

Building a Theory of Learning in Collaborative Institutions: Evidence from the Everglades Restoration Program

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ABSTRACT: Many of society's most vexing problems must be solved through collaborative institutional arrangements. Growing scholarly interest in these types of institutions recognizes that the capacity for collective learning may play a critical role in the success of collaborative institutions. However, limited theoretical or empirical research exists to explain how learning occurs and the institutional conditions that support learning in this context. In this paper, we draw upon a wealth of literature, ranging from organization theory, policy process and change, and network analysis, to establish a framework of collective learning to guide inquiry in learning in collaborative institutional governance settings. In doing so, we link the process of learning to learning products, and examine what factors shape the process, allowing us to better understand the learning path to policy change. We apply our learning framework to a study of learning in a collaborative ecosystem restoration program in the Florida Everglades. We use a multi-method analysis of survey and case study data to examine the how the framework helps explain instances of learning, or learning products, identified in this setting. In doing so, the analysis illuminates more precise theoretical propositions, not explained by the broader literature on collective learning, around the structural, social, and technological features of the collaborative institution, as well as the exogenous events, which may foster learning.

KEYWORDS: learning, Everglades, collective, processes, products, collaborative institutions

INTRODUCTION

Collaborative institutional arrangements can address public problems that span multiple political or jurisdictional boundaries, often characterized by uncertainty and difficult social trade-offs, by bringing together distinct actors and organizations to produce or manage these shared problems (Kettl 2006; Weber 2009; Feiock 2009). These arrangements are commonly described under the broader umbrella of network organizational structures, where the participant organizations are dependent upon one another to achieve tasks that reach beyond the individual capacities of independent organizations (McGuire 2002; Mandel and Steelman 2003; Keast et al. 2004; Imperial 2005). Such arrangements have come to characterize many sectors of public management in the US today, from education and health policy to natural resource management (Karkkainen 2002; Agranoff and McGuire 2003; Ansell and Gash 2007). Due to the complexity often underlying the problems addressed by collaborative institutions, a number of scholars consider the capacity for learning to be an important

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feature for the endurance and success of these institutions (Daniels and Walker 1996; Bressers and Rosenbaum 2000; Allen 2001; Innes and Booher 2003; Weber et al. 2005; Ansell and Gash 2007; Gerlak and Heikkila 2007; Pennington 2008). However, few scholars have studied how learning occurs in collaborative institutions and what factors might foster learning. This paper aims to address this gap. It asks: How can we operationalize and measure learning in collaborative institutions and what can we glean from the learning literature in other contexts to help explain learning in collaborative institutions? By linking the process of learning to learning products, and examining what factors shape the process, we can better understand the learning path to policy change.

Many social scientists have studied the complex processes that underlie human learning, with increasing attention paid to “collective” level, versus individual-level learning (Jones and Glick 1996; Thomas 1999). We draw upon various theories and frameworks of collective-level learning, particularly from organizational, network, and policy process scholars, to define and identify factors that shape learning in the collaborative context. Across these different fields, we find complementary definitions of learning, which we integrate into a framework to guide the study of learning in any collective setting, including collaborative institutions. The framework defines and operationalizes collective learning, which includes attention to the process of and products of learning. As part of this framework, we also identify the types of structural, social, and technological variables that have been identified as drivers of learning across different collective contexts. The value of the framework is in providing a common language and set of variables needed to organize the inquiry and theory building around collective learning in different contexts. We then use the framework to guide a study of learning within a collaborative institution -- the restoration program for the Florida Everglades -- which has been in place for a decade and involves multiple and diverse actors working to solve a complex social-ecological problem. As a case study, the collaborative restoration program in the Everglades, which emerged as a result of the 2000 Comprehensive Everglades Restoration Plan (CERP), is representative of the complexities typical of many collaborative institutions, yet provides a sufficient number of participants and covers a timeframe to observe whether and how learning occurs in such a collaborative institutional setting.

We employ a case-based, inductive approach because it allows us to move from the general framework of collective learning into a more context relevant theory of learning in a collaborative institution. This allows us to generate hypotheses that can be tested in other settings and that can be generalizable to other collaborative institutional arrangements and settings (Gerring 2004; 2007). Additionally, examining learning within the Everglades collaborative program allows us to identify and trace what factors facilitate learning processes, as well as how these processes are linked to learning products, using within-case research (Bennett and Elman 2006). Our primary source of data is a survey of participants in the Everglades program, which we use to identify instances of learning within the collaborative institution. To complement the survey data, we further explore the factors that drive learning using a case study of one of the learning products identified by the survey. This case study of a specific learning product

draws upon primary interviews with participants in the Everglades program, as well as secondary literature. The multiple sources of data and methods of analysis help bolster the validity of our case-based approach (Lieberman 2005).

A FRAMEWORK OF COLLECTIVE LEARNING

Given that collaborative institutions involve “collective” or group behavior, understanding learning within a collaborative institution requires a fundamental understanding of the elements of collective learning. Organizational and network scholars have clearly distinguished between learning that occurs among individuals within a group and collective learning (e.g. see Argyris and Schön 1996; Newig et al. 2009). Individual learning can occur across members of an organization or collective group, but that learning may remain solely at the individual level (e.g. a basketball team whose members all learn to improve their dribbling skills, but the team does not play any differently together). In contrast, collective learning occurs when learning across individuals is translated into organizational-level strategies or outcomes (Argyris and Schön 1996: 16).² The elements of collective learning then involve both *processes* and *products* of learning, with different scholars often emphasizing one of these facets of learning over the other (Argyris and Schön 1996: 3).

Defining collective learning: processes and products

Much of the social science literature that defines collective learning focuses on the process element of learning. Some describe the process through sequential “steps”, such as the acquisition of knowledge, the distribution of knowledge across the organization, the interpretation of information, and translation of that new information into organizational memory (Huber 1991). Similarly, Lipschitz et al. (2002), define learning as involving an assessment of prior actions, examination of errors and opportunities, and establishment of new opportunities within a group or organization. In other words, the process of learning can be understood as a set of actions that allow new information or knowledge to be acquired, processed and shared and transferred across individuals within a group. Others draw out more specific actions that underlie some of these steps in the process. For example, the step of acquiring new knowledge may involve substantial practice, trial and error, or experiential learning -- or “learning by doing” (Levitt and March 1988; Walters and Holling 1990; Lee 1993; Fazey et al. 2005; Henry 2009). In addition, knowledge acquisition may involve active dialogue among organizational members or across networks (Sabatier 1987; 1988; 2005; Nonaka 1994; Sabatier and Jenkins-Smith 1999). It may also involve actively seeking out ideas from external sources (Dixon 1999). While the process of learning may be rather deliberate (Schneider and Ingram 1988), it can also occur inadvertently (Nicolini and Meznar 1995; Cook and Brown 1999).

² Collective learning, also may involve individual-level learning among members of a group, but it can be distinguished from individual learning in that it results in a social or institutional transformation at the group level (e.g. a basketball team that adopts a new fast break strategy, which incorporates new individual dribbling skills).

Even if actors engage in the acquisition of new knowledge and the detection of errors or new opportunities, those steps in the process do not necessarily translate into measurable learning across a group (Nonaka 1994). The dissemination of that knowledge and translation into new actions or outcomes is where the process of learning links to the products of learning. The products of learning can include new beliefs and/or new actions or strategies among the actors in an organization or other collective setting (Knight 2002). In policy settings, the new actions, or products of learning processes, might also include policy changes, which are often seen as more likely when policy actors change their beliefs as a result of learning processes (Weiss 1977; Sabatier 1987; Sabatier and Jenkins-Smith 1993; Klijn and Koppenjan 2000).³ However, new policies or strategies that cannot be linked to learning processes can be mis-diagnosed as “learning” (Volden et al. 2009). That is, simply viewing the products of learning as an indicator of learning may not be a valid measure of learning. Similarly, assuming learning has occurred simply because a learning process is present may lead to inaccurate measures of learning.

Therefore, we argue that including both processes and products in the definition of learning can help establish more valid measures of learning when studying collaborative or other collective institutional settings. Indeed we are not the first to recognize both learning processes and products. Hecló’s (1974: 306) seminal work on policy learning states: “learning can be taken to mean a relatively enduring alteration in behavior that result from experience; usually this alteration is conceptualized as a change in response made in reaction to some perceived stimulus.” More recently, we have seen learning defined as the production of cognitive and/or behavioral changes that result from the acquisition and processing of new information or experience (Clark et al. 2001). However, as noted earlier, research on learning often focuses on either the process or products without connecting these two elements. To study learning in any collective setting, we therefore adopt the following definition:

Collective learning involves both: a) the process of acquiring new knowledge through diverse actions (e.g. trial and error), assessing information to look for prior errors or new opportunities, and disseminating or translating new opportunities across individuals in a collective, which results in b) new collective products such as changed beliefs, strategies, rules, or policies.

Characteristics of the collective setting that shape learning

³ Regardless of the type of learning product, a common, but often overlooked, assumption in the literature, is that learning results in *improved* outcomes or products. For example, scholars from diverse substantive fields -- ranging from ecological systems research (Walters and Holling 1990; Jachtenfuchs and Huber 1993) to international relations (Haas 2000), to policy change (Bennett and Howlett 1992; Dixon 1999; Grief and Laitin 2004) -- have broadly considered learning to be associated with the ability of groups and communities to effectively adapt to new social problems. While we acknowledge the logic behind this assumption, we do not argue for including this assumption in the definition of learning products. Post-hoc evaluations of learning products can certainly be conducted using criteria that are informed by theory or practice. However, such assessments may be highly subjective or even conflictual depending on the criteria chosen (e.g. efficiency, equity, sustainability).

Linking the process of learning to learning products provides a way to operationalize and measure learning but it does not explain what factors shape the learning process so we can better understand how the learning path leads to policy change. In reviewing the literature, we find that most of the factors likely to influence learning processes, and ultimately whether they lead to learning products, fit within the following overarching categories of characteristics of collective settings: structural, social, and technological, as described in more detail below. Much of the literature also points to variables that are exogenous to a collective setting as also influencing whether learning is likely to emerge. Combined with the definition of learning, these factors provide a framework (see Figure 1) that can be used to examine learning across a range of collective settings, including collaborative institutions.

[Figure 1: Framework of Collective Learning]

Institutional Structure: The design or structure of institutional arrangements is widely recognized as playing an important role in fostering collective learning processes (Huber 1991; May 1992; Schneider and Ingram 1997; Ostrom 1999), as well as in blocking or inhibiting collective learning processes or blocking products from emerging from learning processes (Cashore and Howlett 2007; Newig et al. 2009). Such structural features can include the level integration or fragmentation of the actors in an organization or institution, as well as the complexity and differentiation of actors and roles (Hall 2002). As such, institutional structure can shape how organizational or collective actors share information, disseminate learning ideas in the learning process, as well as determine who has authority to act upon new information and knowledge on behalf of the collective group.

Some debate exists as to the type of institutional structures that would promote learning, however. Network scholars, for example, question whether a more decentralized or diffused design fosters the type of deliberation necessary for learning (Crona and Bodin 2006; Newig et al. 2009). Some evidence suggests that decentralized institutions that have a central actor or organization may be effective because such a design fosters indirect interaction among various entities (e.g. see Scholz et al. 2008; Berardo 2009). In the policy literature, scholars have similarly argued that in diffused or fragmented settings, learning may be fostered where a professionalized and open structure exists to allow for dialogue and information sharing (Pedler et al. 1991; Jenkins-Smith and Sabatier 1993). Research examining complex or diffused policy environments, such as collaborative institutions, recognizes the importance of a “boundary” organization or object around which actors with diverse knowledge and resources can share information and knowledge as a source of learning (Cash 2002; Kallis et al. 2009; Lejano and Ingram 2009).

Social Dynamics: Social dynamics are widely discussed in the collective learning literature as influencing the capacity for knowledge generation, as well as the sharing, use and transmission of information across group members (Senge 1990; Lave and Wenger 1991; Contu and Willmott 2003). These social dynamics are increasingly

recognized in the literature as critical factors associated with policy learning (Williams 2009). One aspect of the social dynamics in a collective setting is the influence and power of individual leaders, or prominent organizational actors who can play a key in kick-starting learning processes (Mahler 1997; Dengler 2007). Leaders can bring together diverse interests and ensure that new ideas are fostered and that the institution is committed to the process of learning, creating a learning culture or openness to sharing information, a willingness to experiment and take risks, a tolerance for error (Lipschitz et al. 2002), and facilitate communication across organizational boundaries and diverse members (Tushman and Scanlan 1981). This research comports with much of the collective action literature, which recognizes that the presence of strong leaders as instrumental in facilitating institutional or organizational change (Sabatier and Jenkins-Smith 1993; Libecap 1994; Ostrom 1999; Lubell and Scholz 2001; Heikkila and Gerlak 2005; Weible and Sabatier 2006). Leaders can also play a role in shaping the shared values that can create an organizational culture that may or may not support engagement in collective learning processes (Mahler 1997).

The network literature finds that the social dynamics among the individual members of a group, such as, their frequency and intensity of interaction, as well as their ability to relate to one another in multiple contexts, may also influence the ability of actors to engage in the learning process, particularly their ability to trust one another and accept new ideas (Newig et al. 2009). In addition to their interactions within the collective setting, the actors' social connections external to the institutional environment, particularly broad-reaching social networks, can promote more extensive access to external sources of information and knowledge (Pedler et al. 1991; Liebskind et al. 1996; Olsson et al. 2004; Bodin et al. 2006). This allows for multiple and diverse sources of information, including citizen and local knowledge, which is considered necessary to foster learning (Schusler et al. 2003; Keen and Mahanty 2006; Weber 2009).

Technological and Functional Domain: Technological and/or functional domains can determine the type of information that a collective group will be interested in learning, seek out, or have access to, as well as how frequently and easily information can be shared. For instance, some have argued that organizations or collective groups that rely on fixed operating procedures may become path dependent, or thus blocked from learning, because they do not seek out new or unexpected information (Levitt and March 1988; Carley and Harrald 1997). Others argue that ambiguity and uncertainty in the functional domain (or purpose and goals) and the tasks (technologies or tools for achieving the goals) can challenge learning (Brown et al. 2003; Franz and Sato 2005). Such uncertainty can hinder ability of actors to agree on the nature of problems and solutions, or even the relevance of new information, and thus collectively learn (Sabatier and Jenkins-Smith 1993; Kingdon 1995; Dunn 2004). At the same time, information processing technologies that organizations have available to store, process, and communicate information, might mitigate for the challenges posed by ambiguous functional processes in certain contexts (Brown et al. 2003). Similarly, technologies, resources, or functional processes that ensure transparency, impartiality and reliability

of information have also been considered important in collective learning (Lipschitz 2002).

Exogenous Factors: Another frequently discussed category of variables that can influence collective learning includes the exogenous factors, such as political, social, and economic changes, as well as the media and other venues that transmit information about those changing conditions (Sabatier 1988; Kingdon 1995; Howlett and Ramesh 2002; Lipschitz et al. 2002; Siebenhüner 2002). The literature recognizes that external perturbations may be necessary at times to ignite or foster learning by changing what is known about a group's goals, functions, or outcomes, altering institutional structures and social capacities (Sabatier 1988; Birkland 2006). External information can possess varying degrees of uncertainty or ambiguity that further shapes the capacity for learning. In the case of collaborative institutions, we do not have clear evidence of how different types of exogenous factors are likely to factor into learning or how they interact with or support other variables in the collective learning process. Studying the interaction between these events and the sets of variables previously mentioned will provide valuable insights on conditional nature of the various institutional variables that shape learning.

STUDY SETTING: EVERGLADES RESTORATION PROGRAM

While the framework on collective learning provides the foundation for examining learning in a collaborative institution, and ultimately identifying those theoretical relationships among the categories and types of variables in the framework deemed important in the collaborative context, taking into account the context of a collective is important because we cannot predict, *a priori*, from the broader literature on learning which of the variables in our framework are likely to support learning in collaborative institutions. For instance, in collaborative settings, although participants are likely to share common collective goals (like an organization), their relationships are likely to be more numerous, permeable, and transient compared to other types of collective settings (Hula 1999). Given this context, the actors within these institutions may come with competing interests and demands (e.g. from an organization's individual members or external stakeholders), distinct and perhaps conflicting organizational mandates, missions, cultures, processes, and values. Thus, participants in the collaborative may compete to establish their own organizational missions or may feel disengaged if they are mandated by superiors to participate in the process (Moe 2005). Actors may also have diverse individual values, beliefs, and experiences based on their professional expertise, political backgrounds, and personal experiences. These complicated and diverse combinations of interests within a collaborative institution potentially challenge learning because of the diverse "ways of knowing" involved in these institutions (Lejano and Ingram 2009).

The collaborative institution that is the focus of our study, the Florida Everglades restoration program, like many collaborative processes, involves complex formal and informal relationships amongst a group of organizations that have agreed to shared goals. The primary goal of the collaborative program is to restore the ecological integrity of the Everglades -- a unique and culturally significant ecosystem that has been

impaired after decades of engineering for flood control, agricultural and urban development (Grunwald 2007). The collaborative effort became institutionalized under the Water Resources Development Act of 2000, which established the Comprehensive Everglades Restoration Plan, or the “CERP”. This plan formalizes many of the shared goals of the collaborative program by identifying the operational projects that will re-engineer the existing flood control and water management infrastructure in the Everglades needed to restore, or at least improve, the health of the Everglades ecosystem (US GAO 2007: 5).

The Everglades restoration program has become a network of multiple organizations that institutionalizes communications and joint decisions among various actors that share responsibilities for managing the Everglades and those who are affected by the restoration efforts. One of the lead agencies in the collaborative restoration program is the US Army Corps (Corps), charged with development and implementation of approximately 60 distinct restoration projects that fall under the restoration plan. The South Florida Water Management District (SFWMD), the second lead agency, is tasked with designing projects and accessing and providing land for restoration. After the Corps and SFWMD complete the initial planning and design for specific restoration projects, they must submit the proposed projects to the Congress to obtain authorization and funding for construction (US GAO 2007: 5). The two lead agencies also coordinate implementation efforts that involve numerous state, local, tribal, and federal actors. It can be seen as the one of the most extensive types of collaborative networks – an “action network” that engages in collective action by formally adopting courses of action and delivering services (Agranoff 2003) and is goal-directed, as outlined by the CERP (Kilduff and Tsai 2003).

Several new institutional arrangements were crafted to facilitate and formalize communication and coordination among the actors involved in the Everglades restoration effort. Central to the coordination and communication for the overall restoration effort is the South Florida Ecosystem Restoration Task Force (Task Force). As shown in Figure 2, the Task Force is composed of federal, state, local, and tribal representatives. The Task Force is supported by a “Working Group”, whose mission is to help facilitate the restoration, and the Science Coordination Group (SCG), composed of senior scientists and managers, designed to coordinate the scientific aspects of the restoration effort. Another group, which coordinates science and technical issues related to project implementation between the lead agencies, is the REstoration COordination and VERification Team – known as “RECOVER”. To foster the technical coordination of project implementation on the ground, the implementing agencies also appoint staff to serve on project delivery teams (PDTs). Although most of these coordination and communication venues focus on the planning, technical or implementation issues, there is also a state-sponsored venue, the Water Resources Advisory Commission (WRAC), designed to bring together citizen, business, tribal, and local agency input into the restoration process. Figure 2 displays the complicated interactions between traditional administrative bodies and stakeholder groups along with the newly crafted institutional arrangements in terms of both coordination and implementation of the broader restoration program

[Figure 2 here: Actors Involved in the Everglades Restoration Program]

Since passage of the congressional legislation in 2000 and creation of the various organizational bodies outlined above, the greater restoration project has been marked by project delays (US GAO 2007: 3), conflicts over the program's priorities, legal requirements, and its impact on the ecosystem (The Economist 2005; Grunwald 2006), and concern over the capacity of the program to adequately coordinate its scientific bodies and research (US GAO 2003). Insufficient funding from Washington, litigation, and stalled efforts by the state to buyout lands held by US Sugar have all hampered progress (Grunwald 2007; Cave 2008; Walsh 2008; VanNatta and Cave 2010). However, the Obama administration signed a new deal with the state to share costs and responsibilities⁴ and provided an influx of federal stimulus monies to the program (Quinlan 2009a; Quinlan 2009b), leading to the expectation that many stalled projects may begin sometime in 2010 (Morgan 2009b). Despite some of these delays and criticisms, the program has survived for ten years and some projects have moved forward. The question is: has learning emerged during this process in the face of these challenges?

METHODS

To assess the question whether learning has emerged in the Everglades collaborative program, we adopted the operational definition of learning, developed from the learning framework, to identify and measure learning. This definition requires evidence of learning products that are linked to the different processes of learning. In this study we identified learning products that are presented as collective changes in program strategies or policies (aka collective behaviors)⁵. We identified learning processes that were linked to these outcomes, which include processes of acquiring new information (e.g. program reports, dialogue, or experimentation) about the program and its goals, as well as and processes for sharing and disseminating such information. Where these processes were absent we did not measure program strategy or policy changes as learning products. We also then identified and measured those features of the institutional structure, social dynamics, technological/functional domain, and exogenous conditions that either precipitated or interacted with the learning processes to better understand what leads to learning in the collaborative institutional context.

Multiple sources of data provided indicators of learning products, processes, and explanatory factors. Primary and secondary documents, from Congress, program participants, media, and academic sources and in-person and telephone interviews between 2007-2009 with key informants and staff involved in the collaborative process,

⁴ The new "master agreement" requires the Corps to value state land acquisitions at fair market prices thereby, resolving a long-standing dispute between the two parties regarding how the state would be credited for the land purchases.

⁵ Changes in beliefs or cognition are also outcomes of learning that the literature identifies. We chose not to evaluate cognitive changes for this paper. In a follow-up paper we explore cognitive changes as outcomes in more depth.

which offered an initial assessment of the range of possible types of learning products and processes, as well as data on the structure of the program, social dynamics, technology and functions of the program and external events shaping the program. Thus, these sources of data provide records of how learning processes emerged over time that allow for identifying the factors that facilitated the learning processes during these time periods.

The primary source of data used to identify learning products and processes in this paper, however, came from an online survey of program participants, conducted between January and March 2009. The population of survey respondents came from lists of official representatives serving on the primary coordination, decision-making, and implementation bodies of the collaborative restoration program (as described above and depicted in Figure 2).⁶ The survey instrument asked participants in the collaborative process to identify up to three program policies or implementation strategies within the Everglades Restoration Program that had changed in response to new information.⁷ We then followed up with questions about the source of new information and how that information was processed and shared within the collaborative institution to further connect the learning product to learning processes. The range of potential sources of information and mechanisms for sharing information identified in the survey questionnaire were informed by the interviews and document analyses conducted prior to the survey. Additionally, the survey asked participants to identify experimentation processes and the products of these processes as a second potential process mechanism or path to learning outcomes. Using the survey data that pinpoints where learning processes emerge within (or external to) the collaborative program, allows us to then draw inferences about the role of institutional design, social dynamics, technological and exogenous factors that may be shaping these processes.

To further investigate the institutional, social, technological and exogenous factors that drive these processes, we then returned to the interview data and document data to

⁶ All relevant members of the teams were identified from program participant lists received from the administrative staff involved in these entities. Names of 668 individuals were provided on these lists, however, upon initial contact we found that approximately 10% of the individuals were no longer participating in the program. Another 2% of the individuals notified us that they were not actively involved enough to provide an informed response to the survey. Of the remaining 580 individuals, we received 99 responses after 3 separate follow-up reminders from the PI's (17% response rate). The survey was pre-tested with a staff member of the Everglades Restoration program prior to survey implementation. We recognize that there may be self-selection biases among the respondents, perhaps due to their interest of involvement in the program. Among the survey participants who responded, the average length of time of their involvement was 6.8 years. However, there is wide dispersion in the level of experience within of respondents, with the minimum number of years involved being 1 year, and the maximum 19 (standard deviation = 4.3). It is also possible that participants chose to respond because they felt they had experience and knowledge around learning. In fact, among those who responded, more seasoned respondents chose to answer questions on learning compared to less seasoned participants.

⁷ Those who participate only in the Task Force related bodies and program planning/policies only responded to those questions, whereas those involved in the implementation side only responded to questions involving program strategy changes, and anyone involved in both had the opportunity to respond to both types of questions.

delve into one of the learning products and associated processes, as an in-depth case study. The case study allows for tracing or following the process of the factors that precipitated learning, as well as an exploration for how these factors interrelate. In the discussion section of the paper, we then analyze how the findings from the case study comport with and help explain the survey findings. In this section we also draw inferences from the survey findings that help develop theory the factors that influence those processes.

SURVEY FINDINGS: LINKING LEARNING PROCESSES TO PRODUCTS

The main findings from our survey suggest that learning outcomes in the collaborative Everglades Program are associated with diverse learning processes that are both internal and external to the collaborative. Among the 96 survey respondents, 68 percent responded to the questions on learning (identifying up to three events per respondent). Those respondents identified a total of 89 learning events where new outcomes were linked to learning processes. Not surprisingly, learning events were statistically more likely to be identified by individuals with a longer history of participation in the collaborative program, versus more recent participants.⁸ These events range from very broad programmatic or program planning issues (e.g. a new program initiative to kick start projects or reallocate funds) to very technical issues (e.g. the engineering or design of a particular feature of the restoration effort).

As shown in Table 1, the sources of information within the learning process include reports and studies, as well as dialogue and debate, from both within and outside the collaborative sub-groups in this program. Whereas just slightly more of the sources of learning come from internal reports from the member agencies involved in the restoration program (42%), a significant portion of the learning products were also associated with dialogue or debate within the sub-groups of the collaborative institution (40%). At the same time external sources of information were associated with learning products including debate from groups external to the collaborative process (36%) and reports or studies from external groups, not directly participating in the program (25%). Notably, respondents identified multiple sources of learning for each of the learning products (although no correlations were found among the different types of sources of information).

[Table 1 here: Information Acquisition Sources Associated with Learning Events]

In addition, participants identified the vehicle of dissemination of information, as presented in Table 2, further linking the learning products to processes. The majority of respondents note that implementing teams or agencies were the main vehicle for disseminating information to collaborative members (44% of cases), followed closely by program leaders (42%). External groups and advisory bodies (e.g. the WRAC, SCG, and the Working Group) were also involved in disseminating information in nearly a

⁸ Learning instances were identified by participants with an average of 8.4 years of experience with the collaborative institution, while those who did not identify learning had an average of 5.5 years. The difference is statistically significant ($F=19.3, p<.01$).

quarter (24%) of the cases, followed by the Task Force, which is the collaborative body that guides program collaboration and policy (15% of cases). Our data indicate that the Task Force and advisory groups, as well as the Task Force and external groups, are frequently identified together as vehicles of dissemination for the same instance of learning.⁹ This suggests that just as multiple sources of information are important, so too are multiple venues of dissemination in the learning process.

[Table 2 here: Vehicles of Dissemination and Information Sharing]

As the sharing of information and dissemination of information are identified in the literature as key steps or actions involved in the learning process, we asked program participants their perceptions of information sharing and integration both within the sub-groups of the collaborative institution and across the entire program. Comparing across the sub-groups might elicit insights on whether differences in the technical nature of these groups or their resources or capacities might explain differences in their capacity to engage in learning processes. However, no statistically significant differences across the sub-groups were identified in terms of capacities to engage in learning processes. Moreover, we did not find differences across the sub-groups in the number or types of learning products. On average, the members of the sub-groups all reported having moderately well-established processes, such as internal communication procedures between group members and administrative staff (average rank of 7.1 on a scale of 1-10, with 10 being the highest), moderately effective communication with advisory groups, dedication to diverse sources of information and resources, and review of information, periodic review of program performance, and dedication of staff and resources to coordination among group members (all ranking in the 6.0-6.5 range on a scale of 1-10). Compared to the within-group responses, most respondents to the survey have a slightly lower opinion of the extent to which different sub-groups of the collaborative program share and integrate information (mean response score was 5.8 (83 responses, sd 2.1)).

According to the literature, learning outcomes emerge not just through new sources of information entering the learning process, but also through trial and error or experimentation with existing institutional processes. When asked about experimentation with existing processes, respondents provide somewhat mixed responses. On the one hand, the specific program implementation features that participants identified as open to experimentation were closely aligned with many of the learning outcomes they also identified. On the other hand, 10% of respondents felt that none of the program elements had been open to experimentation and that the program is instead risk averse. Thus, in this collaborative institution, while it appears that experimentation may be a potential pathway to learning outcomes, it is viewed as a less commonly used learning process than forms of information gathering and sharing.

Some of the divergences in identifying learning within this group are not surprising given the diversity of positions and roles that the members of the collaborative hold. In fact, a substantial proportion of respondents (38%) identified these diverging political positions

⁹ Phi correlation = .50 and .30 respectively, $p < .05$.

or conflicting agendas as a major impediment to the sharing and integration of information. While this points to a fundamental challenge known to these types of collaborative processes, it further underscores the importance of both the institutional and social dynamics in these settings to foster learning in collaborative institutions. Not surprisingly, another 28% of the respondents mentioned that the lack of adequate processes, linkages, or direction from leaders as impediments to learning. A much smaller proportion (16%) mentioned inadequate resources (technical or financial) as impediments; whereas 12% mentioned that sharing is impeded by a lack of knowledge or understanding by individuals of data. These barriers, however, should not suggest that information sharing and integration is not occurring across the collaborative group. As Table 3 summarizes, many participants reported using diverse communication tools to share information.

[Table 3 here: Tools for Information Sharing]

THE ACCELER8 PROGRAM AS A CASE STUDY: EXPLORING THE FACTORS THAT SHAPE LEARNING

As our survey data provided an opportunity to identify learning products and understand the linkage between learning processes and products, we now turn our attention to one particular learning product to further illuminate the factors that support and shape learning processes and, ultimately, products. Among the learning products that the respondents identified in our survey, the one identified by the most respondents is a program called “Acceler8”. Those respondents who identified Acceler8 as a learning product came from diverse professional backgrounds, including social sciences, planning, and bio-ecology, as well as from different sub-units of the collaborative program, including the Task Force, Working Group, and project delivery teams. We trace the process of learning in Acceler8 as a case study here, drawing forth evidence from our survey and interviews as well as literature and document analyses to better understand the structural, social, technological and functional, and exogenous factors that shape learning in a collaborative institution. Overall, we find evidence of all of these factors helping to facilitate the learning process. It is how these factors feed into different phases of the learning process and how they inter-relate that can help develop theoretical propositions on collaborative learning, which we discuss in the next section.

Initiated by the state of Florida in the fall of 2004, Acceler8 was designed to accelerate the restoration of the Everglades through the funding, design, and construction of eight specific Everglades restoration projects, totaling some \$1.8 (SFWMD 2009a). The Acceler8 projects include seven projects directly affiliated with Everglades restoration plan, including the construction of treatment marshes, new reservoirs, and canals, and an eighth project that expands existing stormwater treatment areas in South Florida (US GAO 2007: 9).

Concerning the collaborative institutional structure, we find the presence of structural factors that supported internal dialogue among program participants across multiple scales of the collaborative institution, were associated with the learning processes that

led to Acceler8. The genesis of Acceler8 started with internal brainstorming sessions within SFWMD and state leaders, led by then Governor Jeb Bush and top officials with the SFWMD who initiated the plan in response to a lack of federal funding and engagement in the larger restoration program and concerns that public interest was waning (Ammon 2009). By advancing the design and construction of these projects with state dollars, state officials hoped to more quickly realize restoration benefits and jump-start the overall CERP effort (US GAO 2007: 9). Although the initial idea to create Acceler8 took place outside of the collaborative process, multiple groups, including the Task Force and the various functionally specialized sub-groups, provided a forum for dialogue and consensus, prior to establishing and implementing Acceler8 (Ammon 2009). These forums provided a venue for participants to develop a common understanding of the problems (primarily a lack of federal funding and delays stemming from federal planning bureaucracy) that plagued the larger effort and precipitated the need for Acceler8. These institutional structures were clearly factors shaping the processes of learning identified by the survey in the Acceler8 case, as respondents noted that information sources on the problems and proposed program included the state agencies, sub-groups within the collaborative process, and external reports.

Later the restoration program's formal and informal structural arrangements and processes would continue to support a broader dialogue regarding how to modify schedules and priorities of the Acceler8 program in line with participant concerns and suggestions. In the end, the program's eight projects were the result of consensus across the diverse set of participants in the restoration efforts (Ammon 2007), coupled with a greater scientific understanding about the value of stormwater treatment areas to address the phosphorous contamination issues in the Everglades (May 2009). Over time, the sub-groups of the collaborative program would come to serve as vehicles to update participants on the status of the program and thus the structural design features played a key role in shaping information dissemination in the learning process. The Water Resources Advisory Commission was relied upon as the forum to conduct public meetings and manage public comments (Light 2006: 956). In addition to the advisory commission, the vehicles for communicating new information across the collaborative institution about Acceler8, as identified by our survey participants, include the state water management district (SFWMD), project delivery teams, and program leaders.

The structural factors in this case also feed into the social dynamics, most notably trust and leadership, which further shaped the learning process that led to Acceler8. In particular, the state made an effort to establish an environment of trust around the proposed program (Ammon 2009). SFWMD officials engaged with Corps officials to design a project approach where the state would adopt practices that would be consistent with Army Corps procedures regarding the planning, design, and operation of projects, which helped allay fears or threats to the federal partnership that Acceler8 might have posed. In addition to their discussions with Corps officials, both locally and nationally, SFWMD worked to ease concerns about the program with other federal officials and environmental groups, using the structure of the collaborative process. Some federal officials even saw the program as a way to help propel further federal investment and attention to the Everglades in the face of competing environment crises

and disasters (Duke 2007). The context of the broader state-federal leadership relationship, characterized by then Governor Jeb Bush and President George W. Bush, also helped facilitate approval of the initiative (Ammon 2009). This is not to say everyone was happy. Some environmentalists argued that the Acceler8 largely represented water-supply projects that essentially abandoned the environmental components of restoration (The Economist 2005). Despite some opposition, these social dynamics played a role in helping not only disseminate information and new ideas, but also in garnering support needed to translate these ideas into learning outcomes.

Finally, the Acceler8 case highlights collaborative technology and resource factors that influence learning processes. First, the well-constructed functional domain and task plan, established by the CERP, arguably allowed the Acceler8 process to help move from the process of gathering and disseminating information into a learning outcome. The functional domain was defined clearly enough that the new strategy could be viewed and understood as feasible and compatible with the program. State leaders also relied on technical processes to promote experimentation and innovation by harnessing their relationship with a joint venture engineering company. As part of the broader collaborative effort, the joint venture assisted state officials with project planning for Acceler8. Then state officials saw an opportunity to use this resource to assist with the engineering and design of the restoration projects. This played a considerable role in the state's confidence to move ahead with Acceler8 and to obtain the approval of state leaders and federal partners (Ammon 2009).

Ultimately, the lead agencies in the restoration program were able to integrate Acceler8 processes with Corps implementation processes, which enhanced the available tools for accessing and processing reliable information needed for learning across the broader restoration program (Ammon 2009). For instance, state and federal officials collectively designed specific engineering criteria for dam construction in South Florida, which became transferable to other projects in the restoration effort. Second, SFWMD and the Corps initiated use of a shared computer program related to project design criteria. This has allowed for improved project integration across the two agencies and will presumably assist with cost-sharing and other components of design (Ammon 2009). In this way, the Acceler8 program provided a basis and capacity for future technical learning in the broader restoration effort.

Efforts to proceed with Acceler8 were ultimately hampered by a series of external or exogenous events, including a lawsuit and a shift in state attention on restoration toward a plan to buy out US Sugar holdings (Cave 2009). The suite of eight projects once known as Acceler8 is now referred to as the "expedited projects" by the SFWMD (SFWMD 2009b). Recent federal efforts by the Corps to garner congressional authorization to support of a few of the Acceler8 projects suggest the potential lasting effect of the program, however. Further, experience with the Acceler8 program arguably helped raise awareness of the procedural and policy challenges at the federal level that have hampered restoration (May 2009). This awareness provided fodder for changes in federal land valuation policies in the Everglades program, thereby removing

a significant hurdle to progress in the broader collaborative, as land acquisition is a critical component to the goals of the program.

DISCUSSION

Building off the insights from the survey data and the Acceler8 case study, this section offers initial propositions toward a theory of learning in collaborative institutions. Starting with the institutional structure, the evidence suggests that technical sub-groups are often viewed as the sources of information tied to learning. These results point to the importance of institutional design features that allow for structured and technical sources of information to filter into decision-making. They also indicate that learning outcomes are associated with venues that foster diverse social dynamics and dialogue, which may allow for frequent communication and trust building among the diverse parties.

At the same time, various venues outside of the collaborative institution, particularly the individual member agencies, are engaged in learning processes. Most notably, agencies are seen as critical in the process of disseminating information, much more so than the sub-groups of the collaborative institution. The Acceler8 case highlights this as well, as the initial idea developed through dialogue that happened outside of the collaborative process. The implication of this finding is it may be necessary to consider how different structures, particularly boundary spanning “groups” or actors, function at different points in the learning process.

Interestingly, we also found that the types of venues that play a role in producing information are different from the types of venues deemed important for disseminating information. A logical conclusion from this is that in collaborative institutions, the characteristics of the institutional structure that are likely to support the production of new information within the learning process may differ from those structural characteristics that lead to the dissemination of information in the learning process. Having a formalized structure that allows for debate from both internal and external participants may support information production that contributes to learning; whereas having design features that are more technically-focused and tied to the internal decision processes from member agencies may be more critical for the phase of disseminating information.

The member agencies, which implement the program, and provide the links between the members of the sub-committees and the sources of funding and staffing that make the program operational, clearly play a key role as disseminators of learning ideas in this case. This calls attention to some of the emerging literature on the role of member agencies more generally in collaborative institutions, which recognizes that actors and agencies take on different roles with varying degrees of weight or authority in collaborative settings (Koontz et al. 2004; Agranoff 2006), and the role of central agency culture in the collaborative dynamics (Mahler 1997; Bardach 1998). Given our findings, in a collaborative institution we would expect that *learning is more likely in a collaborative institution when: multiple and diverse structures (or actors) are positioned*

to facilitate a) the acquisition of new information from both internal and external sources and b) the dissemination of information across the institution. (Proposition 1)

In applying the framework, the data also provided valuable insights into the nature of the social dynamics that support learning. For instance, the case study of Acceler8 highlights the role of establishing trusting relationships through multiple interactions among the diverse participants in diverse venues over time. While we were not able to retroactively measure the degree of trust and patterns of interaction leading up to the learning events identified in the survey, our findings regarding the importance of multiple sources of information production and dissemination associated with individual learning products lends indirect support to the importance of diverse interactions and networks among the actors in the collaborative setting. Additionally, our case study adds valuable insights into the interplay between these social dynamics and the structural features previously discussed. For example, the Acceler8 case suggests that the institutional structure where dialogue and learning processes take place can depend upon the leaders who manage these processes (or even strategically go outside of these processes), as well as how they rely upon the trust and social capital established as part of the larger collaborative effort. Therefore, we may expect that learning is more likely in a collaborative institution when: *a) leaders or central actors foster new information or dissemination of beliefs, b) interactions build trust among actors, and c) members have diverse social ties to access external sources of information.* (Proposition 2)

The third category of variables in the framework draws the analysis to the features of the technological and functional domain that influence learning. In looking at the overall Everglades restoration program, it is clear that the functional setting involves substantial uncertainty, complexity, and interrelationships that may challenge experimentation across the entire restoration program. Thus, it is not surprising that some survey respondents, particularly newer participants in the program, did not identify learning products. However, in examining the individual learning products, there is evidence that individual learning products are sometimes characterized by functionally discrete domains, where they emerge through pilot testing or are linked to modeling or monitoring efforts. As such, they may be more amenable to experimentation, which the learning literature considers part of the learning process.

Another relevant feature of the technological and functional domain that emerged in this study was the diverse set of tools for sharing information between the coordination teams and implementation teams in the program, both electronic and in-person. Notably, design features that are tied to the internal decision processes from member agencies seem critical to information dissemination. In the Acceler8 case, existing technologies for assessing and processing reliable information were built upon and eventually improved (shared computer design software), which appeared to not only enhance communication, but also help create a greater sense of trust and shared experience, and provide new tools for leaders in managing complex data and personnel. This supports not only the broader literature on the role of technology in collective learning, but also the policy literature, which recognizes the importance of

access to impartial, reliable, and transparent information for collective learning (Haas 2000; Karkkainen 2002; Sabatier 2005). Notably, in a case like the Everglades, which is highly politicized, there may be an important role for exogenous actors, outside the process, to aid in this process. The National Academy of Science has an external scientific and technical review panel (Committee on Independent Scientific Review of Everglades Restoration Progress, or CISREP) that now provides biennial congressionally authorized external evaluations of the CERP's progress. Thus, we would expect that *learning is more likely across a collaborative institution when a) functional settings are more discrete and amenable to experimentation, and b) technology is available to reliability and transparently gather, store, and help disseminate disparate sources of information.* (Proposition 3)

The role of exogenous factors in the learning process goes beyond technical features. As many critics of the restoration have pointed out, the program has had limited success in implementing projects, which theoretically should provide information and experience upon which learning can develop. Part of the project delays stem from limited funding that the federal government had promised, but not delivered, for a number of years, while lawsuits over project design features and other legal debates over processes ensued. At the same time, the lead agencies tasked with implementing and constructing restoration projects face their own internal bureaucratic processes and budgeting hurdles that can delay implementation (NAS 2008). The Army Corps is required to conduct multiple levels of internal and external reviews that the projects under CERP must all go through before implementation.¹⁰ Not surprisingly, the survey respondents in our study commonly recognized these factors, especially internal agency politics and policies, as hindrances to experimentation, implementation, and program learning.

Evidence from the Acceler8 case also speaks to the role of exogenous events as intersecting with process of learning and how that process filtered through the institutional setting. The shift by state leaders to undertake projects on their own, outside of the joint federal-state effort demonstrates a reinterpretation of policy needs as funding from the federal participants was not coming down the pipe. In large collaborative settings like the Everglades Restoration Program the lines between what is exogenous versus endogenous to the program become blurred. That is, project delays can be seen as the result of broader congressional funding battles but also as the result of internal agency bickering and resistance to change. Finer analysis may be necessary to tease out the factors that are truly external to the program. Nonetheless, we would expect that *exogenous factors, notably changing financial resources, political support, or environmental conditions may a) foster learning by sparking new information or changing collaborative processes; or b) hinder collective learning by blocking the*

¹⁰ The internal review for the individual projects included technical review by another district, by the Corps' Office of Water Policy, by a regional implementation team in headquarters, and the Corps' Civil Works Review Board. External review of project costs and risks is done by the Office of Management and Budget and by academics. To receive needed funding to construction projects after review, Corps' headquarters must approve of the projects in a budget bill (subject to internal agency politics over resource allocation for different regions and programs) and finally those appropriations must be approved by Congress (subject, of course, to larger political debates).

translation and dissemination of new information across the collaborative or limiting the capacity for members of the collaborative to adopting new practices . (Proposition 4)

CONCLUSION

This paper set out to understand learning in collaborative institutional settings, by applying a broader framework of collective learning to the context of a collaborative institution: the Everglades Restoration Program. Building upon organizational theory, network studies, and policy process and change research, the framework emphasizes the institutional design features of collective settings that may shape learning. We adopted the operational definition of learning that requires evidence of learning products that are linked to the processes of learning. We identified learning products that are presented as collective changes in program strategies or policies. We identified learning processes that were linked to these products, which include processes of acquiring new information (e.g. program reports, dialogue, or experimentation) about the program and its goals, as well as processes for sharing and disseminating such information. We also then identified and measured those features of the institutional structure, social dynamics, technological/functional domain, and exogenous conditions that either precipitated or interacted with the learning processes to better understand what leads to learning in the collaborative institutional context. By linking the process of learning to learning products, and examining what factors shape the process, we are able to better understand the learning path to policy change.

Applying the framework to study learning in a collaborative institution offers a more nuanced understanding of the variables that are relevant to learning in this particular setting, allowing us to identify propositions that can be tested in other collaborative settings. The propositions derived from this study, however, are just a starting point and we acknowledge that further research is needed to tease out some of the inter-relationships among the explanatory variables and the learning process and products. One of the next steps for research on learning will be to consider how some variables play a more important role in the different steps of the learning process. For instance, some of our data suggests that more technical, or functionally-specialized, sub-groups may be more influential at the stage of the learning process centered around identifying new information. Yet, member agencies may play a more direct role in the dissemination of that information. Our findings also suggest that it is important to develop a sharper understanding of the interplay between the different categories of variables identified in the framework. As the Acceler8 case suggests, the social dynamics defined by the leaders may depend heavily on access to an institutional structure (e.g. sub-groups) as forums to develop trust needed for acceptance of new ideas. Additionally, the technical domain was enhanced in the Acceler8 case as a result of the social dynamics that led to more trust, which combined led to enhanced information sharing. In future research, it will also be valuable to examine the applicability of the framework to study the obstacles to learning. While the Everglades case highlighted some of the exogenous variables that may impede learning, the internal structure, social dynamics, and technical domain can also create an environment that may impede the

process of information acquisition, information sharing and dissemination, as well as the translation of those processes to learning products.

In sum, this paper highlights the need for iterative theory building between the learning framework, which can guide variable selection and analytical approaches, and theories of learning in particular institutional contexts. A framework allows for theories from diverse collective contexts to be grounded in a common language, which ultimately allows the theory to be compared more readily to other collective learning contexts (Schlager 2007). As Ostrom (2005) has argued, without some initial synthesis and identification of the general concepts that underlie any shared phenomena, it remains challenging to compare theories and develop testable models grounded in a common language and analytic structure. Our efforts to synthesize a shared definition of learning from the literature, around both a process and an products, as well as to identify the key categories of variables that shape learning, thus provides an initial attempt to ground a theory of learning in a collaborative institutional setting within a broader learning framework.

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Figure 1: A Framework of Collective Learning

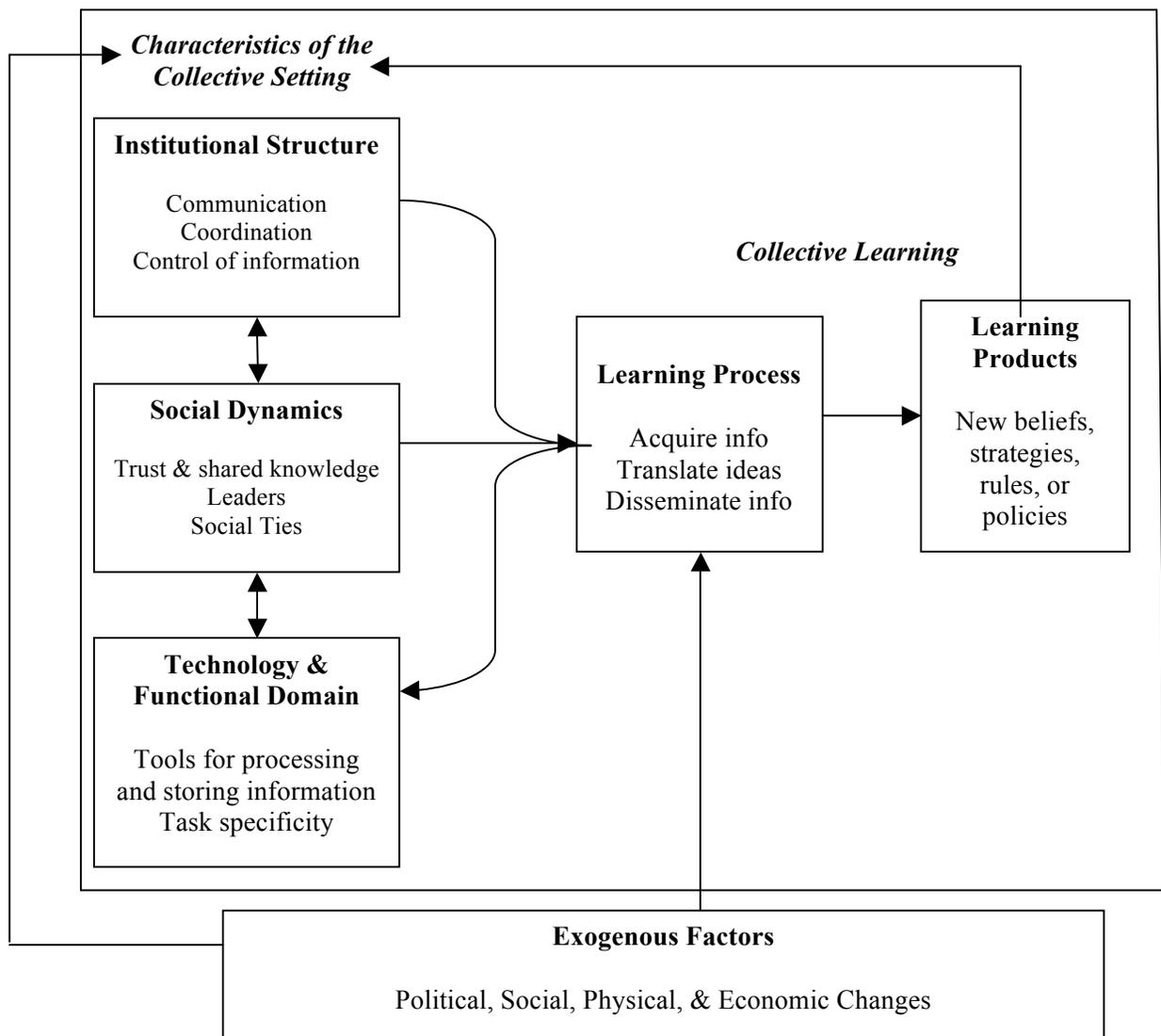


Figure 2: Actors Involved in the Everglades Restoration Program

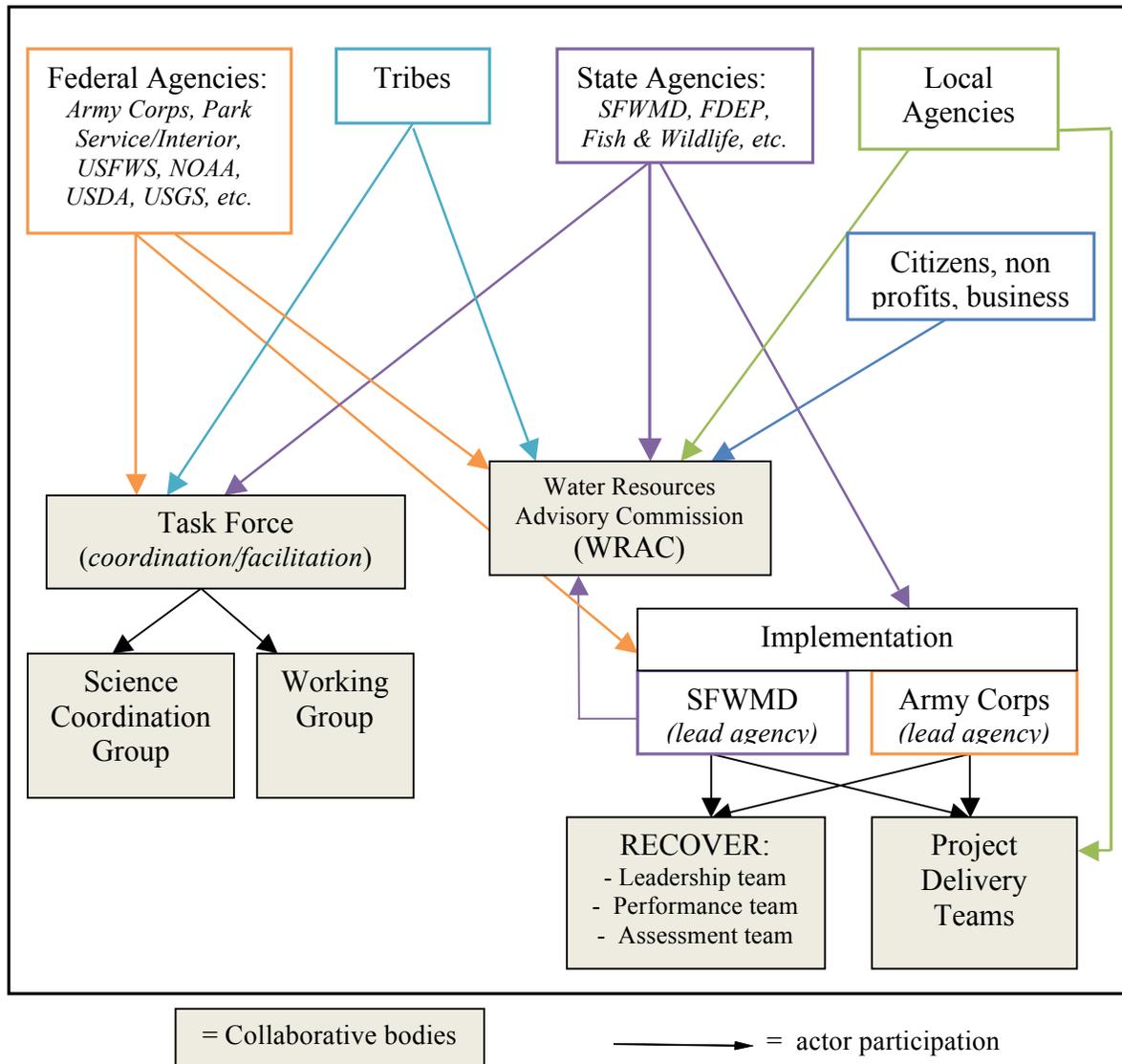


Table 1: Information Acquisition Sources Associated with Learning Events

Internal reports from individual agencies	42%
Dialogue or debate within meetings or teams	40%
Outside debate	36%
External reports	25%
Internal reports to the sub groups	8%

Table 2: Vehicles of Dissemination and Information Sharing

Via implementing agencies or teams	44%
Via leaders	42%
Via external groups	24%
Via Advisory groups	20%
Via the Task Force	15%

Table 3: Tools for Information Sharing

Key Tools for Information Sharing	Percent of Identified Tools
Regular meetings among collaborative members	53%
Email	45%
Internet or Intranet	36%
Informal dialogue	25%
Phone calls	24%
Workshops / Conferences	15%

Note: Number of responses to open-ended questions on information sharing tools and barriers = 70