (1999) 4I framework. In the second set, I discuss how the CRSP/ILs institutionalized knowledge in the form of learning practices within their networks. The third category of findings involves the boundary work of the management entity and its program team members and the impact that work had on organizational learning within the network. In the final set of findings, I take a deeper look at network learning for one area of strategic importance for both CRSP/ILs, human and institutional capacity building. I conclude the chapter with a summary of the different categories and discuss the possible explanations for the findings.

Finding 1 – Theory vs. Learning Observations – Knowledge Sharing in the Network

The IPM CRSP/Innovation Lab and Horticulture CRSP/Innovation Labs were involved in addressing a number of high-stakes and challenging “wicked” problems during the study period, such as invasive insect and plant species crossing national borders, nutritional gaps in local communities due to climatic conditions, and cultural barriers limiting the effectiveness of development efforts. In order to address these novel problems, organizational learning within each CRSP/Innovation Lab network was critical for developing and implementing innovative
solutions. A key element for understanding how learning occurred within the network was determining how knowledge was being shared between the management entity and its program teams, as well as with network partners, individual contacts, and stakeholder organizations outside the network.

According to the Crossan et al. (1999) 4I framework, knowledge is expected to flow along a linear path from the individual to the group and group to the organization, through a feed forward process of exploration. Knowledge is then institutionalized at the organizational level and disseminated from the organization to groups and individuals through a feedback process. When evaluating my case study of the IPM and Horticulture CRSP/Innovation Lab networks within the context of the 4I model, I expected to see comparable flows of knowledge taking place as described in Crossan et al., (1999). I envisioned the NAO serving as a central hub for facilitating organizational learning across a network with responsibilities for collecting and distributing knowledge to and from network members. A “hub,” according to Lemaire, Provan, Mercken, and Leischow, (2017) “is a node that is more connected than the average node and, therefore, a core component of network centralization” (p. 3). Lemaire et al. (2017) add that “because this hub has access to a greater quantity of information and greater diversity of information” it is a node that “has the ability to aggregate and compare information from various sources” (Lemaire et al., 2017; Schilling & Fang, 2014, p. 3). Consistent with the 4I framework, knowledge would first be centralized, with the network program team members operating in the field sharing knowledge generated at the local level with the NAO management team through a feed forward process. Knowledge would then be institutionalized within the NAO, embedded in systems, structures, strategies, and procedures by the management team, and fed back (disseminated) in the form of routines and prescribed practices to groups and individuals.
working as part of program teams or with network member organizations (Crossan et al., 1999). The findings from my case study of the two Labs both supported and contradicted this expectation.

My analysis of the case study data indicated that the management entities of the two CRSP/Innovation Labs did centralize some knowledge drawn from the work of the program team members operating within the two respective networks, that select knowledge was institutionalized within the NAO through formal and informal organizational processes, and that knowledge and specific routines and prescribed practices were disseminated back to the network members through a variety of approaches. What I found however, was that the flow of knowledge differed from what I predicted depending on the type of knowledge involved and the level of complexity of the issues being addressed.

First, knowledge sharing related to CRSP/Innovation lab network program management and administrative matters appeared to flow as expected. Examples of this type of knowledge involved the work plans and annual reports prepared for each individual CRSP/Innovation Lab project. Work plans served as the foundation for the project’s activities and built upon the domain-specific knowledge of individual PIs and that of their project team members (Subject S1, personal communication, August 12, 2013). The annual report creation process for each CRSP/Innovation Lab project was another example where knowledge related to program management and administrative functions was shared centrally through the MEs, aligning with the learning processes described in the 4I framework. Based on the templates provided by the MEs, PIs would document their individual work and solicit similar contributions from team members. The PIs would then consolidate this information among their program team groups to
write and submit a final report to the MEs. At the organizational level, the ME was responsible for pulling together the individual project reports into a single report of the CRSP/Innovation Lab’s overall program activities. This consolidation effort on the part of the MEs involved pulling information from various CRSP/Innovation Lab network members as well as pushing information back to the members in the form of a final report. Network level recipients of this final report included network partners such as USAID, host-country institutions, U.S. partner institutions, and private sector collaborators.

I found similar examples of knowledge sharing based on conversations with interview respondents within the program network level for other program management and administrative functions. In these instances, program team members indicated that they had reached out to MEs to initiate knowledge sharing (Subject CA2, personal communication, January 27, 2014; Subject S9, personal communication, September 29, 2014). Network level organizational learning was exemplified in the changes the CRSP/Innovation Lab Technical Committees made to individual project work plans as well. The MEs would make revisions to the requirements for program annual reports based on knowledge shared from the previous year’s submittal, which included knowledge contributed from across the program network. The feedback processes of organizational learning through the ME were also reflected in adjustments made for local and regional contexts to program management strategies, devised from the previous year’s work, as well as through the knowledge spread by the MEs and USAID to other programs through conferences, meetings, and various digital mediums (Subject S4, personal communication, October 31, 2013).
Figure 4 illustrates knowledge flows involving the CRSP/Innovation Lab management entity for program management and administrative knowledge sharing.

My findings indicated that knowledge largely flowed centrally through the NAO as anticipated for explicit knowledge products like the work plans and annual reports, as well as program management and administrative related knowledge. However, when it came to certain aspects of the scientific or research work being conducted within the network, the data were mixed, with some being shared with the NAO, while other knowledge associated with scientific or research work not involving the NAO at all.
Figure 5 illustrates this indirect flow of knowledge between the program teams and the CRSP/Innovation Lab management entities when sharing research intensive knowledge and/or sharing knowledge in certain situations of problem novelty.

On one hand, PIs indicated that they continued to share knowledge with and solicit knowledge from their management entities when faced with challenging research-related problems or novel circumstances (Subject CA3, personal communication, January 28, 2014; Subject S9, personal communication, September 29, 2014; Subject S10, personal communication, October 21, 2014). On the other hand, several interview subjects commented that when faced with a scientific problem or a novel problem they hadn’t encountered before, their preference was to reach out to professional colleagues outside of their program teams, the NAO leadership, or the
CRSP/Innovation Lab network, for knowledge that could help them address the challenge. In these situations, knowledge did not flow through the NAO operating as a central hub, but rather between individuals and entities, both internal and external to the network, often bypassing the NAO (Subject CA2, personal communication, January 27, 2014; Subject S3, personal communication, October 28, 2013; Subject S12, personal communication, October 28, 2014), while other respondents seemed open to consulting whomever would help them solve the problem (Subject CA4, personal communication, January 28, 2014; Subject S8, personal communication, August 22, 2014).

As described above, the findings both supported and challenged my original expectation, that knowledge sharing involving CRSP/IL management entities at the network level would mirror the linear flow of knowledge as described in the Crossan et al., (1999) framework. I discovered that certain types of program management and administrative knowledge were easily shared in a linear fashion between the CRSP/IL program teams and the MEs. This flow of knowledge also extended to the network level, as program management and administrative knowledge were disseminated without issue to end-users, program network partners, and external stakeholders. This circumstance changed, however when program team members dealt with research challenges or when they began to face problems they had never seen before. In these cases, knowledge flows became more unpredictable. The data included examples where knowledge associated with solving novel problems passed in similar fashion between the program teams and CRSP/IL MEs as program management and administrative knowledge, but also instances when PI program team members sought out knowledge, and shared knowledge, directly with their professional peers outside of the network.
A possible explanation for these findings may be related to the nature of the knowledge being shared within the program network. For example, the knowledge shared in the work plan and annual report examples above, illustrated what Carlile (2004) classified as “common knowledge” and therefore, knowledge that could have been transferred easily across knowledge boundaries within and between organizations (p. 558). Common knowledge is explicit knowledge that results from a stable environment where a common lexicon between parties allows knowledge to be understood and transferred without the need for much negotiation (Carlile, 2004). This certainly describes the context within the CRSP/IL program networks for well-known practices such as modifying the work plan and creating the annual report. Even at the network level, the MEs were able to work across organizations to transfer the program management and administrative knowledge necessary to manage the individual CRSP/IL projects. Contrast that with a setting of problem novelty. Carlile (2004) defines this situation as one where a common knowledge is absent and novelty creates differences in problem meaning and description. In this environment, knowledge must be translated, a process whereby a broker helps to develop shared meaning and understanding, or where tacit knowledge must be made more explicit in order for it to be shared (Carlile, 2004). Given this theoretical lens, it is reasonable to see why the PI program team leaders engaged peers outside of the CRSP/IL program network when doing research or encountering novel problems. Program PIs held a common understanding, a shared lexicon and a familiarity of practice, with their scientific discipline-based peers that they may not have shared with the management entity. Jensen (2017), Owen-Smith and Powell (2004), and Powell et al. (1996), further support the importance of these strong professional and disciplinary network ties to network learning for innovation. Powell et al. (1996) discussed knowledge sharing in a biotechnology network through formal ties between
organizations and scientists working directly with their colleagues elsewhere and the informal relations that individuals held with each other across networks. Additionally, Owen-Smith and Powell (2004) described how networks can consist of both formal knowledge pipelines as ‘closed conduits’ between parties and informal ‘open channels’ where information spills over into other connections within a network (p. 6). While Jensen (2017) illustrated how a network’s effectiveness was associated with its’ ability to leverage the strong ties of an existing scientific community where “professional norms, trust, and a commitment to scientific and technical advancement” were already in place (p.473). Within the CRSP/IL program networks, the data showed that PIs utilized their existing professional scientific networks for help in solving novel problems and sharing their own research discoveries directly with their disciplinary peers inside and outside of the network.

Another possible explanation for the findings is that program team members may have held back on sharing knowledge centrally through the management entity over a reluctance to change their particular approach to solving a problem or concerns that they would lose control over that knowledge once it was shared with others in the network. Carlile (2004) references Bourdieu (1980) and Bourdieu and Wacquant (1992), along with the pragmatist James (1907), to present the concept of “knowledge at stake” to describe the situation where “knowledge is geared to make a particular effect (e.g., solve a particular problem), and because of that individuals are committed to and invested in their knowledge as hard-won outcome” (p. 445). When the PI program team leaders and network partners engaged in research associated the CRSP/IL programs, or encountered novel problems during the course of their work, there was a great likelihood that they invested considerable time and effort in developing the knowledge to solve those complex problems. They may also have engaged in this effort within a specific context,
such as working in a particular country, collaborating with a partner organization, or operating in a local facility specially designed for a certain local context. The resulting combination of these factors is that those PIs and program team members probably had considerable knowledge at stake in this research effort or problem solving work. Carlile (2004) argues that in situations of problem novelty, where individuals have considerable knowledge at stake, knowledge may need to be transformed in order for it to be shared. Transforming knowledge involves “a process of altering current knowledge creating new knowledge, and validating it within each function and collectively across functions” (Carlile, 2004, p. 445).

Transforming knowledge requires parties with knowledge at stake to collaborate and/or negotiate in order to create new knowledge together. This theoretical perspective may help to explain the reluctance of some CRSP/IL PIs and program team members to share or pursue knowledge with the MEs. In situations of problem novelty, those parties with knowledge at stake may have resisted sharing that knowledge over concerns that their work (i.e., the meaning that had created in developing or amassing that knowledge) would need to be transformed into something new in order to have application at the program network level. Transforming knowledge also involves shifting meaning from one context to another, which requires an investment of time and effort on the part of those working to transition knowledge or a practice associated with new knowledge to another context. In the case of the CRSP/ILs, the PIs and program team members simply may not have had the time and available resources to engage with the ME in trying to transform knowledge from one context to another. This circumstance is one that I explore later in the chapter when I discuss the MEs efforts to institutionalize knowledge and the impact of boundaries on organizational learning.
Finding 2 – Institutionalizing Learning Practices within the Network

The first category of findings showed that certain types of explicit administrative and program management knowledge within the IPM and Horticulture CRSP/ILs such as work plans, annual reports, program financials, etc., flowed through the ME and back to network program team members as expected. Other types of knowledge, meanwhile, such as knowledge related to addressing novel problems or research work did not always flow as the 4I model predicted. While managing the flow of knowledge is one key element of an organization’s ability to learn according to the 4I framework, another is the ability of the organization to institutionalize knowledge at the organization and network levels. According to the 4I model, institutionalizing knowledge involved embedding that knowledge in organizational systems, structures, strategies and procedures (Crossan et al., 1999). For the CRSP/ILs, this was particularly critical for knowledge associated with addressing novel problems, which the findings show sometimes involved knowledge being shared without the MEs involvement. Therefore, it was important to understand how MEs were involved in institutionalizing knowledge at the organization and network levels and how they put this learning into practice for purposes of innovation.

The original expectation I presented in Chapter 3 predicted that learning practice created through the work of the network program teams, would likely be institutionalized within the IPM and Horticulture CRSP/Innovation Lab management entities (the NAOs) and disseminated back out through various methods and mediums to CRSP/Innovation Lab network partners. I believe that the concept of learning practices is helpful in understanding and explaining the findings related to the CRSP/ILs ability to institutionalize knowledge within their program networks. Learning practices within the context of my study are not associated with learning pedagogy
where various learning styles are evaluated, different techniques are tested, and instructional best practices are modeled by other practitioners in a community. A different way to interpret this concept and one that reflects the intent in the way I have used it, is to instead view it as ‘learning through practice’ (Brown & Duguid, 2001, p. 42). ‘Learning through practice’ is a “composite concept” that is sometimes called, “learning in practice” (Erkelens et al., 2015, p. 177), “learning-in-working,” (Brown & Duguid, 2001, p. 42), or “learning-by-doing,” (Dewey (1916; 1938). Additionally, learning practices are closely associated with the concepts of know-what and know-how. Brown and Duguid (1998) argue that know-what is often thought of as the knowledge possessed by individuals and passed directly from one individual to another (p. 95). Know-how on the other hand “embraces the ability to put know-what into practice” and “is critical in making knowledge actionable and operational” (Brown & Duguid, 1998, p. 95). (Brown & Duguid, 1998, 2001, p. 42; Daft & Weick, 1984; Dewey 1916, 1938; Lave & Wenger, 1991; Marabelli & Newell, 2012; Orr, 1996; Powell et al., 1996; Yanow, 2000). The learning practices I identified in the data constituted the explicit “know-what” CRSP/IL program knowledge combined with the CRSP/IL ME and program team “know-how” of putting that knowledge into practice within the network.

I identified examples from the data where the IPM and Horticulture MEs were actively involved in institutionalizing learning practices at organization and network levels and disseminating them to partners across the network. I also found instances where learning practices were being shared within the network, but with little involvement from the NAO, thereby denying the MEs the opportunity to institutionalize and disseminate those practices.
With the regular flow of explicit knowledge taking place through the work plan and annual report processes mentioned earlier in the chapter, there was ample opportunity for the IPM and Horticulture IL management entities to institutionalize learning practices being fed forward from the program teams into the various systems and procedures that the MEs employed in directing the activities of the network. Those examples highlighted how the MEs institutionalized the “know-what” of program management and administrative knowledge into organizational routines that could be repeated as “know-how” practices at the organizational and network levels. But the CRSP/IL programs were established by USAID to conduct research and take on the wicked agricultural development problems vexing many countries around the world at the time. Given this responsibility, the MEs had to account for the less explicit and more tacit knowledge associated with researching solutions to novel problems. In order to innovate as a program network, the MEs needed to institutionalize this more complex and nebulous knowledge into learning practices.

In support of my expectation, the case study data in Chapter 4 included several examples where the MEs were able to institutionalize learning practices based on the knowledge generated by their program teams as they dealt with novel problems. Two additional examples, one from each CRSP/Innovation Lab, demonstrate in greater detail how the respective management entities leveraged their position to help institutionalize these learning practices within their networks. The first example came from the Horticulture CRSP/Innovation Lab. In Chapter 4, I described the use of a room cooling technology called “Cool-bot” as a mechanism to preserve horticulture crops in a post-harvest project for small-scale farmers in India, Honduras and Uganda (Horticulture CRSP Annual Report 2009-2010, p. 37-38). The other example, this time from the IPM CRSP/Innovation Lab management entity, demonstrated the NAO’s ability to
institutionalize a learning practice for grafting on behalf of the goal-directed network (IPM Innovation Lab EET Report, 2013, p. 45). The MEs ability to institutionalize the “know-what” knowledge science underlying these techniques with the “know-how” necessary to implement these techniques in different geographical contexts, combined to create a learning practice that could be replicated at the network level.

In contrast to the instances identified above, the data included examples where it appeared that knowledge concerning novel problems was being shared within each program network, but not necessarily being institutionalized at the network level and disseminated back to the network by the ME. The first of these involved partnership building within the project teams, which I found occurred at times with limited involvement from or completely independent of the ME. Individual PIs and their project team members would negotiate and manage partnership activities on their own, with some project team leaders partnering based on their own personal and professional networks that they brought with them from prior work and carried over to the CRSP/IL initiatives (Subject S10, personal communication, October 21, 2014; Subject S11, personal communication, October 22, 2014). Sometimes well-established and productive partnerships fell victim to political and strategic considerations at the funder level. Subject CA2 talked about a colleague in a country involved in a one-year impact project that was not selected as one of the Feed the Future countries when the project was later funded for three years because USAID wanted to focus on certain countries and exclude others (Subject CA2, personal communication, January 27, 2014).

In goal-directed networks like the CRSP/IL programs, organizational partnerships that foster learning within the network are critical to effective program implementation and achieving
the network’s strategic objectives. My findings suggest a number of qualifications, however. First, limited or no involvement from the ME in these partnerships jeopardized the MEs ability to institutionalize knowledge generated through these relationships for the benefit of other program teams or network partners. Additionally, at least two of the examples pointed out that even when the MEs are involved in the partnerships, significant resources and political support need to be invested to support the program team’s continued involvement and to maintain the partnership’s effectiveness. The existence of third party partners also adds additional layers for sharing knowledge within a network, making it more challenging to institutionalize that knowledge in the form of organizational practices, which partner organizations may or may not be required to implement.

Another area where the CRSP/IL MEs experienced difficulty in institutionalizing learning practices across the network involved project related knowledge at the host country level. Both CRSP/IL programs operated in multiple countries, but in the case of the IPM CRSP/IL, it organized its work to serve regions such as East Africa, South Asia, etc., under PI-led program teams. In the East Africa region for example, the program team led projects in Kenya, Uganda, and Tanzania while in Southeast Asia, IPM scientists worked in Cambodia, Indonesia, and the Philippines. Subject S2 indicated that it was difficult for the ME to “bridge projects between host countries” given that “researchers across countries are still relatively segregated.” (Subject S2, personal communication, August 14, 2013). Subject S2 further mentioned that “USPIs and CoPIs were more aware of project work than host countries even within the same region … host countries are not necessarily sharing” (Subject S2, personal communication, August 14, 2013). The implication of these statements seemed to be that learning practices, while institutionalized at the level of the PI and program team, were not being
institutionalized across the extended program network at the host-country level. One of the reasons why this may have been the case was due to inconsistent relationships between the CRSP/IL program teams and the USAID mission staff on a country-by-country basis (Subject S3, personal communication, October 28, 2013; Subject S11, personal communication, October 22, 2014). If the missions were not being kept fully informed about CRSP/IL activities within their own country, or there was a lack of communication because of turnover within the mission staff, it was difficult to envision how the mission would be in a position share CRSP/IL knowledge and associated learning practices with other regional USAID missions.

In summary, the findings illustrate several CRSP/IL efforts to institutionalize learning practices, both successful and problematic. The Horticulture CRSP/IL ME leveraged its central hub position to gather local, context specific knowledge about how best to adapt the Cool-bot technology for use in post-harvest preservation applications, and disseminated that knowledge back out in the form of prescribed learning practices to network participants. The second example also demonstrated the ME acting as a central hub for managing and leveraging knowledge. The grafting technology had been widely shared inside and outside of the IPM network with the practice successfully “transferred from Bangladesh to India, Nepal, Uganda, Kenya, Honduras, Ecuador, and even the U.S.” (IPM Innovation Lab EET Report, 2013, p. 32). These findings were in line with Lemaire et al. (2017) who found that “greater centralization over time in the flow of key information, especially through the NAO, was consistent with higher rates of adoption of evidence-based practices by network members” (p. 16). The second set of examples had a key element in common. Each described network management related challenges that the CRSP/IL MEs and program teams faced in institutionalizing learning practice. In particular, these challenges involved identifying and leveraging network
organizational partners, such as host-country universities and USAID missions, to disseminate and, in some cases implement, project-related knowledge on behalf of the CRSP/ILs. This tended to put a lot of responsibility on the PI program team leaders. Subject CA2 for instance commented, “I often serve as the central point of contact to link people,” but added that “the interlocking networks of development organizations are tough for scientists to navigate … it is difficult to navigate with limited time to network” (Subject CA2, personal communication, January 27, 2014). Extending the reach of the CRSP/IL learning practices between and among organizations outside of the core teams that had been assembled to implement the various regional and country specific projects, revealed to be problematic for institutionalizing network-level learning practices. As subject CA2 shared, “the biggest challenge for the researcher is building and identifying the network” (Subject CA2, personal communication, January 27, 2014). Based on the examples above, actively managing network partners, so that they can help to disseminate and use project knowledge, was also a considerable challenge for the CRSP/IL MEs in their efforts to institutionalize learning practice across the program network.

Finding 3 – Boundary Work of Program Teams and Impact on Organizational Learning

A number of scholars have discussed the impact of boundaries on organizational learning and argued how boundaries could be viewed both as obstacles to learning and as spaces where collaboration and creative friction could accelerate learning (Akkerman & Bakker, 2011a; Scarbrough et al., 2004; Wenger, 2000). In goal-directed networks like the IPM and Horticulture CRSP/Innovation Labs, boundaries are abundant. The management entities operating as NAOs must not only work across organizational lines with program teams drawn from public, private, university, and NGO partners located in the United States and around the world, but also entice
program teams and network partners to do the same. In Chapter 3, I offered an expectation that organizational boundaries were a contributing factor in how network administrative organizations learn through the work of their program team members. As anticipated, my findings from the case study produced evidence that organizational boundaries influenced knowledge sharing and learning between the network program team members and their NAO management entity, as well as across the network between the NAO and program partner organizations. I identified vertical learning boundaries and horizontal knowledge boundaries in each CRSP/IL program network as expected, but discovered a number of other boundary types beyond ‘organizational’ boundaries that were also contributing factors in learning within the program network. In addition, I found that program team members did not uniformly define boundaries, instead learning that individuals identified different boundaries depending on the type of knowledge they were sharing or based on their particular roles and responsibilities within the network.

Scarborough et al. (2004) examined learning and “the role of boundaries to the transfer of learning between projects and other organizational units” (p. 1580). The authors developed a propositional model defining the conditions necessary for learning to take place and identified the learning effects of working within and across two boundary types which they describe as knowledge boundaries and learning boundaries (Scarborough et al., 2004, p. 1584). Knowledge boundaries reveal divisions in practice between groups and operate horizontally, while learning boundaries are vertical “across nested levels of learning” reflecting divisions of practice between local and organization-wide learning contexts (Scarborough et al., 2004, p. 1596). The interviews and documentary data from the case study produced a number of examples where I found
learning and knowledge boundaries to be both accelerators and inhibitors in the ability of each CRSP/Innovation Lab to learn from the work of its respective network program team members.

The first category of learning boundaries I found in the data involved sharing program management and administrative knowledge between the ME and the program teams, as well as, within the program teams themselves. While one subject argued that “no boundaries existed between the project and the management entity” (Subject CA3, personal communication, January 28, 2014), others did acknowledge the impact of boundaries on administrative knowledge sharing within the Innovation Labs. Respondents associated several of these boundaries with the complex and lengthy administrative processes required for managing the program, noting that there were challenges in working across multiple university and government bureaucracies because of all the steps required to managing funding, file reports, and respond to mandated calls from the ME and USAID for project information (Subject S3, personal communication, October 28, 2013; Subject S6, personal communication, August 7, 2014; Subject S7, personal communication, August 11, 2014).

Interview respondents identified program reporting as a specific issue that created learning boundaries within the CRSP/ILs. For both CRSP/ILs reporting requirements made sharing this type of program knowledge challenging for the program teams and differences of opinions surfaced as a result (Subject CA2, personal communication, January 27, 2014; Subject CA4, personal communication, January 28, 2014; Subject S3, personal communication, October 28, 2013). Report complexity could also be described as a learning boundary based on other instances in the data (Subject CA1, personal communication, January 27, 2014; Subject S9, personal communication, September, 29 2014). Subject S6 seemed to summarize many of the
interviewee comments related to collecting metrics and reporting, commenting that “USAID is driven by results accountability, we are dealing with changing people’s minds which you can’t do overnight or on a schedule, it is not predictable, the USAID results orientation doesn’t always mesh with science reality” (Subject S6, personal communication, August 7, 2014).

In a second category of learning boundaries, interview subjects and official CRSP/IL documents described varying levels of collaboration fostering, or inhibiting, knowledge sharing within the program networks. In these situations, the level of collaboration within the CRSP/IL created or broke down boundaries. The Horticulture CRSP/IL reported, for instance, the presence of “significant informal and formal communication, and team formation that crosses the flexible boundaries across units” adding that “on a day-to-day basis, there is a constant connection between and among the units” (2012 Annual Report, p. 86). The report included the example of teams formed to evaluate project proposals such as “advisory board members, directors, operations management personnel, and representatives from the support function units” (2012 Annual Report, p. 86). These teams helped to break down learning boundaries between different levels within the CRSP/IL, taking local knowledge fed forward from program teams and helping to institutionalize it as organizational-wide knowledge at the network level. Another example where collaboration helped to break down learning boundaries involved events the CRSP/IL MEs held to facilitate knowledge sharing. Several interview subjects described how workshops and conferences hosted by the Horticulture and IPM CRSP/IL management entities helped to “foster collaboration” within the program network (Subject CA5, personal communication, October 27, 2014), offered “an opportunity to improve collaboration” (Subject S4, personal communication, October 31, 2013), and were events where “researchers keep asking for more time together” (Subject CA1, personal communication, January 27, 2014). The data also show
that poor collaboration formed learning boundaries within the program network, impacting the CRSP/IL’s ability to meet its program objectives. Subject S9 mentioned a boundary that challenged program team collaboration, commenting that “a barrier existed in that different projects were not collaborating well,” but did concede that “the management entity is paying more attention when we have the technical committee meeting that we are all collaborating” (Subject S9, personal communication, September, 29 2014).

Finally, one of the examples where I found that collaboration challenges within the CRSP/IL program network were creating learning boundaries, involved the IPM CRSP/IL cross-cutting global theme projects. The 2013 EET review of the IPM CRSP/IL reported a change in the ME’s management approach towards the cross-cutting global theme projects from Phase III to Phase IV. With the exception of the Impact Assessment Global Theme, which the IPM External Evaluation Team reported was “doing an excellent job and be carried out for all partners” (IPM EET Report, 2013, p. 40), the report stated that “the ME recognized that the intended close collaboration between them was not at acceptable levels … for the 2009 – 2014 phase, they instituted closer collaboration by putting funds for cross-cutting activities in the host countries into the regional programs rather than that of the cross-cutting programs” (IPM EET Report, 2013, p. 16). Examples from the participant interviews seemed to echo a similar concern, with the data referencing the existence of learning boundaries between the global themes and the regional programs that had a less than positive impact on collaboration and knowledge sharing within the network (Subject S7, personal communication, August 11, 2014; Subject S11, personal communication, October 22, 2014). As these examples show, successfully navigating vertical learning boundaries within the CRSP/IL program network cannot be regarded as a given. Various factors including the type of knowledge being shared, varying levels of collaboration,
and even trust between program team members across boundaries played a role in whether these boundaries created a positive or negative space for learning to occur.

Knowledge boundaries, meanwhile, reflect the challenge of sharing knowledge between groups and organizations and reveal divisions in practice horizontally across a network (Scarborough et al., 2004). As anticipated, I was able to identify a number of knowledge boundaries present in the IPM and Horticulture CRSP/ILs from the interview and documentary evidence. The data showed that some of these knowledge boundaries involved navigating different bureaucracies where each employed their own administrative processes and reporting requirements. This created challenges for sharing program management and administrative knowledge across organizations (Subject S3, personal communication, October 28, 2013; Subject S5, personal communication, August 7, 2014; Subject S6, personal communication, August 7, 2014; Subject S9, personal communication, September, 29 2014). Another category of knowledge boundaries included boundaries found between different organizations from different countries. Several respondents discussed the challenge of boundaries where language and cultural barriers acted an impediment to knowledge sharing (Subject S6, personal communication, August 7, 2014) and working with different cultures also presented boundaries to sharing knowledge within and across countries (Subject S6, personal communication, August 7, 2014). While a final type of knowledge boundary I identified in the data involved overcoming competition between organizations (Subject CA5, personal communication, October 27, 2014; Subject S4, personal communication, October 31, 2013; Subject S6, personal communication, August 7, 2014). The knowledge boundaries I found in the data, such as those involving different bureaucracies working across organizations in the network, boundaries associated with language and culture inherent in working globally, and those involving competition between
organizations, were consistent with my expectations. The CRSP/IL programs were organized as international, goal-directed networks to include organizational partners from across the United States and from around the world. I expected that the CRSP/IL program teams would face boundary issues in sharing knowledge across this diverse network and the data support this finding.

In summary and in support of my expectation, the data indicated the presence of learning and knowledge boundaries that were barriers and facilitators to organizational learning within and across the CRSP/IL networks. These boundaries at times advanced knowledge sharing and other times, obstructed it. But these boundaries were not the only ones found in the data. In fact, one of the interesting findings from my study was the variance in other boundary types that the respondents presented during interviews. These other boundaries, while not anticipated, were very important for the management entities, impacting the work of program team members, and influencing the management entities efforts to institutionalize learning practices within and across the CRSP/IL program networks.

One example involved the contradictory expectations held by USAID and the CRSP/ILs, as they related to the outcomes intended for program network activity. An interview respondent described what they perceived as boundaries between USAID and the university-based management entities when it came to establishing and meeting specific program network objectives, while another described differences of opinion in how the program teams should have focused their work to achieve program goals. For instance, Subject S11 commented that “USAID and universities have different goals and objectives … USAID is constantly changing their agenda because people are coming and going all the time,” adding, “the IPM used to be country
focused, then regional, now country focused again with Feed the Future … what do they want?”
(Subject S11, personal communication, October 22, 2014). Subject S8, meanwhile, described a relationship between universities and USAID that had changed over time, creating a boundary where each held different expectations for program outcomes. “Twenty-five years ago with this project, we had a close relationship,” Subject S8 commented, “in the intervening time, the investments went down … USAID started working with companies via contracts with beltway bandits” (Subject S8, personal communication, August 22, 2014). This new relationship seemed to create an unanticipated boundary because of a divergence in the strategic goals each party held for the focus of the CRSP/IL program activity. According to Subject S8, “universities have other responsibilities, such as capacity building as an outcome for students … USAID lost sense of what it is to work with universities … It is now treating universities like contractors but doesn’t have that much leverage’ (Subject S8, personal communication, August 22, 2014). Other respondents, meanwhile, described how numbers-driven approaches to measuring project outcomes were creating boundaries between USAID and the CRSP/ILs. Subject S9 for instance, shared that “in working across organizational boundaries, one of the challenges is the differences in organizations … when you work with scientists, they are interested in science, when you work with NGOs, they are interested in the message and getting the product out, when you work with USAID, they are interested in numbers” (Subject S9, personal communication, September, 29 2014). Those comments were similar to Subject S12, who offered that “in universities, we take a circumspect view of projects … USAID is always looking at numbers … numbers become the driving force for their project that has to be looked at constantly,” while “university projects are different in that we can take a more long range approach to targets … can’t really worry about these numbers sometimes (Subject S12, personal communication, October 28, 2014).
The IPM and Horticulture CRSP/IL relationship with USAID missions emerged as another unexpected boundary category in my research. Like the other examples that I have discussed in this section, the data provided evidence of boundaries that served as both accelerators and inhibitors to organizational learning within and across the program networks. Earlier in Chapter 4, I described associate awards as one of the funding streams available to CRSP/IL program networks. These sub-projects were contracted directly with USAID missions located in target countries where the primary CRSP/IL activity was occurring. Associate awards were generally smaller in scale in terms of funding, were shorter in length than the primary project, and were typically focused more on technical assistance than research (CRSP Guide, 2005; IPM Innovation Lab EET Report, 2013). In terms of boundaries as accelerators of organizational learning, the data included a number of instances when the CRSP/IL management entities and program team members developed and disseminated knowledge as part of their work with USAID missions through these associate awards (Horticulture CRSP Annual Report 2012-2013, p. 66; Subject S4, personal communication, October 31, 2013; Subject S9, personal communication, September, 29 2014; USAID Partnering with Feed the Future Innovation Labs, 2014). While the examples above showed how the IPM and Horticulture CRSP/ILs operated within and across organizational boundaries to support the goals of the USAID missions, I did identify examples in the data where a divide between CRSP/IL and USAID mission goals served as a boundary that impeded program progress (Subject CA2, personal communication, January 27, 2014; Subject O1, personal communication, April 8, 2015; Subject S3, personal communication, October 28, 2013; Subject S4, personal communication, October 31, 2013; Subject S11, personal communication, October 22, 2014).
Lastly, two unforeseen boundary categories involving incentives emerged from my data analysis. The first category related to the financial incentives available to network program team members involved in executing the work of the CRSP/ILs and engaging in interdisciplinary project collaborations. The second boundary category involved the incentives and professional rewards available to program team members for publishing in scholarly journals conflicting with the expectations of the funder requiring publicity/promotion and public dissemination of unpublished data.

Several interview respondents identified a lack of available financial incentives as a boundary impacting their work in the CRSP/IL programs (Subject S1, personal communication, August 12, 2013; Subject S8, personal communication, August 22, 2014; Subject S11, personal communication, October 22, 2014). The resource restrictions of the CRSP/IL programs seemed to represent a boundary for some respondents who indicated that a lack of financial resources was impeding the program team’s ability to make a broader impact (Subject S6, personal communication, August 7, 2014; Subject S12, personal communication, October 28, 2014). In addition to the lack of financial incentives for individual researchers working on CRSP/IL projects, some interview respondents discussed a lack of incentives for project teams to share knowledge and collaborate with one another. These incentives seemed to be a sticking point irrespective of whether the projects in question were being implemented within the same CRSP/IL program network, or involved project collaboration across CRSP/IL networks (Subject O1, personal communication, April 8, 2015; Subject S3, personal communication, October 28, 2013; Subject S9, personal communication, September, 29 2014; Subject S11, personal communication, October 22, 2014; Subject S12, personal communication, October 28, 2014).
Despite the lack of financial incentives that respondents presented as boundaries to learning and collaboration, a number of interview subjects highlighted a different set of incentives that kept them positively engaged in working across these boundaries. For instance, several respondents indicated that they worked on CRSP/IL projects to generate funding to support graduate students, taking great pride in their role in helping to develop these students as well-trained academic researchers (Subject S3, personal communication, October 28, 2013; Subject S6, personal communication, August 7, 2014; and Subject S8, personal communication, August 22, 2014), while Subject S1 argued that [CRSP/IL projects] “are still one of the best ways to do agricultural international research” (Subject S1, personal communication, August 12, 2013).

Another boundary category involved incentives for CRSP/IL program team members to publish in peer-reviewed journals, and the problem this sometimes created when PIs were required to share unpublished research data and project outcomes developed during the course of project implementation. I learned that the incentives to publish project outcomes for those working in academia, which represented most of the CRSP/IL program team members, sometimes conflicted with the wishes of the funder to get the data out as quickly as possible. This boundary seemed to exist around the PIs preferred method for sharing new knowledge developed through the work of the project and the implications to the author for disseminating research data in publicly-accessible forums prior to peer-review publication.

A number of professional rewards are generally associated with the ability of academic faculty to publish in scientific journals appropriate to their fields of research, including, compensation, promotion and tenure, increased access to university facility resources, and
recognition among professional colleagues. The CRSP/IL programs provided a platform for program team members to engage in agricultural research and pursue refereed publications using outcomes and data from their projects (Subject CA2, personal communication, January 27, 2014; Subject S3, personal communication, October 28, 2013; Subject S5, personal communication, August 7, 2014). Publishing in academic journals was important for the management entities as well, as it helped to legitimize the work of the CRSP/IL programs. The management entities, therefore, encouraged and supported efforts by program team members to publish (Subject S3, personal communication, October 28, 2013; Subject CA5, personal communication, October 27, 2014).

Along with doing the work well, publishing the results of CRSP/IL research was a significant incentive for those working in academia. USAID as the primary funder meanwhile, appeared to operate with a different set of incentives. USAID’s interests with the CRSP/IL projects included getting the project knowledge and research data disseminated back out to the public as quickly as possible so that lessons learned could be shared with USAID missions, discoveries could be leveraged with other development contractor partners, and best practices could be adopted in the field at scale (Subject O1, personal communication, April 8, 2015; Subject S7, personal communication, August 11, 2014). USAID was also interested in promoting the results of the projects to key stakeholder audiences including Congress, the development community, and the public at large. Demonstrating project outcomes to these stakeholder audiences was another important incentive for securing continued funding for the CRSP/IL programs (Subject CA5, personal communication, October 27, 2014).
The academic and ME incentives to publish versus the incentives to make project research data available as quickly as possible, created a significant boundary. There were several examples that surfaced as issues during my analysis. First, in the academic publishing world, the timing of when data is released matters (Subject S7, personal communication, August 11, 2014). Another issue referenced during the interviews was the need to reconcile the university Institutional Review Board process with the publicity mandate from USAID. Subject S7 shared that “IRB is a big challenge, people we interview as part of the CRSP, want to give their names, want to be referenced in the publicity, but IRB prevents it” (Subject S7, personal communication, August 11, 2014). This created “a tension” as USAID wanted the data for promotional purposes, which ran counter to the academic research processes (Subject S7, personal communication, August 11, 2014). Speaking of research versus publicity, Subject S7 presented these as opposing goals, arguing that “USAID wants us to make sweeping generalizations but as researchers, we tend to avoid this,” adding that “we are developing the science to base development actions on, sometimes we test things that don’t work” (Subject S7, personal communication, August 11, 2014).

This boundary was recognized by ME leaders, who tried to navigate the professional needs of program team members, with the requirements of USAID to broadly disseminate project outcomes. Subject S7 described a shift within the management of the IPM CRSP/IL for example, noting a transition from the view by ME leaders that scholarly publishing should be the only output of the CRSP/ILs, to an expanded view where public outreach had become a component that had served that IPM well (Subject CA5, personal communication, October 27, 2014; Subject S7, personal communication, August 11, 2014). Another way that the MEs tried to overcome this boundary, was by facilitating events where program team members could present
aspects of their research without jeopardizing their ability to publish, but in a way that public audiences could also benefit (Subject S2, personal communication, August 14, 2013; Subject S3, personal communication, October 28, 2013; Subject S8, personal communication, August 22, 2014).

The data indicated that boundaries were both prevalent and consequential for the CRSP/IL program networks. Learning boundaries contributed to knowledge sharing between the program teams and the management entities for both CRSP/ILs, while knowledge boundaries contributed similarly to organizational learning by way of the ME’s and program team’s relationships with their network partners. In addition to these expected boundaries, the data included a number of other boundary types that also impacted the work of the program teams and management entities. One group of boundaries centered on the shared outcomes for program network activity, with boundaries emerging because of a misalignment in network goals between the ME-led program teams and USAID. While, another group of boundaries involved conflicting incentives, like those illustrated in the pull between academic publishing and public dissemination of research results, as well as a perceived lack of financial incentives to engage in certain aspects of the work, or to collaborate across boundaries.

**Finding 4 – Network Learning for Capacity Building**

In Chapter 4, I discussed human and institutional capacity building (HICD) efforts for the IPM and Horticulture CRSP/ILs and shared some of the different ways the two programs conducted this work as part of their respective programs. USAID established requirements and set deliverable goals around capacity building and encouraged the management entities to create metrics for individual projects within each of the CRSP/IL program portfolios (Title XII Report
to Congress FY2009 and FY2010, 2011). The Board for International Food and Agricultural Development (BIFAD) which provided oversight of the CRSP/IL programs on behalf of USAID, also included HICD among its key project outcome targets (BIFAD Review of the Collaborative Research Support Program (CRSP) Model, 2012). Capacity building was therefore a key strategic objective of the management entities responsible for the IPM Phase IV and Horticulture Phase I projects and featured prominently in the activities of each program network.

Given the importance that USAID placed on HICD, I expected that management entity directors would be heavily involved in setting a robust HICD agenda for their CRSP/IL program networks and that this would lead to considerable HICD-related knowledge sharing and exchange of best practices among ME directors. I formed my original expectation around this premise, anticipating the data would show that capacity building knowledge and best practices were readily shared between Innovation Labs through their director level interactions. The data indicated something different, however. I found that learning around HICD was rarely shared between directors across CRSP/ILs, who instead, focused most of their inter-director collaboration on policy related concerns and presenting issues to USAID as a collective group (Subject S4, personal communication, October 31, 2013; Subject S5, personal communication, August 7, 2014). Despite this finding running counter to my original expectation, I discovered that the management entities did direct considerable effort towards their own HICD activities, fostering institutionalization of HICD learning practices across their respective program networks. In the following section, I showcase two areas of emphasis for the CRSP/IL MEs, fostering consistent messaging about their CRSP/IL HICD work for communications with stakeholders and institutionalizing HICD practices within their program network. I delve deeper into these findings to discuss how the MEs and program team members addressed HICD and
consider how the findings contribute to a better understanding of organizational learning within the CRSP/IL networks.

Based on comments from interviewees and the evidence I found in official CRSP/IL documents, the IPM and Horticulture CRSP/IL management entities appeared to foster consistent messaging about the HICD activities taking place within their respective program networks. This turned out to be an interesting finding, especially when compared with the previous section where my findings showed a considerable variance among program team members in how they characterized boundaries and communicated the impact of boundaries on their work (Subject CA5, personal communication, October 27, 2014; Subject S10, personal communication, October 21, 2014). These descriptions were congruent with the way HICD activities were described in official reports and promotional materials (Horticulture CRSP Annual Report 2010). Program team members also exhibited consistency with the MEs in how they characterized the audience for CRSP/IL capacity building work, identifying similar target groups as the MEs that included students, farmers, scientists/researchers, and individuals working for partner organizations (IPM Innovation Lab Capacity-Building, 2013). Respondents also described individual capacity building in terms similar to those used by the MEs, illustrating how HICD work targeted at individuals was divided into short-term and long-term categories (Subject S9, personal communication, September, 29 2014; Subject S10, personal communication, October 21, 2014).

When asked to describe institutional capacity building, interview respondents offered descriptions that were relatively consistent with accounts offered by the MEs, USAID, and other network partners in official documents (Horticulture EET Report, 2013; IPM Innovation Lab
EET Report, 2013). For instance, interviewees described institutional capacity building in relation to facilities and physical improvements made in the course of conducting the work, along with processes and practices introduced by the MEs and PIs targeted at individuals that resulted in sustainable institutional change (Subject S11, personal communication, October 22, 2014). Several respondents discussed the role of CRSP/IL program teams in establishing facilities aligned with international university, research institution, NGO, and corporate partners to carry on the work started by US principal investigators (Subject S9, personal communication, September, 29 2014; Subject S10, personal communication, October 21, 2014). These descriptions seemed to align for the most part with descriptions of institutional capacity building from the documentary data (Horticulture CRSP Annual Report 2012-2013, p. 363; IPM Annual Report, 2011-2012, p. 91).

Both CRSP/ILs communicated to external audiences about their HICD work through annual reports, work plans, mass media publications, speaking engagements, and via presentations at BIFAD meetings (Creating Future Leaders: BIFAD and Feed the Future Dialogue on Human and Institutional Capacity Development, 2014; Feed the Future Innovation Lab for IPM A Decade of Innovation 2004-2014, 2015; IPM Innovation Lab Capacity-Building Through Long + Short-Term Training, 2013). This dissemination of project information across multiple outlets is further evidence of a targeted and consistent communications effort on the part of the program teams, which helps to explain why messaging about HICD was so consistent across interview respondents and the documentary data.

In addition to fostering consistent messaging about HICD, the MEs were also committed to institutionalizing HICD knowledge as part of leading their CRSP/IL program networks. One
of the ways that the IPM and Horticulture CRSP/IL MEs did this, was to create the structure for ongoing capacity building activity. Sometimes this took the form of physical infrastructure that the CRSP/ILs established for training and research activities (Feed the Future Innovation Lab for IPM A Decade of Innovation 2004-2014, 2015; IPM Annual Report, 2013-2014; IPM Innovation Lab EET Report, 2013). Creating the structure for institutionalizing capacity building also involved the CRSP/IL program teams introducing new processes and practices focused on developing individuals working in network partner organizations. The CRSP/ILs employed this approach under the premise that developing individuals working for these local partners, helped to build institutional capacity for these organizations and enhanced their ability to continue the work begun under the auspices of the program (Subject S9, personal communication, September, 29 2014, Subject S11, personal communication, October 22, 2014).

Another approach to institutionalizing capacity building involved identifying and developing the capacity of partner institutions and their employees, to help solve specific project challenges, and extend the capabilities of the project teams. Subject S5 indicated that the IPM CRSP/IL had begun to work on value chain project grants with commercial companies to help produce technologies like the trichoderma fungus and leverage the broader reach of these partners to take the technologies directly to farmers (Subject S5, personal communication, August 7, 2014) and a number of similar examples were identified in the data (IPM Annual Report, 2013-2014; Subject CA3, personal communication, January 28, 2014; Subject S4, personal communication, October 31, 2013).

Each CRSP/IL management entity’s efforts to monitor and measure the HICD activities of the program teams and partners, were also an important part of their ability to institutionalize
HICD knowledge within the networks. One way that the CRSP/IL management entities provided this oversight was by establishing goals and metrics for program principal investigators and partner institutions, requiring that projects document their capacity building work in target countries (BIFAD Review of the Collaborative Research Support Program (CRSP) Model, 2012; Creating Future Leaders: BIFAD and Feed the Future Dialogue on Human and Institutional Capacity Development, 2014, p. 4; Report on the BIFAD and USAID Consultations, 2015; Subject CA1, personal communication, January 27, 2014; Subject S2, personal communication, August 14, 2013; Subject S3, personal communication, October 28, 2013)

While the CRSP/IL HICD activities were largely viewed in positive terms, I did identify some examples in the data where the MEs and program teams did not appear to be as successful in institutionalizing the individual and institutional capacity building work taking place within the program networks. One example from the data involved measuring the long-term impact of this work. Subject O1 argued that “the ILs have been strong with individual capacity building,” but was hoping for “more tracking and monitoring of individuals, monitoring the result of that people investment” [to ask] “what did those individuals accomplish?” (Subject O1, personal communication, April 8, 2015). This challenge varied country to country and was compounded by the complexity of working in different parts of the world where the local context for capacity building work changed for each setting (Subject O1, personal communication, April 8, 2015). Measuring the long term impact of training and development on people was not a problem exclusive to the CRSP/IL programs either. According to USAID’s Evaluation Policy, “impact evaluations measure the change in a development outcome that is attributable to a defined intervention” (USAID Evaluation Policy. January 2011, p. 2). In Hervy and Gilboy, 2014, p. 19).

The documentary evidence included several examples where USAID, BIFAD, APLU and other
institutional stakeholders discussed the challenges of measuring these interventions and debated potential practices to address them, such as using a set of indicators to precisely measure impact (BIFAD and New University Partnerships, p. 82), performance metrics linked to institutional change (Hervy & Gilboy, 2014, p. 19), and special assessment tools like the Women’s Empowerment in Agriculture Index (WEAI) (Horticulture CRSP Annual Report 2012-2013, p. 214).

Another issue with institutionalizing capacity building for individuals involved the limited time that faculty were able to devote to the capacity building component of the projects. According to Subject S7, “working with students takes a huge time commitment” and individual capacity building “requires institutional support” to “operationalize … long and short term training” (Subject S7, personal communication, August 11, 2014). Respondents I interviewed felt supported by their home institutions to deliver on their capacity building commitments, including their work with graduate students, but some felt increasing pressure from USAID to devote more of their time and resources towards expanding to other countries and coordinating with mission-driven training projects (Subject CA2, personal communication, January 27, 2014; Subject O1, personal communication, April 8, 2015; Subject S4, personal communication, October 31, 2013). Subject S4 for instance, commented that “USAID sees training needs resting with the missions … the missions are better off recognizing that CRSPs are capacity building projects” (Subject S4, personal communication, October 31, 2013). Reconciling these individual capacity building time commitments in the project with changing expectations of the program sponsor, emerged as a growing challenge for the ME leadership and program team members during my interviews.
When it came to capacity building for institutions, I found examples in the interview and documentary data that highlighted concerns over the effectiveness of this component of HICD, as well as criticisms directed at one of the key strategies embraced by the IPM and Horticulture CRSP/IL MEs for delivering institutional-level work within their networks. For example, USAID’s governing board for agricultural development projects, BIFAD, expressed significant concerns over the level of effectiveness of institutional capacity building work in international development projects, including the CRSP/IL programs (BIFAD Review of the Collaborative Research Support Program (CRSP) Model, 2012, p. 4; Creating Future Leaders: BIFAD and Feed the Future Dialogue on Human and Institutional Capacity Development, 2014).

Additionally, interview subjects associated with the two CRSP/ILs, also described some of the challenges with building institutional capacity. Subject O1 for instance, discussed the CRSP/ILs need for shifting some of their attention away from building research capacity towards more of the organizational capacity necessary to run programs, commenting that “more needs to happen, but there is less of a research related angle on that … institutional capacity building is more a university project to look at the program infrastructure, using university experts to look at university level functions, accounting, recruiting, etc.” (Subject O1, personal communication, April 8, 2015). Subject S11 expressed concern over using technical assistance as a way to build capacity, arguing, “the finer points of training builds capacity … technical assistance, us going to do the work does not build capacity, a two-day workshop does not build capacity (Subject S11, personal communication, October 22, 2014). While Subject CA4 described a missed opportunity to develop institutional capacity for their project by not having the available time or resources necessary to develop a proper market in the United States for the target agricultural product (Subject CA4, personal communication, January 28, 2014).
Another finding from the data involved differing and sometimes conflicting perspectives on a key strategy used by the CRSP/ILs for institutional capacity building. This strategy involved CRSP/IL ME and program team members developing the research competencies of individual host country scientists and students, with the hope that they would sustain ongoing institutional growth when they return to their home universities or organizations. As I mentioned earlier, the IPM CRSP/IL program in particular was heavily invested in sponsoring students in their pursuit of graduate degrees, anticipating they would apply their newly learned research skills back in their home countries as US-trained PhD scientists (Subject S9, personal communication, September, 29 2014). The CRSP/ILs also worked with individual scientists at partner organizations as part of the strategy for creating institutional capacity. According to Subject O1, “if you are in a university with an international partner doing project work with a US researcher in country, you learn from the US academics in your field and greatly improve the quality of work … you get anointed and other people come to you after that experience … your capacity has been built … the hope is that you cascade this knowledge to your fellow countrymen” (Subject O1, personal communication, April 8, 2015). While the CRSP/ILs focused on individuals already working in partner host-country institutions, as they were more likely to remain at their home institutions (Subject S5, personal communication, August 7, 2014), they also worked with individuals who leveraged this knowledge, inside and outside of their home countries, which benefited those countries both directly and indirectly (Subject S6, personal communication, August 7, 2014).

While CRSP/IL interview respondents largely subscribed to this institutional capacity building approach, others outside of the CRSP/IL program teams maintained contrary perspectives. The data included some specific criticisms that questioned the core tenets of the
strategy for effective HICD. For example, comments from an online AgExchange event included in the 2015 BIFAD and USAID Consultations report stated that, “the central definition of ‘human and institutional capacity development’ has been problematic, sometimes conflating the human and the institutional dimensions, assuming that improvements in human capacity will automatically lead to institutional strengthening” (Report on the BIFAD and USAID Consultations, 2015, p. 9). Similarly, Maredia (2011) commented as part of a presentation for a BIFAD meeting on CRSP HICD work, that “not all of those numbers [referring to numbers of people trained through short and long term HICD efforts] translate into institutional capacity building,” adding, “in other words, just training students from developing countries does not count as institutional capacity building because many times those trainees are not selected in a way that is based on the needs of those institutions and so they don't contribute to develop a comprehensive strategic capacity needed in the country” (Dr. Mywish Maredia in BIFAD Meeting Minutes Oct. 11, 2011 p. 212-213). Finally, the authors of the 2012 BIFAD Review for the CRSP/IL program argued that the CRSP/IL “training does not assure that returning young scientists will necessarily build institutional strengths” (BIFAD Review of the Collaborative Research Support Program (CRSP) Model, 2012, p. 4), recommending instead that the CRSP/ILs put an increased focus on “strengthening host country universities to increase their ability to train a new generation of scientists to replenish the dwindling supply of professional research leaders in host countries” (BIFAD Review of the Collaborative Research Support Program (CRSP) Model, 2012, p. 4).

As the findings have indicated, the data did not support my original expectation, in which I suggested that knowledge related to capacity building would readily be shared between CRSP/IL program directors. That being said, the data did show that human and institutional
capacity building was of critical importance to the CRSP/IL program teams, as well as to organizations inside and outside of the program network. Unlike in the previous section when I discussed the impact of boundaries on organizational learning within the CRSP/IL program networks and there were varied levels of consistency in defining and understanding the impact of those boundaries, with capacity building, there was a much greater degree of alignment in among interview respondents and stakeholders as reflected in the documentary data. Specifically, the data demonstrated that the MEs were able to foster consistent messaging about the networks’ goals for HICD work among program teams, a communication strategy that resulted in coordinated actions among program PIs and their network organizational partners. The data also provided evidence showing how CRSP/IL MEs were mostly successful in institutionalizing capacity building work within the network for individuals and institutions. Institutionalized knowledge and learning practices for working with students, engaging farmers, developing infrastructure, and creating new processes, to name just a few, all contributed to achieving goals important to both the program network members and USAID.

Summary of Findings and Discussion

The study’s findings illustrated a number of aspects of organizational learning within the CRSP/IL program networks, as well as the important role of the management entities in directing, administering, and utilizing learning practices generated through the work of program team members. I now present additional explanation for why the data may have produced these findings and highlight the linkages between the different findings categories. In the first category of findings, I discussed why knowledge did not always flow in the directions that I anticipated, despite the MEs’ central position in the program network. Earlier in the chapter, I shared a
couple of possible explanations based on the work of Carlile (2002, 2004) for why I believed this was occurring. Program and administrative knowledge being shared within the CRSP/IL networks equated to a type of explicit common knowledge that Carlile (2002, 2004) argued was easily transferred within and across the network. As problems became more complex and the knowledge necessary to address them more novel in nature, intermediaries were necessary to translate and transform that knowledge through negotiation (Carlile, 2002; 2004). I also referenced the work of Jensen (2017), Owen-Smith and Powell (2004), and Powell et al. (1996) who looked at the importance of formal and informal ties within pre-existing professional scientific networks for the PIs as they faced novel problems. Finally, I discussed the concept of ‘knowledge at stake,’ as another plausible explanation for why CRSP/ILs program teams were holding back on sharing knowledge or seeking out new knowledge on a given issue from their ME leaders (Carlile, 2004).

Another possible reason for why knowledge did not flow as I had originally predicted can be associated with my earlier discussion in the chapter concerning know-what and know-how. The concept of know-what is associated with explicit knowledge and the knowledge of individuals, compared to know-how, which is seen as more of a tacit, collective knowledge, where knowledge is put into practice. The two terms are not mutually exclusive, as know-how puts know-what to work. Brown and Duguid (1998) argue that the two function together as knowledge but that there are differences in the ways in which that knowledge (know-what + know-how) is shared within and between organizations. For instance, knowledge shared within a community, according to Brown and Duguid (1998) “circulates easily” while knowledge shared between communities “sticks” and does not flow as seamlessly (p. 100). There is an important distinction here between communities and organizations. A community can exist within a single
organization such as a small working group, a project team, or a department, or, it can exist across organizations, such as network task force, a program team, or a joint partnership. Brown and Duguid (1998) argue that the reason for why knowledge moves differently within and between communities, is that “socially embedded knowledge…sticks, because it is deeply rooted in practice” and “within communities, practice helps to generate knowledge and evince collective know-how” (p. 100).

In the case of the CRSP/Innovation Labs, the regional program teams operated as communities when it came to knowledge sharing. In Bangladesh for example, the IPM program team’s know-what of working with eggplant root stock grafting techniques, combined with their know-how of selecting the proper varietals of eggplant, culminated in producing a fruit that met local market tastes (IPM Annual Report 2009-2010; Subject S2, personal communication, August 14, 2013). The development of knowledge by the program team members took place over time, via trial and error, or said another way, through the enactment of practice. Within the community (the regional IPM program), the knowledge moved easily, with the learning practice being applied in different countries within the same targeted region (Subject S11, personal communication, October 22, 2014). However, this type of embedded knowledge was not as easily shared across communities (to other IPM regions). As Brown and Duguid (1998) explain, “trying to move the knowledge without the practice involves moving the know-what without the know-how” (p. 100). The problem faced by the CRSP/IL ME program leaders was how to overcome what Erkelens et al. (2015) called “local knowledge embeddedness” (p. 178).

How does an NAO take knowledge developed through the enactment of practice at the local program level, a knowledge tied to local context in many cases, and re-embed that
knowledge within other programs or share it with stakeholders across the network? This question links to the second set of findings that explored the ability of the MEs to institutionalize learning within their program networks. I found several examples in the data illustrating the MEs’ attempts to institutionalize learning. Some of these worked well, such as the Horticulture and IPM CRSP/IL efforts involving learning practices associated with the Cool-Bot technology and eggplant grafting techniques, which the MEs institutionalized and transitioned to other programs inside and outside of their networks. Other attempts to institutionalize local practice at the organizational and network levels did not work as well. The findings showed that learning practices involving establishing and leveraging partnerships, as well instances where project related knowledge was not being shared at the host country level, were not being institutionalized. There are two key implications from these findings. First, NAOs must take active measures to institutionalize at the network level locally-embedded learning practices advanced by their program team representatives. Second and related, the organizational memory of the network needs to be more than just a repository of knowledge (the know-what), it needs to account for the application of that knowledge (the know-how), as well as the complexities of local context, in order for that knowledge to be institutionalized.

Erkelens et al. (2015) describe a process they refer to as “knowledge pollination,” to illustrate how a network of individuals can assist in “un-embedding” knowledge from one local practice and institutionalizing that knowledge within another local practice (p. 178). The authors define three processes that constitute knowledge pollination, “organized learning” that includes “formal instruments, systems, and sessions,” “learning in practice,” developed by “engaging in shared practices with colleagues,” and “network learning” which they describe as “building, maintaining, and interacting with a network of colleagues with relevant experience and
expertise” (Erkelens et al., 2015, p. 178). This knowledge pollination represents an active approach to “overcome local knowledge embeddedness” and according to Erkelens et al. (2015), “can contribute to organizational learning” (p. 178). In addition to those referenced in section 2 of the findings, there are two additional examples I found in the data that exemplify an active approach on the part of the MEs to institutionalize knowledge from local practice, not unlike what Erkelens et al. (2015) advocate with their knowledge pollination concept. The first of these was the Horticulture CRSP/IL Trellis Fund program. This initiative involved small, targeted projects designed for graduate students to deliver technical assistance in Feed the Future countries (Horticulture Innovation Lab External Evaluation Team Report, 2013). These projects put student researchers in direct contact with smallholder farmers, with whom they shared new practices and developed long-standing relationships. Enabled by the Horticulture CRSP/IL ME, these projects provided a great learning experience for the students, a service to the farmers, and a source of knowledge for the network as local context lessons-learned were gathered and disseminated across the network. Individual students who were involved in these programs were able to un-embed what they learned by solving an issue in one local context for possible application in other regions where the Horticulture CRSP/IL was engaging in similar work. The second example from the data involved an informal model employed within the IPM CRSP/IL as way to structure program PI work on projects. Subject S1 argued that project collaboration needed to be deliberate and that this could be achieved by pairing each principal investigator with a peer researcher in the local partner institution. This “dyad,” Subject S1 described, “becomes a triad as you include students” adding that “this becomes the learning community” (Subject S1, personal communication, August 12, 2013). The challenge Subject S1 alluded to however, was finding a way to scale collaboration beyond the small dyad or triad learning
community, commenting that “fostering this community, this is the management problem” (Subject S1, personal communication, August 12, 2013). Relying on individuals to replicate knowledge across a network is a strategy that faces some particular challenges that I will discuss in the concluding chapter.

Another element to institutionalizing knowledge in addition to the NAOs being active in knowledge pollination, or some other approach to leveraging locally embedded knowledge across the network, is the development of an organizational memory. Organizational memory has been explored by scholars that have looked at the concept in terms of knowledge storage made up of a repository to house the explicit know-what of an organization (Huber, 1991; Olivera, 2000). For instance, Tsang and Zahra (2008) define organizational memory as “stored information from an organization’s history that may affect its present and future interpretations of events and managerial decisions” (p. 1444). As I mentioned earlier and consistent with what I have discussed, organizational memory, especially in a network setting needs to encompass not only the explicit know-what knowledge of an organization, but the know-how to put that knowledge to work. I have used the term learning practices to encompass this combination of content and action. The IPM package is one example from the data that seems to model an effort to institutionalize learning practices into organizational memory. Chapter 4 includes a detailed description of IPM packages, but in short, they are a collection of techniques and technologies compiled by the IPM ME and program teams to address specific pest problems. These IPM packages are created based on the experience of field work and research, are tested in different countries, climates, and regions, and are widely promoted inside and outside of the program network. Held as part of the organizational memory of the IPM CRSP/IL program network, they are learning practices that contain both the know-what of a technology, the scientific basis for the
use of trichoderma fungus against certain pests, for example, with the know-how of applying that technology in specific field settings. Learning practices help to incorporate into organizational memory, the tacit knowledge developed as part of the researchers, students, and farmers’ collective experience of using the technology in different local contexts.

The findings showed that the process of institutionalizing learning practices as part of the organizational memory of the CRSP/IL networks took time and resources from the MEs, program teams, and network members. It did not occur organically. IPM packages were not built overnight and the ability to leverage them for use in parts of the world, different from locations where they were first developed, required even more of a focused effort. Similarly, overcoming local knowledge embeddedness also required the support of the NAO, along with a concerted effort on the part of network program team members to translate learning practices from one local setting to another (Erkelens et al., 2015). While institutionalizing learning practices at the network level can occur, the data illustrated that in a goal directed network like the CRSP/IL programs, this does not happen without purposeful interventions from the NAO, its program teams, and program network members.

The need for interventions also extended to situations where organizational and other boundaries impacted the work of the networks. The findings demonstrated how various categories of boundaries, like learning and knowledge boundaries, along with unexpected boundaries that surfaced during the research, such as those involving financial support for programs, professional rewards, and network goal congruence, all influenced the NAOs’ ability to facilitate network learning from the work of their program team members. Despite the effects that boundaries had on learning within the network, the NAOs I studied operated in a position
where they were able to exert influence of their own in relation to boundaries, through their role as brokers (Evans, 2010; Provan & Milward, 2001; Raab et al., 2015; Wenger, 2000), boundary spanners (Feldman et al., 2006; Feldman & Khademian, 2007; Williams, 2010, 2002), and boundary organizers (Mørk, Hoholm, Maaninen-Olsson, and Aanestad (2012).

Earlier in the chapter, I discussed the broker role as one that the NAO can take on to help garner participation from different parties and to facilitate learning through the negotiation of organizational differences across boundaries. Quite often, the CRSP/IL management entities were put in position to broker knowledge across organizational boundaries, both inside and outside of the program networks. One example from the findings where the ME was required to serve as a broker, involved the boundary between regional and global programs in the IPM CRSP/IL program. Projects like the Global Impact Assessment and Plant Virus Diseases global theme were paired with the regional projects, sometimes creating a boundary over sharing knowledge, resources, or both. Some regional project leaders questioned the value of integrating the global themes against the high transaction costs of these cross-cutting projects and viewed the global programs in terms of policing their activities, rather than contributing additional research and capacity building (Subject S11, personal communication, October 22, 2014; Subject S7, personal communication, August 11, 2014). The MEs seemed to broker this boundary using a combination of carrots and sticks, offering financial incentives on one hand, by providing the global themes with their own budgets and on the other hand, passing along mandates from USAID that required adherence to certain components of the combined regional/global work (Subject S7, personal communication, August 11, 2014).
Wenger (2000), meanwhile, focused on the nuances of brokering between communities of practice, where he warned that “brokering knowledge is delicate … it requires enough legitimacy to be listened to and enough distance to bring something really new” (Wenger, 2000, p. 236). This type of brokering between communities aligned with the CRSP/IL MEs boundary work efforts in a variety of areas. One example from the data involved brokering knowledge between CRSP/IL researchers and African farmers, two very different communities working together to improve a tomato crop. The farmers wanted to continue spraying pesticides, a simple and easy to understand method for dealing with the pest, while the IPM team needed to get them to understand that they could save in production costs by moving to an IPM approach, a more knowledge intensive concept and complex approach (Subject S11, personal communication, October 22, 2014). This understanding that the IPM CRSP/IL team was able to cultivate with the farmer over time, was built on the legitimacy of the source (the ME) bringing something new (the production cost data) to the problem, which Wenger (2000) mentions above as a condition for brokering knowledge. In addition, the farmers themselves brought their own knowledge of pesticides, which according to Subject S11, they knew to be “a safety issue for themselves and their families.” (Subject S11, personal communication, October 22, 2014). An NAO’s ability to broker knowledge is strengthened by its ability to reconcile the existing knowledge from different communities, while adding its own knowledge contributions to help solidify understanding between communities. Subject S11 cautioned though, that “this type of understanding only comes with interaction,” (Subject S11, personal communication, October 22, 2014) a clear signal that brokering requires active engagement to fully grasp each community’s contributions.
Interaction within and across boundaries is also a key component of boundary spanning, one of the other ways that the MEs and program teams worked to navigate the various boundaries found within the CRSP/IL programs. In Chapter 2, I discussed the boundary spanning concept within the broader frame of boundary work, referencing Guston (1999, 2001), who argued that individuals engaged in boundary spanning contributed across boundaries while maintaining accountability to their own organization, as well as Williams (2002), who identified some of the key traits shared by practitioners who serve in boundary spanning roles, such as solid interpersonal skills, entrepreneurial thinking, empathy, and trustworthiness. In addition, I highlighted the connection between organizational learning and boundary work, describing how boundary spanners were well-positioned at the edges of their organizations to direct the flow of knowledge outwardly, to ingest new knowledge from partners and the environment into an organization, and to facilitate bringing parties together from different ways of knowing a problem in order to create new ways of knowing the issue, a critical skill for fostering innovation (Feldman et al., 2006; Feldman & Khademian, 2007; Latour, 2005; Schneider & Ingraham, 2007; Yanow, 2009). The IPM and Horticulture CRSP/IL program team members operated as boundary spanners throughout the study period, as did management entity leaders who had considerable interaction of their own with individuals representing other organizations, inside and outside of the network. The data included several examples where CRSP/IL program team members operated as boundary spanners on behalf of the program network. One way they did this was collecting information at the local level to help guide the regional program work. Subject S13 discussed surveying potato farmers in South America and reporting back to the program team and ME on observations from their interactions with IPM technologies (Subject S13, personal communication, November 16, 2015), while Subject S11 shared how they had
gathered information through follow-up biological surveys based on initial conversations with farmers to determine what pest problems they were encountering (Subject S11, personal communication, October 22, 2014). Boundary spanning activity within the CRSP/ILs also included helping to create new ways of knowing problems among interested stakeholders representing different organizations or coming from different backgrounds. The photo-voice technique employed by the Horticulture CRSP/IL in Cambodia to assist farmers and researchers co-creating common problem definitions, served as one example of this boundary spanning activity from the data (Subject CA3, personal communication, January 28, 2014). Sometimes, boundary spanning involved working across different bodies of knowledge to help create a new consensus for future action. Subject CA2 described such a situation for those involved with seed growing and storage, with one community focused on cold storage and another committed to the benefits of a dry storage method (Subject CA2, personal communication, January 27, 2014). The boundary spanning activity in this case involved promoting new knowledge to help the various communities reach a common understanding. The program team’s efforts to create an understanding and coalescence around “the drying chain” for seed storage, helped to bridge well-defined boundaries and make positive project outcomes (Subject CA2, personal communication, January 27, 2014).

Lastly, Mork et al.’s (2012) model of boundary organizing offers an alternative approach to conceptualize the challenges and opportunities NAOs encounter as they engage with boundaries across their networks. The concept goes beyond brokering, which involves managing the relationships across boundaries, and boundary spanning, which focuses on managing practices across boundaries (Mork et al., 2012), to help “explain how innovating organizations are able to not only span boundaries, but also to destabilize and alter boundaries” (Mork et al.,
According to the authors, boundary organizing does this by, “handling multiple boundaries,” “facilitating mutual benefit,” and through “mutual adaptation of practice” (Mork et al., 2012, p. 276). The first aspect of the model describes the likely circumstance that development of new practices involves working within and across multiple boundaries of different types to develop or acquire new resources, identify and cultivate alliances, and facilitate political support for planned activities (Mork et al., 2012, p. 277). For the CRSP/IL management entities and their program teams, having to handle multiple boundaries was a daily occurrence. Whether it involved identifying and managing an external partner to produce and deliver an IPM package, build support around a technical student-led technical assistance project, or solicit associate award funding to extend the reach of an existing program, the CRSP/IL program networks embodied this aspect of Mork et al.’s framework. The second aspect of boundary organizing, “facilitating mutual benefit,” involves the situation where an “innovating organization will frequently change boundaries” as new techniques and technologies are developed in response to addressing novel problems, which will create new contested boundaries of their own. In this circumstance, Mork et al. (2012) argue that “potential partners need to be approached with an offer that would provide mutual benefits” (p. 281). I provided several examples in the findings where a lack of incentives contributed to a boundary within the CRSP/IL programs. These boundaries were related to fostering inter-CRSP collaboration, expanding projects to other countries, working with USAID missions, and publishing research data versus making it publicly available. This need to incentivize boundary work within the CRSP/IL program networks closely aligns with Mork et al.’s (2012) call to provide mutual benefits when new boundaries emerge due to innovation. The third aspect of boundary organizing is “mutual adaptation of practice,” a condition where it may be “necessary to stabilize
the organization of new practices internally before being able to create synergies with new partners across organizational boundaries” (Mork et al., 2012, p. 282). This last aspect of the model is directed at the need to create new and modify existing practices as a result of new boundaries being negotiated, with Mork et al. (2012) arguing that modifying practices will be “necessary to keep new practices in place” (p. 282). I equate this aspect of the Mork et al. (2012) framework to the IPM and Horticulture CRSP/ILs efforts to institutionalize those learning practices developed through project innovations, such as the IPM packages and Horticulture CRSP/IL technology transfer initiatives. When new learning practices are developed, the operational practices necessary to keep them in place and importantly, to promote them outside the network, require a modification from how similar work may have been completed in the past. This was the case for examples like the IPM package on root-stock grafting that was used to combat bacterial wilt and the Cool-bot technology used within the Horticulture CRSP/IL. Each application of those two innovations, whether it was deployment in a new country, or utilization against a new pest or plant disease, required existing implementation practices to change and new training practices to be created. Mork et al.’s (2012) explanation of boundary organizing also applied to examples involving the CRSP/ILs working with USAID missions on Associate Award projects. These complex projects required the MEs to handle multiple boundaries, such as the obvious international boundaries of implementing a project in a new country, but also the less obvious boundaries associated with bridging the different organizational cultures of US academic institutions with USAID missions and their contractor development partners. The Associate Award USAID mission projects also required boundary organizing on the part the MEs around creating mutual benefits for each stakeholder. I mentioned earlier in the chapter that sometimes the incentives for USAID missions did not always align with the available incentives
for the CRSP/IL program teams. The CRSP/ILs were able to overcome this boundary at times by engaging in projects that created immediate impacts for the USAID missions and while still providing incentives relevant to the academic members of the program teams. Finally, when CRSP/IL and USAID mission collaborations were successful, new practices were created or existing ones were adapted in a mutually agreeable way. Overall, Mork et al.’s (2012) boundary organizing framework is helpful in characterizing the complex boundary work of the CRSP/IL MEs, as they tried to develop and institutionalize innovative solutions for novel problems across their program networks.

Conclusion

In this chapter, I presented four categories of findings that emerged from the research. In the first category, I found that knowledge flowed within the CRSP/IL program network differently based on the type of knowledge involved. Program and administrative knowledge typically circulated through the management entities from the program teams in line with the Crossan et al. (1999) framework, while knowledge associated with addressing novel problems was more multi-directional, with program PIs often leveraging personal connections within pre-existing professional scientific networks inside and outside of the network to share and seek out new knowledge. The second category of findings showed how learning practices were institutionalized by the IPM and Horticulture CRSP/IL management entities. While institutionalizing learning practices such as those involving program teams building partnerships and replicating knowledge across host countries were problematic, examples like the Cool-Bot technology and the IPM packages involving grafting techniques, demonstrated how the MEs were able to institutionalize local knowledge from one program team at the network level and
disseminate that knowledge to other network members. The third category of findings described the various boundaries I found within the case study data, and their impact on organizational and network learning. In addition to the presence of vertical learning boundaries that influenced institutionalizing learning practice within the individual program network teams, and knowledge boundaries that impacted learning between different organizations across the network, other boundaries like goal incongruence between USAID and the CRSP/ILs, a lack of financial and other resources, and a misalignment of academic and government incentives, all played a role in learning within and across the program networks. Finally, I discussed network learning for human and institutional capacity building. Each CRSP/IL was deeply invested in working with individuals to improve their ability to conduct agricultural development work, as well as investing in the development of the physical and human capital necessary for institutions to carry on the work of the project teams once the projects were completed. I highlighted some of the similarities and differences in how each management entity approached this work and discussed some of the implications for organizational learning within the networks. In the next chapter, I conclude the dissertation by presenting my contributions from the research, share additional theoretical implications, and propose a preliminary framework for NAO practitioners based on the study’s findings.
Chapter 6 – Contributions, Implications, and Conclusions

Introduction

The IPM and Horticulture CRSP/IL program networks were a rich source of data for exploring organizational learning in a network setting and for understanding the role of network administrative organizations in enabling, managing, and leveraging learning practices for purposes of innovation. In this final chapter, I first present and discuss the contributions from my research. Based on the findings from my study, I propose an expansion of the Crossan et al. (1999) 4I framework to include a network-level of learning and the addition of knowledge and learning boundaries to the model. I then discuss the two-part role of network administrative organizations within the context of the 4I framework, and introduce two new learning processes, incentivizing and incubating, to show how NAOs can facilitate, cultivate, and disseminate situational learning practices directly, and through connections that they help to establish. I then discuss additional theoretical implications based on the findings from the study, and put forward a preliminary framework of recommendations for NAO network managers as they look to lead similar goal-directed networks. I conclude the dissertation by addressing limitations of the study and considering areas for future research.

Organizational Learning in a Network Context – an Expansion of the 4I Framework

The 4I model has demonstrated over time to be a flexible and widely used framework for understanding organizational learning processes in a multi-level context (Crossan et al., 2011). It remains limited in its explanatory power, however, because it concentrates on the learning processes of single organizations, with very little attention given to an explanation for how
organizational learning takes place at a network level. I address this gap by proposing an expansion to the 4I framework that builds on the work of Crossan et al. (1999) and others. From my study, I first theorize that network-level learning should not be treated as a linear extension of the existing 4I framework when learning for innovation is a goal of the network. Simply adding another level to the 4I framework does not account for the multi-directional flow of learning that I found in the CRSP/IL case data. Second, the existing 4I framework does not consider the presence of organizational boundaries and their influence on network-level learning. The CRSP/IL programs were multi-sector goal-directed networks that spanned complex geographical and organizational boundaries. I include boundaries in the proposed 4I framework expansion and discuss how the existing literature and findings from the CRSP/IL case study data help explain how boundaries both aided and inhibited organizational learning within the IPM and Horticulture CRSP/IL networks.

The question of how networks learn is not an easy one to answer and the literature is mixed on the topic. Chapter 2 highlighted some of these varied perspectives showing that network level learning usually falls into two camps, either learning within the network by individuals, groups, and organizations (the accumulation of learning) (Dyer & Nobeoka, 2000; Inkpen & Tsang, 2007; Larsson et al., 1998) or learning by the network itself (learning by a group of organizations as a group) (Knight, 2002; Knight & Pye, 2005). Organizational learning within a network context can also be quite distinct from learning within single organizations because the creation and sharing of knowledge and ways of knowing among organizations must take place across multiple and varied boundaries (Akkermann & Bakker, 2011a; Carlile, 2004). Boundaries serve as both obstacles and resources for organizational learning (Carlile, 2004; Wenger, 2000) and when encountered, can force individuals to reconsider their own assumptions.
about a topic, evaluate another’s position on an issue, and look for common meaning to help solve problems (Akkermann & Bakker, 2011a). Boundaries can represent a division of practice as well, a place where deep-seated knowledge among stakeholders can be sticky, making it difficult for knowledge to pass across and beyond the boundary itself (Scarborough et al., 2004). Individuals and organizations with knowledge at stake can erect boundaries to the effective sharing of that learning in a network environment (Carlile, 2002, 2004).

The competing perspectives on network learning in the literature and the impact of boundaries on learning within inter-organizational environments make conceptualizing learning at the network level within the 4I framework a challenge. Extending the 4I model to include an additional structural level for the network and applying the existing 4I feed forward and feedback processes to this new level does not adequately capture the kind of network learning, or lack thereof, that I have found taking place through my research of the USAID Innovation Labs for Collaborative Research. In contrast to the smooth, bi-directional flow of learning envisioned in the 4I framework, the knowledge generated through the work of the program teams in the CRSP/IL networks I have studied did not flow neatly forward from individuals to groups to organizations to the network. Neither did knowledge easily funnel back from the network as institutionalized structures, procedures and routines to the organizational, group, and individual levels. Instead, the findings presented in Chapter 5 showed that knowledge flowed in unpredictable, multidirectional ways across organizational boundaries, or at times, failed to flow at all.

A major reason for why this may have been the case is the novel nature of the problems being investigated. Carlile and Rebentisch (2003) describe the challenge of transferring
knowledge where novelty is introduced and the complexity of integrating knowledge in a group setting where multiple stakeholders must determine whose knowledge takes precedence (p. 1182). Novelty presents itself in unfamiliar circumstances and is represented in the capacity of an actor to understand the common knowledge, differences, and dependencies surrounding an issue, “to be able to share and assess when all is not known” (Carlile, 2004, p. 557). In their analysis of the 4I framework, Berends and Lammers (2010) found that “learning around a novel and ambiguous concept evolved in a complex learning trajectory in which learning did not progress along a linear path” (p. 1046). My case study highlights a similar dynamism among the learning processes present within the Innovation Lab networks. Like Berends and Lammers (2010), the learning processes I identified in relation to the flow of learning among levels did not match up with those identified in the 4I framework. This was particularly true at the network level, where the focus of the Innovation Lab network activity has been the search for innovative solutions that address complex, novel problems.

The focus on network innovation is “seen as increasingly important to organizational performance, facilitating the creation of new knowledge, rather than just the transfer of existing knowledge” (Swan & Scarbrough, 2005, p. 914). Swan and Scarbrough (2005) reference a coalescence in the literature around the “positive and performative” role that networks play in terms of innovation where the common view is that “innovation is more likely to occur at the interstices of collaborating groups and organizations” (p. 914). With such a prominent focus on network innovation in the literature and given the importance of novel problem solving within the goal-directed activities of the Innovation Lab networks in my case study, it is helpful therefore to think about a network-level expansion of the 4I framework centered around network learning for innovation (Crossan et al., 2011).
Figure 6 shows an alternate depiction of the 4I framework that I have developed to demonstrate organizational learning processes for innovation in a network environment. The extension of the model is based on the work of Carlile (2002, 2004); Crossan et al. (1999), Scarbrough, et al. (2004), and Swan and Scarbrough, (2005), with my own contributions based on inferences that I have made through analysis of the CRSP/Innovation Labs case study data. The modified 4I framework incorporates the network as a new level of learning, but not as a
linear addition to the individual, group, and organizational levels. Instead, figure 6 shows a mirrored image of the 4I processes and multilevel learning structure within the umbrella of a single network depicted as a red horizontal bar at the top of the figure. The duplication of the base framework from figure 2 is meant to illustrate the presence of multiple organizations operating as part of the network. Figure 6 shows two organizations for illustration purposes, but the actual network would likely include three or more organizational members.

I argue that the network level should be shown in this manner because, when innovation is a goal of network learning, knowledge does not exclusively flow in a linear path from the organizational member to the network and vice versa. When networks are facing novel problems, knowledge and ways of knowing are communicated in more multidirectional ways. Vertical green arrows in the diagram show how individuals and groups interact directly with their peers and peer groups in other organizations within the network. In some cases, organizations connect directly with other networked organizational members through binary relationships as well, via formal partnerships, strategic alliances, and collaborative projects (Provan et al., 2007). Other times, individuals may interact directly with colleagues or groups of colleagues based on personal relationships established as part of pre-existing professional scientific networks (Jensen, 2017; Owen-Smith and Powell, 2004; Powell et al., 1996). The core exploration and exploitation processes of the original 4I framework are still present in this modified version as shown using curved solid arrows for feed forward and curved dotted arrows for feedback processes. In the modified version of the framework however, these same processes of exploitation and exploration can occur organization to organization through the work of project teams interacting directly with peer teams in other network organizations and by individuals connecting with other
individuals inside or outside the network by way of their own social and professional network relationships.

The other major change made to the original 4I framework is the inclusion of boundaries. The case study data presented in Chapter 4 and the findings in Chapter 5 showed the presence of numerous boundaries in the CRSP/IL Innovation Labs, including vertical learning boundaries within the program teams and horizontal knowledge boundaries between network members.
Figure 7 shows these boundaries as red dashed rectangles with grey shading. Learning boundaries are a way to depict the creative abrasion taking place at the project level and the subsequent change that can occur across the organization if project level learning is transferred throughout the organization (Scarbrough et al., 2004). Project-level learning can apply to intra-organizational and inter-organizational learning situations mapping quite well to the Crossan et al., (1999) 4I processes, where knowledge is predicted to move vertically from the individual to the organization through exploration and from the organization, back to the individual through an exploitation process. Knowledge boundaries, conversely, reflect the challenge of sharing knowledge between groups and organizations. Scarbrough et al., (2004) associate these boundaries with the work of Carlile (2002, 2004) who found that increasingly complex boundary interactions can be a significant management problem. Carlile (2004) found that when problem novelty was low, knowledge was shared across boundaries using a transfer method where knowledge is shared easily within and across organizational boundaries. As problem novelty intensifies, so too does the complexity of sharing knowledge across boundaries as knowledge shared across boundaries must be translated instead of merely transferred Carlile (2004). In a setting of high problem novelty, a situation of great complexity can result in a scenario where knowledge must be transformed into new forms of knowledge because no common language exists and no known ways of solving the problem have been developed Carlile (2004). NAO-led goal-directed networks often deal with addressing wicked problems where a high degree of problem novelty is a common element.

Figure 8 shows the critical boundary spanning position that an NAO can occupy within the modified 4I framework. Operating at the nexus of horizontal learning and vertical knowledge
boundaries, the NAO is well positioned to help overcome boundary challenges to organizational learning present in a goal-directed network.

Depicted in figure 8 as a diamond, the four points of the shape illustrate how NAO network managers and program team members can operate both horizontally and vertically. Often called boundary spanners in the literature for their ability to work across boundaries in collaboration with multiple actors to accomplish shared objectives (Williams, 2002), these well-placed
individuals can use the collaborative relationships they have developed within the context of their work for achieving mutual understanding and learning among stakeholders, both inside and outside of their organizations and project teams (Williams, 2002). The NAO spans horizontal learning boundaries along 4I process lines with the potential to institutionalize knowledge within the NAO organization itself among its project team groups and individual program administrators and researchers. The other axis points of the diamond reflect how the NAO spans vertical knowledge boundaries between network organizations. In addition to connecting organizations in the network, NAOs have the ability to employ management interventions that may aid in the transfer, translation, transformation, and ultimately, the institutionalization of knowledge at the network level - a critical necessity for addressing novel and wicked problems.

Organizational Learning in a Network Context – the Two-Part Role of NAOs and New Processes for the 4I Framework

The Two-Part Role of NAOs

In the context of goal-directed networks like the Innovation Labs for Collaborative Research, the ME administrators and scientific researchers working as part of the program network project teams possessed the ability to generate and disseminate situational knowledge which they accumulated from operating within and at the intersection of organizational boundaries. These individuals were well positioned to learn through their work, to leverage their expertise for the purpose of mediating meaning between the organizations they bridged and to foster absorption of the knowledge for future network innovation (Cohen & Levinthal, 1990). From my study, I theorize that network administrative organizations play a two-part role in fostering organizational learning within their networks. First, NAOs create and enable
individual-level learning through the activities and work of network managers. Second, NAOs facilitate creation and sharing of knowledge within and across the network by creating the space for interactions to occur organically among network members, purposefully bringing select network members together, removing barriers to collaboration, and fostering the replication of situational knowledge generated by program team and network members from one local context to another.

In the first category of findings discussed in Chapter 5, I illustrated how the CRSP/IL NAO network managers shared program and administrative knowledge with program PI team leaders and other network stakeholders. This involved helping PIs and host-country university partners learn the processes and procedures associated with establishing the project work plans, complete technical committee and trip reports, manage program finances, negotiate contracts with third-party collaborators, and compile annual reports for submission to USAID. The CRSP/IL NAO network managers were also involved in developing the individual-level learning of graduate students, farmers, private-sector partners, program funders, and other program participants through direct work with those individuals and sharing lessons learned through presentations, publications, and outreach to the broader international development community. This focus on direct individual-level learning among participants in the network, is an important first part of an NAO’s organizational learning role.

The second part of an NAO’s role in organizational learning is broadly characterized as the facilitation of connections and dissemination of learning within the network. While NAO network managers can engage in developing individual-level learning as the previous paragraph indicated, learning is taking place all the time within the network independent of those NAO
interventions. The case data illustrated that whether it was the fieldwork of project teams with farmers to test the viability of an IPM package in a new region or country, a project involving a USAID mission that overlapped with a CRSP/IL initiative, or a conversation between a PI and a colleague doing similar work in their discipline working outside of the network, these dyadic engagements were generating learning practices that could potentially benefit the network as a whole. The challenge and opportunity for NAO network managers is to instigate and leverage these types of dispersed, local, and contextual interactions with the goal of lifting them up to the network level as broadly accessible learning practices. Paquin and Howard-Grenville (2013) explored similar activities which they described as “network orchestration,” arguing that “the orchestrator must invest time, energy and other resources in encouraging serendipitous interactions that may lead to ties (“blind dates”) while balancing its efforts to selectively enable certain ties to come to fruition (“arranged marriages”) (p.1624). NAOs can create the space for purposeful interactions that leverage existing network ties and develop new ones through formal measures such as developing cross-network task forces to address specific issues, securing contracts that bring disparate organizational members together around specific deliverables, and hosting scientific conferences that offer an opportunity for individuals from different backgrounds and organizations, inside and outside the network, to share their work. Creating an environment where the network can benefit from new knowledge coming into the network from individuals and organizations outside the network is crucial to innovation. The NAO’s ability to create informal space is also very important. This might involve connecting two or more network members by consulting with them on a specific issue of importance, brokering a relationship for a network member with a new external partner, and facilitating ‘networking’ gatherings at
meetings, conferences, and events where participants can share knowledge with one another in a social setting and build personal bonds that extend to future projects.

The NAOs ability to remove barriers to these formal and informal interactions is also a key part of the NAOs role in organizational learning. Earlier in the dissertation, I discussed IPM and Horticulture CRSP/IL ME efforts to remove boundaries that were preventing formal and informal interactions among network partners. Examples included facilitating engagement between global and regional themed project leaders, synching CRSP/IL projects with USAID mission projects and their development partners, various workshops and events that brought scientists together from different parts of the world to create a common language for addressing local challenges, and projects like the Horticulture Trellis program that created ties between students and end-user farmers that created new understanding and personal bonds. Boundaries can represent a source of organizational learning (Powell et al., 1999), but can also impede the development of beneficial ties among network members. Lastly, NAO network managers facilitate the dissemination of learning generated through these serendipitous and targeted interactions to benefit other network members and achieve network goals. The IPM and Horticulture CRSP/IL management entities were both dedicated to promoting the work and results of their network program team members. This took the form of thematic workshops organized to showcase particular technologies, targeted trainings to bring successful practices to end-users, and marketing publications that touted the positive outcomes of CRSP/IL cross-network project team work. The NAO is the advocate and amplifier for the results of formal and informal interactions taking place within and across the network.
Incentivizing and Incubating, Two New Processes Proposed for the 4I Framework

Finally from my study, I theorize the addition of two new processes to the Crossan et al. (1999) 4I framework, incentivizing and incubating, which are associated with the role of the NAO as a boundary organization. These two new processes are not learning processes per se, although I argue that they are very important to organizational learning for innovation at the network level. While learning may occur through the creative abrasion of organizations, project teams, and individuals operating in a multi-organizational network (Hoflund, 2012; Powell et al., 1996) the sharing of that knowledge across projects and within the network organizations seems to rarely happen so “smoothly or directly” (Scarborough, et al., 2004, p. 1579).

These proposed new processes of *incentivizing* and *incubating* have implications for theory, adding value to the 4I framework by offering new ways to explore learning at a network level. Given the nature of how knowledge flows through the NAO in a goal directed network, or more importantly, at times does not flow, like sometimes when facing novel problems, I argue that new processes associated with the 4I framework (Crossan et al., 1999) are necessary to help explain organizational learning at the network level. These two new processes, *incentivizing* and *incubating*, were informed by examples in the data where the CRSP/IL MEs, operating as NAOs, employed these processes as a part of enabling, managing, and leveraging learning across their respective CRSP/IPM networks.

The proposed organizational process of *incentivizing* is based on the “activation” and “framing” network management behaviors introduced by Agranoff and McGuire (2001b, p. 299). Activation involves behaviors such as picking your network team, identifying stakeholders in the goal-directed activities of the network, evaluating and leveraging individuals with different
skillsets, and aligning with organizational partners who can bring knowledge and resources to the joint efforts of the network (Agranoff & McGuire, 2001b, p. 299; Hoflund, 2012). Framing behaviors, meanwhile, involve establishing the rules of the network, shaping its values and norms, attempting to influence the perceptions of the network participants towards the network’s goals and securing commitment and support for network purposes (Agranoff & McGuire, 2001b, p. 299-300). The NAO is often in a position where it must spur knowledge exploration and the sharing of that knowledge among members of the network through direct managerial actions. This may include distributing grants, contracts, and other types of funding vehicles to entice knowledge sharing among project groups and organizations who otherwise may find reasons not to collaborate, at least not in a way that benefits the full network. Incentivizing may also take the form of policies, procedures, and rules created by the NAO for being part of the network designed to induce knowledge sharing and collaboration.

I provided a number of examples from the data that described incentives, or the need for incentives as detailed by interview respondents and discussed these earlier in the findings. Looking specifically at the study’s findings related to human and institutional capacity building, at times, the CRSP/IL MEs employed incentives to create consistent messaging about CRSP/IL HICD activities across the program teams and among program network partners, so that external stakeholders like USAID, BIFAD, and members of the international development community, were kept informed of the important work being done within the programs. The MEs did this by incorporating capacity building requirements into the project reporting deliverables, such as the workplans, technical committee documents, annual reports, and promotional publications. Other times, financial incentives like the Trellis Fund project funding, allowed the Horticulture CRSP/IL to incentivize capacity building among its affiliated graduate students by having them
work on real-world technical assistance applications (Horticulture CRSP Annual Report 2009-2010; Horticulture EET Report, 2013). The incentivizing process also described the MEs actions to form program teams, as project funding was allocated to link US PIs with in-country partners and graduate students, and technologies and training, which were used as incentives to engage a new partner as a way to help extend the reach with certain countries or markets (Horticulture CRSP Annual Report 2009-2010; Horticulture EET Report, 2013). In associating incentives with Agranoff and McGuire’s (2001b) framing terminology, the CRSP/ILs helped set the guiding principles for collaboration around capacity building, to help establish capacity building goals and metrics, and to gain buy-in from program team members and network partners around specific HICD project work.

The IPM CRSP/ILs project to address the Parthenium weed in Ethiopia was a good example of the incentivizing process in relation to Agranoff and McGuire’s (2001b) framing behavior. The project required establishment of quarantine facilities in Ethiopia where the special weed-eating beetles brought into the country could be safely researched for integration into the local environment. The IPM CRSP/IL ME and project team not only needed to incentivize local participation in creating this facility and staffing its operation, it also needed to get buy-in around the goal of the facility, which was the release of the beetles to combat the invasive weed. This required getting local governments, scientists, and importantly farmers, to buy-in to need for building this institutional capacity (the facility) and commit to supporting the practices associated with deploying this type of IPM strategy (Feed the Future Innovation Lab for IPM A Decade of Innovation 2004-2014, 2015; IPM Annual Report, 2013-2014; IPM Innovation Lab EET Report, 2013).
The proposed process of *incubating* is based on the Agranoff and McGuire (2001b) “mobilizing” and “synthesizing” network management behaviors. Mobilizing refers to taking “a view of the strategic whole” and includes an ability to “develop and achieve a set of common objectives based on this whole” (Mandell, 1988 in Agranoff & McGuire, 2001b, p. 300). It also refers to gaining buy-in on network activities, getting consensus on the role and scope of network operations and management, and building support for network goals from participating organizations and coalitions (Agranoff & McGuire, 2001b, p. 300; Hoflund, 2012). The synthesizing behavior meanwhile, involves “creating the environment and enhancing the conditions for favorable, productive interaction among network participants” (Agranoff & McGuire, 2001b, p. 300). It is an opportunity for a network lead to blend participants from different backgrounds, who sometimes come with contrasting views and values, towards the strategic purposes of the network, by creating the space for consensus building and collaboration (Agranoff & McGuire, 2001b, p. 300; Hoflund, 2012). Synthesizing also comprises efforts by network managers to “achieve cooperation between actors while preventing, minimizing, or removing blockages to cooperation” (Agranoff & McGuire, 2001b, p. 300). The authors equate this synthesizing behavior to a “steering of network processes” or a type of “game management” on the part of the network manager (Agranoff & McGuire, 2001b, p. 300). Not only is the NAO responsible for creating the mechanics of knowledge sharing as represented by the incentivizing process above, but also for establishing the site of knowledge creation and sharing described in the previous section. Incubation is a process that refers to creating an environment where learning can take place, where continuous dialogue on shared targets for network activity can be enabled, and where ongoing attention can be applied to network interactions that ensure long-
term viability of a collaborative space where goals can be achieved and novel problems can be solved.

Looking again at the HICD work of the two CRSP/ILs, the MEs exhibited the incubating process in relation to HICD work in a number of ways, but two in particular are worth noting. First, as discussed in the previous section, the CRSP/IL MEs helped to create the “environment” or “space” for collaboration and knowledge sharing around capacity building to take place. Sometimes they did this by creating institutional capacity through physical infrastructure like the quarantine facility mentioned above, or the Regional Innovation Centers established by the Horticulture CRSP/IL ME and its partners. Other times, this took the form of meetings, conferences, and other events that helped to create human/individual capacity by bringing people together from across the program network to debate, discuss new ideas, come to new agreements, negotiate new understandings, and give the CRSP/IL MEs the opportunity to reinforce the strategic HICD goals for the networks. Incubating also described the CRSP/IL ME efforts to develop HICD by creating hands-on learning experiences. Examples included a farmer field training on reducing white fly infestation on tomato crops in Bangladesh (IPM Report 2009-2010), a post-harvest training in Rwanda (Horticulture CRSP Annual Report 2010-2011), and developing the production capacity of a partner to produce Trichoderma to reduce soil fungal diseases in Nepal (IPM Annual Report, 2013-2014). These experiences reinforced the “learning-in-working” (Brown & Duguid, 2001, p. 42) approach employed in many CRSP/IL HICD strategies, which in addition to helping to develop the individual capacity of the target audience, also led to the creation of new learning practices that the ME and program team members could replicate in other contexts.
A second way that the CRSP/IL MEs and program teams demonstrated the incubating process for HICD, and also related to the previous section, involved their efforts at “removing the blockages to cooperation” (Agranoff & McGuire, 2001b, p. 300), or what I have discussed at various points in the dissertation as boundary work. Boundaries, as in other aspects of CRSP/IL program network activity, were a contributing factor in the ability to achieve human and institutional capacity building goals. Many of the findings on boundaries highlighted earlier in the chapter, such as those involving program and administrative knowledge sharing between the MEs and program teams, boundaries over reporting requirements, challenges of working with different bureaucracies in different countries, and boundaries around financial incentives for increased project collaboration, all impacted the CRSP/IL MEs as they worked to implement HICD across their program networks. Despite these challenges, the IPM and Horticulture CRSP/IL MEs were largely successful in preventing, eliminating, or bridging boundaries to collaboration within and across their program networks, by operating as brokers, boundary spanners, or boundary organizers for HICD project related work. The data indicated for example, that the CRSP/IL MEs shared HICD program management and administrative knowledge with minimal difficulty between the ME and the program teams and the MEs were able to foster consistency in the use and reporting of project metrics associated with HICD work, such as numbers of degrees conferred, farmers trained, workshops delivered, etc. (Subject CA1, personal communication, January 27, 2014, Subject S2, personal communication, August 14, 2013, Subject S3, personal communication, October 28, 2013).

The ability of the CRSP/IL MEs to incentivize program teams and network partners, to rally around mutually agreed upon HICD strategic goals, was a key function of their responsibility as NAOs. The incentivizing process I proposed further helped to characterize the CRSP/IL ME
efforts at creating a consistent message and common understanding about HICD work that permeated throughout the data. Similarly, the findings also supported use of the proposed incubating process in accounting for how the CRSP/IL managed the many boundaries impacting HICD work and described the CRSP/IL ME and program team efforts at creating collaborative spaces, both physical and virtual, where learning practices could be created and institutionalized.

The proposed incentivizing and incubating processes contribute to expanding the Crossan et al. (1999) 4I framework by helping account for the absence of processes within the 4I model for understanding learning at the network level. They illustrate the importance of enabling an environment for learning, bringing network partners together through enticements, finding ways to motivate adherence to shared goals, creating the structures and routines for sustaining learning, and investing the time and resources for developing learning practices among partners in situations of program novelty when knowledge must be transformed. These processes contribute to a better understanding of organizational learning in the CRSP/IL program networks and may be transferrable to other goal-directed network settings.

Additional Theoretical Implications from the Findings on HICD

In addition to the theoretical contributions that I have advanced thus far in the chapter, the findings on HICD raise two additional theoretical implications that are important to consider, and for which I will offer potential explanations. The first of these involves an NAO’s ability to replicate individual level learning at an institutional level. As described earlier, one of the criticisms levied against the CRSP/IL programs involved concerns about the CRSP/ILs ability to develop institutional capacity at the same level as they were developing capacity among individuals involved with the program. Training students to perform agricultural development
research on high value crops, or honing the skills of individual farmers to properly stake a field to avoid bacterial wilt, often resulted in an immediate return on that capacity building effort. In the CRSP/IL programs, the management entities were able to measure and track this immediate outcome, thereby demonstrating learning at an individual level. The MEs were also able to institutionalize what had been learned from implementing the various HICD strategies targeted at individuals and share this knowledge and know-how with their program team members, who could then apply what had been learned in other program settings to their own.

Contrast that with institutional capacity building, where NAO and program team HICD strategic goals were more difficult to demonstrate and disseminate back to the program network members as institutionalized learning practices. Critics of the CRSP/IL institutional capacity building efforts presented earlier in the chapter, focused on a perceived overreliance by CRSP/IL MEs on individuals trained through the programs, such as students or partner researchers, who were expected to return to their home institutions following their CRSP/IL project work and leverage what they had learned as a way to develop the institutional capacity of their home organizations. The theoretical implication of this finding is that it raises questions about multilevel learning and specifically, whether individual level learning can be linked with learning at the organizational level.

As discussed at different points in the dissertation, the Crossan et al. (1999) 4I framework defines these different learning levels and offers a set of processes that help explain the flow of knowledge in a multilevel setting. The linkage between learning practices at one level with learning practices at another, and the impact of team level learning on the organization is further supported by additional studies found in the literature exploring the use of the 4I framework to
understand learning in multi-level organizational environments (Berends & Lammers, 2010; Crossan et al., 2010; Di Milia & Birdi, 2010). The CRSP/IL HICD approach of training individual students and scientists to develop institutional capacity, tended to align with the 4I multilevel learning model as well. Individual students representing partner universities were trained by the CRSP/IL ME team members represented learning fed back from the institution (the ME) to the individual (student researcher) via the 4I institutionalization process. That researcher then was in a position to use their new found expertise to draw upon knowledge in order to solve problems similar to what they experienced as part their CRSP/IL work, aligning with the 4I intuiting process. The researcher then refined their ideas through group-level conversations with peers using the 4I interpreting process, followed by a process of creating shared understanding and coordinated actions that used the integrating 4I process to bring that learning to the organizational level. The circle was completed when the knowledge and know-how was institutionalized at the researcher’s home organizational level, embedded in new structures, routines, and processes, thereby resulting in new institutional capacity (Crossan et al., 1999).

The above application of the 4I model to help explain the CRSP/IL institutional capacity assumes that these processes occurred in sequential order and that knowledge was flowing in a consistent linear progression between levels. In all likelihood, learning processes would not be so orderly and as the findings have already shown, knowledge flowed within and across the CRSP/IL network in unpredictable, multidirectional ways. What if the students had chosen not to continue their careers in agricultural development, or if the scientists from partner research universities had not wanted to return to their home universities as expected? What would have happened if the students did go in to agriculture and the scientists returned to their home
universities, but external forces redirected their work, limiting their ability to make institutional change in their organization? Finally, what if the technologies they were trained in became obsolete by the time they have reached a level in their organizations to leverage what they were trained to do as individuals for the benefit of the institution? Berends and Lammers (2010) explored organizational learning within the context of the Crossan et al. (1999) framework and found that discontinuities can influence the learning processes in a multi-level environment.

The Berends and Lammers (2010) study is helpful in developing possible explanations for those situations when CRSP/IL institutional level capacity building work linked to individual capacity building learning practices, such as training students and researchers with the goal of them building capacity in their home institutions, did not achieve the institutional level capacity building objectives that were expected. According to Berends and Lammers (2010) a discontinuity occurs when one of the four learning processes is “interrupted or where learning does not flow from level to level” (Berends & Lammers, 2010, p. 1048). The authors found through a longitudinal study of an organization implementing a new knowledge management system, that discontinuities in the learning processes across organizational levels were “explained by dynamics and tensions enacted in the social and temporal structures enacted in the learning processes” of the organization (Berends & Lammers, 2010, p. 1045). Social structures referred to the “positioning of learning organizational structures through the actors who are involved in the learning processes,” while temporal structures referred to enactment of structures that impacted “the timing of learning processes” (Berends & Lammers, 2010, p. 1048-1049).

The social structures Berends and Lammers (2010) refer to include individuals who are “connected to group and organizational levels through the positions they occupy,” which provide
“identity and power” and offer actors the opportunity to “enact particular practices and localized elements of strategies, structures, systems, and procedures” (p. 1049). For the CRSP/ILs, the social structure included actors at many levels of the program network who held different positions with different organizations. Looking at one example from the data, the learning triad that Subject S1 described as part of their interview included a principal investigator (member of a CRSP/IL program team and university faculty), a student researcher (typically a masters or doctoral student at a US or international university), and a partner research scientist (usually an international university faculty/scientist or international research organization scientist) (Subject S1, personal communication, August 12, 2013). In the individual-to-institutional capacity building approach, individual capacity would be built by the student and partner researcher through the conduct of the agricultural development work of the project. These individuals would then use what they had learned as they became future academic scientists (in the case of the students) or immediately apply the knowledge to institutional level problems as more experienced scientists (in the case of the partner researcher). The model assumes that PIs would also learn from these experiences and share their learning practice with the management entities who would institutionalize various HICD practices that worked and those that didn’t at the NAO level and disseminate them back out the program network for the benefit of other program teams. Berends and Lammers (2010) argue that discontinuities can create interruptions to these “learning trajectories” and for the social structures underlying organizational learning processes, power relations and politics “can enable or deny access to learning practices” and “provides means to influence organizational learning processes” (p. 1048-1049; Contu & Wilmott, 2003). The data illustrated that power and politics, both internal and external to the program teams, influenced CRSP/IL capacity building efforts. For instance, when the USAID Feed the Future
initiative was launched, external political pressure required the ME and program teams to shift
capacity building resources from countries where PI researchers had long-standing relationships
to countries where these relationships needed to be developed (Subject CA2, personal
communication, January 27, 2014; Subject S11, personal communication, October 22, 2014).
Another example involved political pressure to focus CRSP/IL HICD efforts on the technology
transfer or associate award work of USAID mission projects as a way to demonstrate more
immediate program and capacity building outcomes, than the longer timeframe required for
capacity building outcomes associated with the US researcher – student – international
researcher model (Subject CA2, personal communication, January 27, 2014).

Speaking of time, the other source of discontinuity in organizational learning processes
that Berends and Lammers (2010) explored was the temporal structuring of organizational
learning. The authors argue that these temporal structures can be based on different “conceptions
of time” such as “clock time” (how long it takes to do something as measured by clocks and
calendars) and “event time” (time driven by occurrence of various events) (Berends & Lammers,
2010, p. 1049). Both clock and event time influenced the HICD activities of the CRSP/IL
program network teams. For example, in terms of clock time the data showed that the actual time
the program teams were able to work in-country was usually limited to a few weeks and several
respondents talked about the limited time they had to devote to project activities including
capacity building work (Subject S1, personal communication, August 12, 2013; Subject S3,
personal communication, October 28, 2013). Clock time also came into play for the annual
reporting, technical committee, and work plan cycle. The need to provide official reports on at
specific dates on the calendar did not necessarily align with HICD efforts like working with
students or partner researchers who may have needed more or less time to achieve institutional
capacity building outcomes. Event time also created discontinuities for organizational learning processes. Berends and Lammers (2010) point out that “the timing of organizational routines, for example, may be triggered by events (p. 1049). For the CRSP/IL program teams, a number of events fell into this category. For instance, USAID data calls would require PIs to divert from planned activities, including HICD work, to respond to requests for various program metrics, while events focused on collaboration such as ME conferences and USAID agricultural meetings, often required the program teams to create presentations and/or research reports that deflected from their time with their research teams and end-users.

In summary, learning between organizational levels is a complex endeavor influenced by a number of internal and external factors. Even with HICD work which the CRSP/ILs were recognized for doing well, underlying social and temporal structures created discontinuities in this effort that obstructed the linkage of learning at the individual level with institutional level and prevented the flow of learning practices within and across the CRSP/IL program networks.

The second theoretical implication from the findings I highlight focuses on the situated nature of organizational learning and its connection with practice. Earlier in the summary of findings section, I discussed Erkelens et al. (2015) knowledge pollination concept to help understand the role that individuals could play within an organization or network to assist in un-embedding knowledge from a practice grounded in one local context, and re-embedding that practice within a different context, somewhere else in the network. The individual component of CRSP/IL HICD work, which focused on developing skills and abilities of farmers, students, researchers, and others with the expectation that those individuals would return to their home organizations to develop institutional capacity, relied in part on this knowledge pollination
approach. But as was pointed out in the last section, individual situations can change and those who were expected to spread their newly developed knowledge to other contexts, may no longer have been in a position to do so. In addition, it is also important to consider the possibility that HICD efforts focused on individuals in one local context, may not have been applicable to other contexts because learning practices were tightly integrated with specific contextual environments. The challenge for NAOs tasked with leading goal-directed networks is how best to recognize this limitation in regards to working with individuals and to consider other ways of institutionalizing learning practices within and across their program networks.

An alternate way to consider the challenge of replicating learning practices from one local context to another within an organization or network draws on practice theory literature. Gherardi (2006) breaks down the practice-based view of organizational learning into three types of relations between practices and knowledge that are relevant to this discussion. The first is “containment,” which characterizes knowledge as a process that occurs within situated practices and acknowledges that practices have been “constituted as objective entities” … “about which practitioners already have knowledge” and “recognize as practices” (Gherardi, 2006, p. 38). Nicolini (2011) argues that this social containment is most closely associated with communities of practice where “knowledge is the property of individuals of a collective” and where “knowledge is shared and perpetuated by socializing newcomers” into “patterns of relationships” associate with particular activities (p. 603; Brown & Duguid, 1991; Wenger, 1998). The CRSP/IL efforts to train graduate students in well-established agricultural development techniques embraced by the community of researchers and scientists engaged in this type of work, to have the students learn by modeling existing practices “owned” by this particular community and eventually pass along what they had learned to future graduate students and
newcomers to the profession, exemplifies this social containment view of practice-based learning. The second type of relation between practice and knowledge that Gherardi (2006) defines is “mutual constitution” which describes how “activities of knowing and practicing are not two distinct and separate phenomena” but “instead, they interact and produce each other” (p. 38). This aligns with my earlier discussion of know-what and know-how linked together as learning practice. In the case of the CRSP/IL programs, this mutually constitutive relationship between knowledge and practice described several of the learning examples I found in the data, including the production of IPM packages and dissemination of techniques to apply them, photo-voice techniques used for developing knowledge in Horticulture CRSP/IL workshops, and in HICD work where training farmers, for example, often led to new discoveries that applied to local contextual conditions (Subject CA3, personal communication, January 28, 2014; Horticulture CRSP Annual Report 2011-2012, p. 139). The last type of relation Gherardi (2006) describes is “equivalence”, a view that no primacy of knowledge is given to an individual subject, or even to knowledge codified in a routine or procedure, before that knowledge is applied as a practice (p. 39). In other words, knowledge creation is tied to an activity and “knowledge [is] formed in the action itself and by means of it” (Gherardi, 2006, p. 39). Nicolini (2011) expanded on this third relationship by exploring “practice as the site of knowing,” arguing that “knowing is both sustained in practice and manifests itself through practice” adding that individuals are not the only source of knowledge or knowing, as knowledge cannot be considered separately from practice, but rather, is created through the “knowledge-in-action” of organizational practices “situated in the historical, social, and cultural context from which it arises” (Nicolini, 2011, p. 602). Through a longitudinal study of a telemedicine system, Nicolini (2011) also discovered that “the site of knowing is never a single practice but a set or nexus of
interconnected practices” where “the knowing implicated in the activity” … “transpires, in fact, through more than one person’s conduct and artefacts” (p. 614).

When applied to the CRSP/IL HICD findings, the Gherardi (2006) concept of “equivalence” and Nicolini’s (2011) “practice as the site of knowing” approach are helpful in explaining some of the challenges faced by the CRSP/IL management entities as they tried to replicate learning practices between individual programs. For instance, while the IPM ME and its program teams delivered similar pest management trainings to farmers, directed at similar crops, and using well tested methods, the variables related to that training were always different. Whether there were obvious differences like the training being held in different microclimates, instances where participants spoke a different language than another audience for a similar training, or different groups of people attending, or less obvious differences, like political instability creating anxiety and distraction for those participating, the time of year creating challenges for travel, or unseen pressures on the instructors themselves, the learning practice was always unique. The practice as the site of knowing, as Nicolini (2011) described, was not a single practice but an interconnected nexus of many practices and therefore, very difficult to replicate. Given this complexity, the CRSP/IL MEs were challenged with the need to create the conditions for practice to emerge in different contexts as way to create learning practices, rather than trying to duplicate the practices themselves or relying solely on individuals carrying knowledge to other contexts. Fortunately, Nicolini (2011), building on the work of Czarniawska (2000), Latour (2005), and Lindberg and Czarniawska (2006), presented the concepts of “translation by contact” and “translation at a distance” as mechanisms to keep different knowings together and help establish this nexus of dispersed practices as the “site” of knowing for an organization (p. 614). The concept of “translation by contact” involves “weaving
knowledges together through discourses, artifacts, and spaces” to “capture the work and effort necessary to sustain connections in action that bring together dispersed knowledges,” while “translation at a distance” is about “making knowing exist in more than one place at a time” as “many forms of knowing originate far from the scene of action” (Nicolini, 2011, p. 614-615). The discursive practices Nicolini (2011) refers to as part of translation by contact include conversations, dialogue, and discussions, mechanisms where different knowings are “reenacted and challenged” and that the author argues, “are all activities that establish more or less durable associations between practices and knowledges” (p. 614). In addition to discursive practices, translation by contact includes material and symbolic artifacts which serve as mediators to help bring different knowledge together and physical space as a force to connect different knowings (Nicolini, 2011). Material and symbolic artifacts are analogous to boundary objects which I have discussed at length in this and earlier chapters, while physical space could be a room where people connect, a desk to collate important mediating artifacts in once place, or in the case of the CRSP/IL HICD trainings, a farmer’s field that creates a contained space in which to help bound and define the practice. Translation by a distance, meanwhile, is focused on “circulating knowing in practice and linking parties together in such a way that knowing is then in more than one place at any one time” (Nicolini, 2011, p. 615). Nicolini (2011) argues that “although knowledgability cannot be transferred like an object or substance, it can be translated and tentatively reproduced elsewhere in time and space,” which occurs by disembodying the knowing from one context, materializing it into a mediator and “somewhat” retranslating the knowing “in view of the new contextual conditions and existing practices” of the new location (p. 615).

While most of the findings on CRSP/IL HICD work focused on building the capacity of individuals and building the capacity of institutions by way of those individuals, this practice-
based approach is not beyond the capabilities of the CRSP/IL management entities as some examples from the data mirror already employed elements of this approach. One example are the IPM packages which include the above mentioned mediators in the form of detailed instructions, procedures, and recommendations for how to deploy the packages in different environments. Another example from the HICD findings are the facilities (IPM Ethiopian Quarantine Lab, and Horticulture Regional Innovation Centers) that the CRSP/IL programs helped to launch. These physical spaces not only included mediators and served as physical locations to convene practices, but also facilitated discourse among scientists, students, end-users, and government officials. As CRSP/IL program team members and local staff conducted work in these spaces, knowledge and practices were co-created, joining a nexus of other practices related to the associated work of the facilities (such as releasing beetles against the Parthenium weed in the case of the Ethiopian facility) creating a nexus of practices that could be translated by the MEs, institutionalized at the network level, and re-translated in another regional context to serve as a starting point for creating a whole new nexus of practices. Individuals tasked with leading network administrative organizations are in a position to recognize the situated nature of organizational learning for institutionalizing knowledge in their networks by understanding both the connections that individuals have with the contexts in which they learn (Crossan et al., 2011) and the relationship between local contexts and the site of knowing as a nexus of interconnected practices (Nicolini, 2011).

**Implication of Findings for Practice and a Preliminary Framework for NAO Practitioners**

Taken as a whole, the findings also offer a number of practical implications that can be consolidated into a preliminary framework, useful for professionals tasked with leading network
administrative organizations. Similar to the theoretical implications of the findings shown in Table 2, I have structured the framework along the same lines as my research question, categorizing its elements in terms of potential NAO actions that enable, manage, and leverage organizational learning for innovation. Table 2 provides a summary description of this preliminary framework for NAO leaders, followed by a discussion of the framework including implications of the findings for practice.

<table>
<thead>
<tr>
<th>Enable</th>
<th>Manage</th>
<th>Leverage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Create the environment for learning (formal and informal)</td>
<td>Help create, or facilitate the creation, of network learning practices</td>
<td>Make knowledge stick by institutionalizing the learning of individual members</td>
</tr>
<tr>
<td>Create opportunities for virtual engagement, but be prepared to overcome resistance</td>
<td>Work to develop a “base of knowledge” among network partners, and dedicate the resources required to learn collectively as a network</td>
<td>Utilize network-wide structures, systems, procedures, and learning products to develop organizational memory</td>
</tr>
<tr>
<td>Foster the development of network communities to share more than common knowledge</td>
<td>Participate as members of network communities to be well positioned for sharing learning practices</td>
<td>Leverage boundary objects as mechanisms for creating understanding across communities and negotiating shared objectives</td>
</tr>
<tr>
<td>Take purposeful actions to ensure knowledge moves between and among network members</td>
<td>Embrace partnership building and be prepared to seek out new partners on behalf of another member or stakeholder</td>
<td>Be prepared to engage with partners in unfamiliar ways when knowledge transformation is required to address novel problems</td>
</tr>
<tr>
<td>Negotiate mutual understanding and incentivize to free knowledge at stake</td>
<td>Identify boundaries and negotiating positions to help broker solutions and avoid boundary entanglements</td>
<td>Foster learning-in-working to institutionalize new learning practices emerging through the work of network members</td>
</tr>
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Table 1 – Preliminary Framework for NAO Practitioners
Enabling Organizational Learning

Enabling is a key element of the preliminary framework. The NAO’s ability to create an environment for organizational learning to occur will greatly enhance the prospects that knowledge will be shared within and across the network. Much like the IPM and Horticulture CRSP/IL MEs were able to do for their respective program networks, NAOs must take advantage of their position in directing network activities to create spaces where formal and informal knowledge can be created and shared. The creation and sharing of formal knowledge is usually associated with premeditated structures that foster dissemination of explicit knowledge like training, university education, and professional development. The CRSP/ILs MEs enabled structures for this formal learning by developing official CRSP/IL technical trainings, sponsoring graduate student degree programs, and conducting workshops for CRSP/IL program team and partner scientists. Processes in support of the goal-directed work of the network like the annual report and work plan writing activities for the CRSP/ILs, also brought network members together in a space for knowledge creation as well. Learning-in-working was another source of knowledge creation I discussed and was used by the CRSP/IL MEs to enable learning within and across the network. The Trellis program conducted by the Horticulture CRSP/IL was one program that fostered learning-in-working experiences by embedding graduate students with local practitioners and scientists to address short-term applied projects. NAO leaders should be aware that with nearly every structured environment created to facilitate formal learning and knowledge sharing to take place, there is often an ability to use those same venues, events, and structured experiences, as environments for informal knowledge development and dissemination. Spaces for informal knowledge sharing can include the hallway conversations between attendees at conferences, the experiential takeaways from working with end-users by actually performing
on-the-ground network activities, and time spent learning other peoples’ work and work styles as part of traveling and working in different contexts. The practical implication for NAO leaders is that well-designed structured network activities can enable the kind of formal and informal learning that goal-directed networks need to continuously innovate.

Given the dispersed nature of networks, facilitating face-to-face events, meetings, and work experiences among network members is not always an option for NAOs. When NAO leaders cannot physically convene network members, engaging with them virtually becomes a viable option for knowledge creation and sharing. The findings showed that enabling learning through virtual engagement was another strategy that the CRSP/IL MEs employed to foster an environment for organizational learning with network members. In the case of both CRSPs/ILs, interview subjects described daily email communication between the NAO and PIs, meetings among their teams and project network members held using online videoconferencing tools like Skype, and the use of online webinars that provided a more scripted platform where PIs, government policy specialists, or scientific experts could present on a topic and solicit questions from a globally dispersed audience. Sometimes virtual knowledge sharing took the form of asynchronous information management systems, such as digital libraries, knowledge databases, and CRSP/IL websites, which were valued differently by the interview subjects depending on the respondents’ role in the project. The MEs and USAID seemed to be proponents of knowledge management systems as a way to share knowledge, while PIs tended to be less enthusiastic about the value of the material available within these systems as a source of learning or resistant to using them for their particular projects (Subject O1, personal communication, April 8, 2015; Subject S3, personal communication, October 28, 2013; Subject S9, personal communication, September, 29 2014). The knowledge management literature explores this issue of virtual
engagement at length and as studies show, there are a number of factors that go into the investment decisions for building institutional repositories and using internet-based technologies for synchronous virtual communication. Ultimately, NAO leaders need to evaluate for their particular program network whether the return on investment of implementing these types of systems and processes, are justified by their use and benefit to stakeholders.

One of the implications from the findings discussed earlier in the chapter and relevant to NAO practitioners, is that certain types of knowledge can transfer relatively easily within the network because it is considered common knowledge and does not require interpretation or negotiation to move between network members (Carlile, 2004). To enable the flow of more complex knowledge that requires translating or transforming that knowledge (Carlile, 2002, 2004), NAO practitioners should consider creating communities of practice to help bring network members together. The community of practice (CoP) approach, discussed at different times in the dissertation, can be a physical or virtual group that convenes around a common interest area, can operate outside of a network members’ home organization, and can include individuals and groups that can cross organizational lines (Lave & Wenger, 1991; Wenger, 1998). Communities of practice have the potential to be particularly effective mechanisms for NAO practitioners to foster learning within the network environment because they involve ‘learning by doing’ exemplified in the work practices of members (Wenger, 1998) The explicit and tacit knowledge produced and shared through the work of CoP members, the know-what and know-how of learning practice, is valued by members of the community because it is mutually constituted through shared experiences (Wenger, 1998).
The central hub position afforded to the NAO by way of its responsibility for directing the activities of the network, would seem to include a central role in enabling the knowledge flows within and among program network members (Lemaire, et al., 2017). The findings demonstrated that for certain types of knowledge like administrative and program information, this was the case. In terms of dealing with challenging problems though, as the findings on the CRSP/IL program networks demonstrated, knowledge related to solving complex or novel problems did not flow as anticipated. For the IPM and Horticulture CRSP/IL management entities, operating in the hub position of the network did not always guarantee that project team members sought knowledge or shared project related knowledge with them. I gave examples where PIs had reached out directly to peers in their discipline within their own professional networks, or to members of their program teams, rather than to the management entity. I found this to be an occurrence among my interview subjects when project PIs indicated they were seeking research-related information, or when they were sharing research-related knowledge associated with solving novel problems. The implication from this finding for NAO practitioners is that even when operating in a central hub position as an NAO, knowledge associated with solving novel problems may not always naturally ‘feed forward’ from the organizational network members to the central hub as expected. Therefore, enabling involves the NAOs operating in a central hub position, but not relying on that advantage. In situations where knowledge may not naturally feed back to the NAO on its own, it will require purposeful actions by the NAO to ensure knowledge moves between and among network members. NAOs may consider creating the spaces for formal and informal learning and knowledge sharing discussed earlier in this section as ways to be part of the knowledge flow by facilitating the venue for exchange, incentivizing network members to participate in these collaborative forums. Actively engaging as
members of a network community, community of practice, or professional group, as just
discussed, may also be a purposeful action that NAOs should consider. NAO practitioners must
also recognize where they add value in the process and acknowledge when their participation in
the flow knowledge in dealing with novel problems creates impediments to learning among
network members. If all knowledge flowed through an NAO without the benefit of exchanging
knowledge in the environment outside the network, the NAO risks assuming a path where no
new ideas and solutions are applied to complex problems and innovation is stunted.

An important implication from the findings for NAO practitioners to consider are the
unique challenges they may encounter when working with individuals who consider their
knowledge at stake. Even in a network where knowledge may be flowing as intended, some
individuals may resist sharing their hard earned knowledge over concerns that they may lose
control, or because what they believe they know may lose its relevance when directed at
addressing novel issues elsewhere in the network. The 4I learning processes do not account for a
situation where knowledge does not feed forward into the organization or network because it is
purposefully being withheld. NAOs leaders must be able to recognize these pockets of
knowledge at stake among individuals or organizations within the network and be prepared, as
Carlile (2004) indicates, to spend more time in order to gain access to and ultimately, transform
this knowledge together with those who resist sharing it with others. Enabling in this
circumstance may require NAOs to incentivize these individuals to share their knowledge or to
create a less threatening space where a mutual understanding can be created where both sides can
benefit. Transforming knowledge requires considerable trust between the individual and the
NAO and NAO practitioners should be prepared to devote time and energy to building the
necessary relationships for supporting this activity (Carlile, 2002, 2004).
Managing Organizational Learning

NAOs need to help create, or facilitate the creation, of network learning practices. NAO practitioners must take advantage of the environments or sites of learning that they have enabled, so that they can further nurture the development of learning practices (know-what + know-how). As I discussed earlier in the chapter, these bring together the cognitive and behavioral knowledge elements of learning, the explicit and tacit knowledge together, and can be associated with specific contexts (Brown & Duguid, 1998). Sometimes, managing involves an NAO taking an active role in working to create learning practices. Other times, NAOs support network participants engaged in efforts to generate new knowledge and ways of knowing, like when attempting to solve complex problems, research new processes, or undertake experiential learning opportunities. NAOs also need to administer network processes that help disseminate learning practices across the network and participate as a member of network communities to help ensure that they are part of sharing learning practices.

One of the implications from the CRSP/IL findings for NAO practitioners, is that institutionalizing learning practices at the network level requires developing the organizational capacity among network partners to be able to implement the know-what and know-how embedded in those practices, and instill the wherewithal to disseminate those practices to end-users, if that is an element of the network’s goal directed activities. Cohen and Levinthal (1990) called this concept absorptive capacity, the ability of an organization to accept new learning because their base of knowledge allows them to assimilate the transfer of that knowledge. I believe in this circumstance, it applies to the network level as well, where the NAO must cultivate its network organizational partners, spending the necessary time and resources to create
a “base of knowledge” concerning network goals and activities, so that those organizations are able to embed and leverage new learning practices. The findings showed that not all CRSP/IL network members or stakeholder partners were in a position to use a particular learning practice because they didn’t have the base of knowledge necessary to benefit from the practice. The institutional capacity building component of the IPM and Horticulture CRSP/IL HICD work was designed to create this base of knowledge among in-country university collaborators, NGO partners, and peer research organizations. The goal of the CRSP/IL MEs was to instill a level of knowledge among its institutional partners so that the agricultural development work started during the performance period of the program could be sustained once the program ended. While not all goal-directed networks will have the absorptive capacity challenges among institutions like those faced by the CRSP/IL program network, NAO practitioners should consider the possibility that they may need to help develop a “base of knowledge” among their network partners to learn collectively as a network. This could be particularly true when the network is built with members representing different sectors using different language or terminology to describe their work, or in periods of problem novelty, when innovation creates a knowledge gap requiring all network partners to catch up to a new base of knowledge.

While NAOs are capable of enabling new communities of practice to foster knowledge creation and sharing among network members, sometimes network communities have already been established formally or informally by groups of network members. In this circumstance, it is important for NAO leaders to participate as members of these communities so that the NAO is well positioned for contributing to the creation and sharing of learning practices by being part of the community conversations. Often, this will require purposeful actions on the part of the NAO leaders to earn the trust of community members, as well as a commitment of time to participate
in community activities. One of the ways that CRSP/IL NAO leaders did this was to participate as presenters at scientific conferences, USAID sponsored meetings, and regional CRSP/IL program events so they could connect with people inside and outside of the network concerning the work taking place within the CRSP/IL programs. CRSP/IL NAO leaders also regularly visited regional project sites to connect with program team members and experience the local context for each project first-hand. These trips allowed the CRSP/IL NAO leaders to become more familiar with the local, often informal communities, which consisted of CRSP/IL program team members, local partners, end-users, and others, working to achieve the goals for each particular project. Spending time on the ground and interacting with the people doing the project work specific to that local context, fostered shared experiences, creating an environment of mutual understanding where complex knowledge could be more readily translated or transformed (Carlile, 2002, 2004).

Also of importance to NAO practitioners, NAOs should embrace partnership building and be prepared to seek out new partners on behalf of another member or stakeholder. One of the aspects of the network governance model that makes it so attractive for use in delivery of public services, like the CRSP/IL programs, is that networks bring together many different types of organizations with a variety of capabilities (McGuire, 2006; Provan & Milward, 2001; Raab et al., 2015). As a collective whole, organizations participating in networks have a far greater reach working together, than operating as separate organizations independently trying to achieve the same objectives (Kettl, 2000; McGuire, 2006; Provan & Milward, 2001; Raab et al., 2015). The findings illustrated that some of the key duties of an NAO involved its responsibilities for seeking out new partners, establishing strong, collaborative relationships, and regularly engaging with those partners to ensure that expectations of all parties were mutually aligned. The CRSP/IL
NAO partnering activity illustrated that managing organizational learning sometimes involved partnership building on behalf of another member or stakeholder as well. The implication for NAO leaders is to recognize that they are in a key position to connect individuals and organizations inside and outside of their network. Serving in this partner building role requires a concerted effort by the NAO to be actively advocating on behalf of network members so that they can effectively make connections on their members’ behalf. Additionally, in cases where the NAO is working to address novel problems, learning for innovation in other words, may require more deliberate and sustained actions on the part of the NAO to identify and cultivate new and existing partnerships. Scholars have used the term “broker” to help visualize this active role that NAOS can play by facilitating the creation, sharing, and mediation of knowledge (Evans, 2010, p. 876; Provan & Milward, 2001, p. 418; Raab et al., 2015, p. 488). Broker organizations are often tasked with navigating and sometimes spanning, boundaries of all types to facilitate network activity, including but not limited to, identifying new partnerships, connecting partners to work on common areas of interest, managing knowledge exchange between partners, and negotiating disputes between partners when they arise.

Finally, managing organizational learning also requires NAO leaders to be able to identify and work within or across boundaries that emerge as a result of these network partnerships. Often, this will involve identifying boundaries and negotiating positions to help broker solutions and avoid boundary entanglements. While some of these boundaries, like learning and knowledge boundaries can be identified relatively easily, others are less predictable and may involve unanticipated issues that impact learning within the network. In order to manage these boundaries, NAO leaders need to know what boundaries exist, where they are located, and who is involved. NAO practitioners also need to understand the various perspectives
underlying the boundaries so that they can help to broker solutions during boundary disputes among partners, proactively avoid potential boundary entanglements, and negotiate with partners to help all parties coalesce around network goals. For NAO practitioners, it is first important for NAO leaders to identify, as best they can, the different boundaries impacting learning within their networks. The CRSP/IL case study data showed a considerable variance among respondents in how they defined boundaries. Some of this variance may be attributable to the role and responsibilities of respondents, such as PI program team leaders who identified boundaries related to academic publishing and public data. However, not all respondents defined boundaries consistently based on “where they sat” organizationally within the network. Those individuals tasked with leading NAOs should consider mining the network through regular communication with their own team and those contacts from their organizational partners, to identify the different learning, knowledge, and other boundary types impacting the work of their network.

Second, it is important to understand what issues are motivating different parties on either side of a boundary, in order to be able to help navigate that boundary on behalf of the network. Boundaries often exist because of differences between individuals or organizations around complex issues. Understanding the issue and the perspectives of each party allows the NAO to foster negotiation and where appropriate, offer solutions to bridge these divides and create a common agreement for moving forward. In learning and knowledge boundaries, this sometimes involves the NAO facilitating knowledge sharing when one party or another is unwilling because their knowledge is at stake as discussed earlier. In this scenario, much like the example provide earlier concerning the boundary between regional projects and global theme projects in the IPM CRSP/IL, part of the NAO’s responsibility is to help reconcile the differences through
negotiation, incentives, or other means, so that the boundary can be crossed and knowledge can flow within the network as expected.

Leveraging Organizational Learning

For an NAO, a core responsibility is retaining the knowledge and ways of knowing generated through the work of network members to help achieve network goals. In other words, NAOs need to make knowledge stick by institutionalizing the learning of individual members. According to Crossan et al. (1999), “institutionalization is a means for organizations to leverage the learning of the individual members” (p. 529). I have discussed Crossan et al.’s (1999) institutionalization learning process at different points in the dissertation and shared a number of examples where the CRSP/IL MEs leveraged the knowledge from their program team members and partners by institutionalizing that knowledge in different ways. While enabling and managing are about getting knowledge flowing within the network, institutionalizing knowledge is about making it stick at the network level so that it can be put to work for the benefit of other network members. Some of the more structural ways that NAOs can do this are by developing systems that monitor the work of the network, encouraging network members to communicate to the NAO about new innovations and solutions, and establishing metrics to track program network activity and using those evaluation results as opportunities for learning. Learning can also be facilitated by the NAO and network members by creating reports, publications, multimedia, websites, and other communication products that leverage learning practices and help to establish an organizational memory based on the use of the network knowledge at a given time, and for certain contexts. The findings showed that the CRSP/IL MEs actively engaged in creating official reports and publicity materials documenting the program network’s activities.
These materials not only helped to make knowledge stick, they also kept external stakeholders and the broader development community informed of the CRSP/IL project work and were used to rally continued support and funding. NAO practitioners can employ strategies to help institutionalize knowledge across their own networks.

An NAO’s role in enabling, managing, and leveraging organizational memory on behalf of the network is an important consideration for NAO practitioners. Olivera (2000) argues that “the benefits of collecting, storing and providing access to experiential knowledge are particularly relevant for multi-unit organizations where knowledge acquired at one site can be beneficial to others sites” (p. 811; Goodman and Darr, 1996, 1998). While networks consist of more than one organization, Olivera’s argument still holds true as the key consideration for NAOs is how to maintain and disseminate experiential knowledge from one network member to another (Olivera, 2000). Tsang and Zahra (2008) meanwhile, discuss organizational learning by using the metaphor of storage bins, one human and the other non-human. The human aspect of organizational memory focuses on the individual who accumulates knowledge and experience and shares that knowledge and experience by moving through the organization and interacting with others (Tsang & Zahra, 2008). The non-human storage bin involves knowledge recorded in artifacts such as formal regulations, computer software systems, reports, and routines for example (Tsang & Zahra, 2008). Importantly, Tsang and Zahra (2008) point out that while “a routine may be recorded in both human and non-human storage bins” … “the performative aspect often only involves human storage bins” (p. 1445). I discussed the concept of organizational memory earlier in the chapter and argued that within a network setting, organizational memory needed to account for learning practices that combined the know-what with the know-how of putting that knowledge to work. I provided the example of the IPM
packages as one instance of this for the IPM CRSP/IL program network and illustrated how the NAO had created structures and procedures for leveraging IPM packages for use in other regional contexts. Individuals tasked with leading NAOs need to be aware of this connection between the human and non-human elements of organizational learning. The NAO should utilize network-wide structures, systems, procedures, and learning products to develop organizational memory, but critically, cannot rely on these mechanisms alone to be instruments for leveraging organizational memory. NAOs should need to connect, the performative, human element necessary for utilizing these non-human measures.

For NAOs, leveraging also involves institutionalizing knowledge from different communities (pull) and creating feedback loops to share knowledge back out to those communities (push). NAOs need to engage with different communities as active members, as well as serve as a bridges between them, in order to be in a position where they can initiate this pull/push action. Network communities carry different levels of expertise, may include individuals who come from different professions, or even share different goals for the project. One way that NAOs can connect these communities is to leverage boundary objects as mechanisms for creating understanding across communities and negotiating shared objectives (Akkerman & Bakker, 2011, Carlilie, 2002, Star & Griesemer, 1989). NAOs practitioner leaders can initiate the use of boundary objects to help leverage knowledge on behalf of network communities. Boundary objects can be anything that two or more communities share in common that serve as a way to translate between communities, create new terminology, define new procedures, and ultimately, create new learning practices (Akkerman & Bakker, 2011, Carlilie, 2002, Star & Griesemer, 1989). For the CRSP/IL MEs, the annual report document served as a boundary object for the networks, a space where research learning outcomes could be presented.
in a consistent manner and where a shared understanding of project level indicators allowed for knowledge to be absorbed within the participating networked organizations. The process of developing the annual report, while viewed by some as an administrative burden at times, also created a space for organizational learning as it forced program participants to reflect on positive and negative results from the short and long term training activities of the project, the research outcomes, and the impact the project had on the end-user farmers and their communities.

The ability of an NAO to leverage learning practice may be hampered by the nature of the knowledge itself. In situations of high problem novelty, in order for knowledge to be institutionalized, it may first need to be transformed into new forms of knowledge where no common language may exist or way of solving the problem has been agreed upon (Carlile, 2004). Leveraging in this circumstance goes beyond institutionalizing common knowledge like program and administrative information, or translating knowledge to establish a consistent way of discussing issues between people or communities. Leveraging involves transforming knowledge that encompasses considerable interaction from those involved, it requires each network partner to step out of their comfort zones, work across boundaries, enter into new territory where knowledge must be defined, and collaborate in an arena without rules for interaction (Carlile 2002, 2004). The high degree of problem novelty in this instance also generates competing interests between network members making sharing and collaboration more difficult (Carlile, 2004). Carlile (2004) describes knowledge transformation as a political process in this circumstance because agreement must be negotiated and knowledge is regularly contested by different organizations with their own vested interests. Therefore, NAOs need to be prepared to engage with partners in unfamiliar ways when knowledge transformation is required to address novel problems and help to navigate the political nature of this knowledge
transformation process, which at times, requires serving as the arbiter between network members.

NAO leaders should consider fostering learning-in-working to institutionalize new learning practices emerging through the work of network members. For NAO leaders, another way to think about this is closely related to what Marabelli and Newell (2012) call knowledgeability. This term describes how knowledge is always being developed through everyday activities, built from hands-on learning, grounded in the context of where the knowledge is being developed and inseparable from the material elements that individuals use in their work (Marabelli & Newell, 2012; Orlikowski, 2006, p. 460). This perspective is based on the premise that knowledge cannot be separated from practice and that knowledgeability is demonstrated through the practices that emerge through work (Marabelli & Newell, 2012, p. 19). Therefore, a NAO’s ability to leverage the learning of their network team members to innovate is aligned with how well they foster learning-in-working opportunities among network members, so that the new learning practices emerging through this work can be institutionalized (Brown & Duguid, 2001). In addition, as network partners come together to address complex problems requiring novel solutions, the practices through which they conduct their work become a mechanism by which knowledge can be transformed. NAO leaders need to recognize this opportunity and structure their relationships with network members to facilitate and capitalize on these emerging learning practices as pathways to innovation.

**Limitations of the Research**

There are several important limitations to this research. First, my case study was based on data associated with two CRSP/IL program networks. These two purposely chosen cases
produced adequate data for the study and afforded me the opportunity to provide a rich level of detail concerning the CRSP/IL program networks that I would have been more difficult to achieve with a larger-N study. However, the tradeoff of using this approach was that it limited my ability to make generalizable conclusions concerning how similar program networks may operate in terms of their organizational learning work.

A second limitation of the research is connected with the time period for the study, 2009-2014. The IPM CRSP/IL project was entering its fourth phase as a program network during the study period, while the Horticulture CRSP/IL was embarking on its first. I was able to compare the data across program phases, as both operated with similar NAO structures for operating as MEs and each encountered a shift towards the Feed the Future initiative at the behest of USAID at the same time. However, there were instances when each CRSP/IL reported project outcomes that were clearly at different levels of maturity, or in the case of the IPM CRSP/IL, may have introduced historical data drawn from prior work when discussing then current programs. This could create a circumstance where the experience of one CRSP/IL over the other might have impacted the data unintentionally.

Lastly, the study could have been further enriched by employing a more ethnographic approach to capture primary data on the personal interactions, research discussions, and local contextual influences on CRSP/IL program network activities. Participant observation of the work plan creation process, being part of a regional conference, seeing how the knowledge from local farmers changed the behavior of the scientist, to name a few examples, would have provided an opportunity to witness learning practices as they were being created and shared among network members. While this research method was not part of the study given the limited
scope, available time, and lack of access I had at this level, including this technique in future research would bring a new element to the analysis and serve as an additional way to triangulate the documentary and interview data with first-hand researcher accounts.

**Conclusion and Areas for Future Research**

In this final chapter and for the dissertation, the findings illustrate how the management entities, operating as network administrative organizations, assumed an active role on behalf of their goal-directed networks in facilitating the sharing of knowledge, institutionalizing that knowledge as learning practices, and navigating boundaries that contributed to organizational learning, within and across their networks. Additionally, the proposed incentivizing and incubating processes add value to the Crossan et al. (1999) 4I framework, contributing to a better understanding of organizational learning in a network setting by illustrating the importance of enabling an environment for learning, bringing network partners together through enticements, finding ways to motivate adherence to shared goals. The result is the creation of structures and routines for sustaining learning, and investing the time and resources for developing learning practices among partners in situations of program novelty when knowledge must be transformed. The preliminary framework I propose also makes a contribution to the field by helping individuals tasked with leading NAOs consider specific actions they can use as a result of these findings. Actions such as creating opportunities for virtual engagement, embracing partnership building on behalf of the network, and utilizing boundary objects to bring network partners together to negotiate common goals, helps NAO leaders enable, manage, and leverage organizational learning associated with the boundary work of their program team representatives to innovate as networks.
While the CRSP/IL case study helped to address my overall research question, a number of areas emerged that should be considered for future research. First, the preliminary framework for NAO practitioners can be evaluated by different NAOs for use in other types of networks. While the framework is not a prescriptive model, it can serve as a starting point for NAOs leaders as they work to maximize organizational learning within their networks for purposes of innovation. Another area of future research would be to extend the research to include other CRSP/ILs that were not led by network administrative organizations to see if the learning dynamics are different. While I was able to perform a cross-case comparison of the IPM and Horticulture CRSP/ILs, for elements of their network-level goal-directed activities such as capacity building, it would be interesting to learn how CRSP/ILs operating under different management structures conducted their HICD work. Exploring other program networks within the international development community would also be a rich area for further research. In particular, one area that surfaced during the interviews was the difference in how programs funded by private foundations operated versus those funded by public agencies such as USAID. Subject S3 for instance, compared the Bill and Melinda Gates Foundation with USAID, pointing out that Gates funding was less restrictive and required less reporting, was more accessible with less visa restrictions for international student participation and was focused more on local socioeconomic impacts and less on scientific outcomes (Subject S3, personal communication, October 28, 2013). It would be beneficial to the field to explore similarities and differences of organizational learning in these different private and public networks. Lastly, it would be interesting to delve deeper into the professional rewards/incentives versus public data dissemination issue that emerged as a boundary in my research. While the circumstances I discovered in the data related to academic incentives weighed against broad sharing of data by
the funder, the issue could be broadened to investigate how conflicting incentives impact organizational learning in multiple program network environments.

The USAID sponsored Integrated Pest Management and Horticulture Innovation Labs for Collaborative Research were excellent cases to explore organizational learning in a network setting. These are truly transformational programs, where program team members worked every day to find new ways to eliminate destructive pests, grow better and more nourishing vegetables, advance the skills, knowledge, and abilities of farmers, and partner with international colleagues and the institutions they represented to carry on the work beyond the project team’s involvement. It is important for scholars and practitioners in the field of public administration to recognize the importance of organizational learning in program networks like the CRSP/ILs. It is also valuable to understand the role of network administrative organizations in enabling, managing, and leveraging this learning. NAOs assume a key responsibility for ensuring that this learning becomes the foundation for meeting network service goals and a major instigator for directing organizational learning towards ongoing innovation for solving wicked problems.
References


Appendix A: Interview Protocol

Title of Project: Managing Organizational Learning through Boundary Spanning Collaboration – Dissertation Research

Investigator(s): Scott Weimer

Part A: Background and leadership role within CRSP

1. Can you tell me about your position with the ______ IPM program?
   a. How long were you a ___(position name)?
   b. What were your responsibilities in that role?

2. As a _______, with whom in the ___ IPM management entity do you regularly interact? With whom outside of the management entity, but within the IPM network do you regularly interact?

3. Describe how in your position, you share program knowledge with IPM management entity leaders, USAID personnel, program PIs, and other IPM program leaders from outside your own institution?

4. How does your own organization manage administrative and/or scientific knowledge generated through your work? How about for other individuals or organizations within your IPM network?

5. What skills or characteristics do you believe make for successful sharing of program knowledge and information across organizational boundaries? What boundaries do you feel exist and between whom?

6. How do you motivate your colleagues to learn about your work? How are you motivated to learn about IPM administrative matters or other individuals work?

Part B: Personal perspectives on boundary spanning collaboration

1. How do you characterize collaboration?
2. Can you name three trusted colleagues outside of your own organization within the IPM network that you would contact if you need advice?

3. What do you believe your role should be in fostering collaboration between your IPM colleagues? How about between your IPM colleagues and USAID? What about between you and other program leaders from the IPM network?

4. What do you do when you are faced with a novel problem or challenge you have never seen before?
   a. How do you engage your home organization?
   b. Do you consult any colleagues in USAID or other IPM members?

5. What is your biggest challenge in working across organizational boundaries? How have/do you overcome these impediments?

6. As a person who collaborates across organizational boundaries, how would you characterize the level of support from your home organization for these activities? How about the level of support from USAID or other IPM colleagues?

Part C: Understanding of CRSP-related knowledge sharing and collaboration effectiveness

1. How does knowledge sharing take place within the IPM network? What kinds of structural processes and procedures are in place for creating and sharing knowledge?
   a. Within IPM?
   b. With other Innovation Labs
   c. With USAID?

2. How did VT or your PI prepare and train you and your colleagues to collaborate (internally and externally)?

3. What mode of interaction available as part of the IPM project, have been most effective creating and sharing knowledge?
   a. What do you believe has worked well with communication between your IPM and other members of the IPM network and USAID personnel?
   b. What hasn’t?

4. How well do you feel the existing IPM program knowledge sharing and collaboration mechanisms are working?
5. When you convene with other members of the IPM program, what format does it most often take (face-to-face individual meetings, face-to-face group meetings, videoconference, telephone, email, social media?).
   a. Which approach do you believe is most effective?

6. What about when you convene with other experts in your field, what format do those gatherings most often take?
   a. How do you share knowledge and learn from your non-Innovation Lab peers?

7. Can you give an example of when you and other IPM program leaders have approached USAID together to discuss an issue?

8. What is the most successful episode of collaboration or knowledge sharing with USAID or another Innovation Lab member that you have experienced?

Part D: Perceived linkage between knowledge sharing and organizational learning

1. What do you believe are the most critical learning or knowledge sharing issues faced by IPM?

2. How do you share the experience you have accumulated in the field with other members of your own organization, other Innovation Lab peers and USAID?

3. Can you think of an example when some piece of knowledge shared by another Innovation Lab member or USAID has changed the way you approach your work or looked at a particular problem? What about the opposite, do you know of any examples when another Innovation Lab member or USAID has changed their behavior as a result of knowledge you have shared with them?

4. How well do you think the Innovation Lab program model promotes new inquiry when faced with complex technical/scientific or administrative/implementation problems?

5. Can you discuss your relationship with your home institution? How has your collaborative work with the IPM program changed organizational approaches for managing development assistance projects, if at all? How has the experience you have contributed to the program influenced behavioral change in your home organization? In the Innovation Lab network as a whole?
## Appendix B: Description of Interview Data Analysis

### List of codes and their relationships to concepts

<table>
<thead>
<tr>
<th>Pre-interview theory-based coding</th>
<th>First-order data-driven coding</th>
<th>Second-order pattern coding</th>
</tr>
</thead>
<tbody>
<tr>
<td>Activation / Framing (Agranoff and McGuire (2001b))</td>
<td>Convening</td>
<td>Incentivizing</td>
</tr>
<tr>
<td>Group Jargon (Crossan et al. (1999))</td>
<td>Incentives</td>
<td>Enabling</td>
</tr>
<tr>
<td>Boundary Object (Star &amp; Griesemer (1989))</td>
<td>Technical Committee Meetings</td>
<td></td>
</tr>
<tr>
<td>Improvisation (informal routines) (Crossan et al. (1999))</td>
<td>Work Plan Related</td>
<td></td>
</tr>
<tr>
<td>Collaboration (O’Leary et al. (2006); Thomson &amp; Perry, (2006))</td>
<td>Boundaries</td>
<td></td>
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<tr>
<td>Intuiting (4I) / Metaphor (Crossan et al. (1999); Sfård (1998); and Elkjaer (2004))</td>
<td>Disseminating Knowledge</td>
<td></td>
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<tr>
<td>Resource Allocation (Crossan et al. (1999))</td>
<td></td>
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<tr>
<td>Mobilizing / Synthesizing (Agranoff and McGuire (2001b))</td>
<td>Partnering</td>
<td>Incubating</td>
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<tr>
<td>Conversation in and about Practice (Gherardi (2006))</td>
<td>ME Program Facilitation</td>
<td>Managing</td>
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<tr>
<td>Routines ((Crossan et al. (1999); Cyert and March (1963); Dyer &amp; Nobeoka (2000))</td>
<td>PI Program Facilitation</td>
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<tr>
<td>Enacting Professional Identity (Gherardi (2006))</td>
<td>Learning Issue (Challenge; Knowledge at Stake)</td>
<td></td>
</tr>
<tr>
<td>Experimentation (Dewey (1916, 1936))</td>
<td>Learning Triad</td>
<td></td>
</tr>
<tr>
<td>Interpreting (4I) / Sharing Dialogue (Crossan et al. (1999))</td>
<td>IPM Challenges</td>
<td></td>
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<tr>
<td>Integrating (4I) / Storytelling (Crossan et al. (1999))</td>
<td>Capacity Building</td>
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<tr>
<td>Institutionalizing (4I) (Crossan et al. (1999))</td>
<td>Innovation</td>
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<tr>
<td>Coherent Collective Action (Crossan et al. (1999))</td>
<td>USAID Activity</td>
<td></td>
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<tr>
<td>Boundary Spanning (Guston (1999, 2001))</td>
<td>Boundary Spanning</td>
<td></td>
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<tr>
<td>Transfer (Carlile (2004))</td>
<td>Internal Communication</td>
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<tr>
<td>Transform (Carlile (2004))</td>
<td>Professional Network Knowledge Sharing</td>
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<tr>
<td>Capacity Building</td>
<td>Institutionalizing</td>
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<tr>
<td>Innovation</td>
<td>Leveraging</td>
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<tr>
<td>USAID Activity</td>
<td>Putting knowledge to work</td>
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<tr>
<td>Boundary Spanning</td>
<td>Transforming knowledge for innovation</td>
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<tr>
<td>Internal Communication</td>
<td>Knowledge Boundary (vertical)</td>
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<tr>
<td>Professional Network Knowledge Sharing</td>
<td>Learning Boundary (horizontal)</td>
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<tr>
<td>Translate (Carlile (2004))</td>
<td>External Communication</td>
<td>IL Network Level Knowledge Sharing</td>
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| **Description and sample supporting references for first- and second-order codes** |
|-----------------------------------------|------------------|----------------------------------|
| **Second-order codes** | **First-order codes** | **Sample supporting references** |
| Incentivizing | Incentives | "I learn a lot from others in the technical committee meeting. The IPM is implemented in different regions, time zones, climates, but there are themes in common." (Subject S10) |
| Enabling | Technical Committee Meetings | |
| | Work Plan Related | "You don’t have to convince people within the CRSP to “learn” about the work ... you do have to incent to collaborate." (Subject S7) |
| Boundaries | | |
| | | |
| Convening | | |
| | | |
| Disseminating Knowledge | | |

| Incubating | ME Program Facilitation | "With the work plan, the ME has the responsibility to create, monitor, and train on technologies. We take the approach of training the scientists first before we roll out to the host countries. We need to go through the US |
| Managing | PI Program Facilitation | |
| | Learning Issue (Challenge; Knowledge at Stake) | |
| | Learning Triad | |
“Collaboration has been someone intentional Each principal investigator in the pair are from different institutions. The dyad becomes a triad as you include students … this becomes the learning community.” (Subject S1)

<table>
<thead>
<tr>
<th>IPM Challenges</th>
<th>Partnering</th>
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<tbody>
<tr>
<td>Institutionalizing</td>
<td>Capacity Building</td>
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<tr>
<td>Leveraging</td>
<td>Innovation</td>
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<tr>
<td>USAID Activity</td>
<td>Boundary Spanning</td>
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"Tech transfer – grafting of vegetable using disease resistant root stock with the scion of desirable eggplant varieties in Bangladesh … the most important thing in Bangladesh is that the variety has to be regional … there are market specific tastes … necessary for success, adoption … the practice was picked up at an IPM CRSP meeting, taken into the training stage, commercialized with Bangladeshi company" (Subject S2)
<table>
<thead>
<tr>
<th>Knowledge Boundary (vertical) (Scarborough et al., 2004)</th>
<th>Internal Communication</th>
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<tbody>
<tr>
<td>&quot;The invasive species workshop in Senegal was another good example … it involved partnering with scientists from multiple countries … the learned together working across cultural and disciplinary boundaries.&quot; (Subject S6)</td>
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<thead>
<tr>
<th>Knowledge Boundary (horizontal) (Scarborough et al., 2004)</th>
<th>Professional Network Knowledge Sharing</th>
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<tr>
<td>&quot;We have good relationships [with ME] … for introducing the natural enemy of the weed, the ME helped secure environmental assessments with USAID to get the required USAID permits, and helped move them through the system.&quot; (Subject S10)</td>
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<thead>
<tr>
<th>Learning Boundary (horizontal) (Scarborough et al., 2004)</th>
<th>External Communication</th>
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<td>&quot;Regionally, you have the same type of network ... It is a small world out there ... With IPM working with vegetables, you go to institutions beyond USAID such as CG centers, Foreign Agriculture Organizations ... It is a relatively small community ... Everyone is open to sharing what they know, what they are doing, what the problems are.&quot; (Subject S12)</td>
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