iisd | International Institute for Sustainable Development | Institut international du développement durable

IISD REPORT

Developing Social Capital in Networked Governance Initiatives: A lock-step approach

Gabriel A. Huppé and Heather Creech

June 2012

International Institute for Sustainable Development

The International Institute for Sustainable Development (IISD) contributes to sustainable development by advancing policy recommendations on international trade and investment, economic policy, climate change and energy, and management of natural and social capital, as well as the enabling role of communication technologies in these areas. We report on international negotiations and disseminate knowledge gained through collaborative projects, resulting in more rigorous research, capacity building in developing countries, better networks spanning the North and the South, and better global connections among researchers, practitioners, citizens and policy-makers.

IISD's vision is better living for all—sustainably; its mission is to champion innovation, enabling societies to live sustainably. IISD is registered as a charitable organization in Canada and has 501(c)(3) status in the United States. IISD receives core operating support from the Government of Canada, provided through the Canadian International Development Agency (CIDA), the International Development Research Centre (IDRC), and from the Province of Manitoba. The Institute receives project funding from numerous governments inside and outside Canada, United Nations agencies, foundations and the private sector.

Head Office

161 Portage Avenue East, 6th Floor, Winnipeg, Manitoba, Canada R3B 0Y4
Tel: +1 (204) 958-7700 | Fax: +1 (204) 958-7710 | Website: www.iisd.org

Developing Social Capital in Networked Governance Initiatives: A lock-step approach

Written by Gabriel A. Huppé and Heather Creech

June 2012

Table of Contents

Executive Summary

Globally, there is an increasing recognition that technocratic approaches have limitations, especially when it comes to solving complex problems that span numerous administrative boundaries and fragmented institutions. Where policy problems exceed a certain level of complexity and significance, and where existing institutions are too weak to manage these problems, empirical evidence suggests that polycentric arrangements, such as networked governance initiatives, emerge to produce solutions that are more beneficial. By integrating distributed capacities for collective problem solving, governance networks allow diverse actors to work collaboratively towards mutually beneficial outcomes.

In an earlier paper, we emphasized the enabling role of social capital: the fabric of trust, shared values and understanding that allows diverse participants to work together towards collective outcomes and common goals (Huppé et al, 2012). Only with an adequate level of social capital can a governance network create shared value and engage in processes of reflexive governance. In this paper, we elaborate on three methods with potential to enhance social capital in governance networks. These methods are: institutional brokering, knowledge sharing and social learning, and collaborative visioning. They are instrumental in creating the organizational conditions that allow the heterogeneous actors and stakeholder groups that form the network to achieve positive collective outcomes.

In this paper, these organizational innovations are conceptualized as elements of social capital (trust, mutuality and reciprocity) and collective cognition (shared mental models, joint problem perceptions and relational skills). Networked governance is composed of the elements of shared visions, strategic alignment and collective problem solving. We describe the development of social capital and collective cognition as being instrumental to achieving effective networked governance. Our contribution is based on the understanding of a reciprocal causation between constructive interactions and the development of social capital. On one hand, the development of social capital depends upon a certain level of constructive interaction across network actors, while on the other, constructive interactions depend upon a certain level of social capital in the network. This interplay between effective networked governance and the stock of social capital is at the heart of our paper.
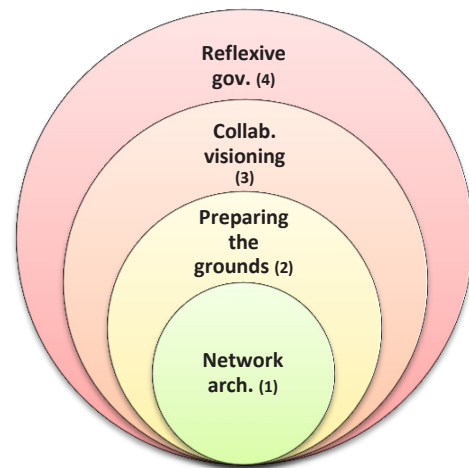
FIGURE ES1. STOCK OF SOCIAL CAPITAL AND STAGES IN THE NETWORKED GOVERNANCE PROCESS

Figure ES1 depicts stocks of social capital. Composed of four stages, it shows the relationship between the stock of social capital in governance networks and the ability of the network to move to more advanced stages of networked governance. Each stage demands more social capital than the last. Therefore, social capital must be developed sufficiently at each stage in order to enable progress at the subsequent one. Each stage is limited in its ability to enhance the stock of social capital. The more advanced the stage, the more potential there is to add to the stock. At the first stage, network architecture, initiatives should use a combination of social network analysis and stakeholder analysis to identify and select stakeholders for participation in the governance network and to assess the implications of prevailing network structures on the ability of various stakeholder groups to contribute fully to collaborative processes. It includes the consideration of institutional brokering. Preparing the grounds engages network actors in activities

of knowledge sharing and social learning using techniques like hexagon modelling, card sorting, role playing, joint interactive use, 3CM (Conceptual Cognitive Mapping), ARDI (Actors Resources Dynamics and Interactions) and other participatory approaches. At this stage, the network builds a holistic understanding of the policy problem, and weaves, through the connected knowledge and social systems, a relational ability to access negotiated capacities so that the contributions of diverse actors may be shared across the network. The third stage, collaborative visioning, has actors imagine positive images of the future that are mutually beneficial and collectively desirable. This visioning process extends the social learning process. If sufficient strategic alignment is created during the visioning process, network actors may achieve the ultimate stage of networked governance, and engage in processes of exploring, innovating, selecting and implementing policy options in a reflexive manner. As an extension of the visioning process, collaboration relies on continuously testing concepts that could accommodate the views of the diverse participants whose support is needed to make the policy work (Kemp & Rotmans, 2009; Smith and Kern, 2009), while anticipating interpretations, structures and activities of network participants (Bardach, 1977; Kingdon 2003).

The paper is structured as follows. The first two sections introduce the important theories underlying our concepts of networked governance and social capital, and lay the foundation for our proposed lock-step approach. Section 3 describes institutional brokering as a network function that bridges various clusters that were previously disconnected or malconnected in the network, and facilitates the creation of compelling syntheses that combine resources across various subgroups to solve collective problems (based on Berkes, 2009; Burt, 2004; Hargadon, 2002). This function is enabled by organizational bridging and networking leadership. The following section describes an approach to knowledge sharing and social learning that is embedded in both governance structures and the characteristics of the system that is the target of policy (ie. watershed, river catchment, etc.) (based on Pahl-Wostl & Hare, 2004; Pahl-Wostl, 2006). By eliciting diverse conceptions of the target system, the network develops a holistic understanding of the policy problem, and builds the capacities for collective problem solving. Section 5 discusses collaborative visioning as a process of creating strategic alignment towards shared visions of the future. Section 6 proposes methods for stakeholder analysis, and their potential application to various stages of networked governance (based on Prell, Hubacek & Reed, 2009; Reed, Graves, Dandy et al., 2009). Section 7 presents our overarching framework for building social capital and achieving the creation of shared value and reflexive governance. This section ties together the first six sections of the paper. We propose that cognitive elements mediate the relationship between the development of social capital and effective networked governance initiatives. Developing social capital and collective cognition is seen as instrumental to achieving positive outcomes of policy and governance innovation.

Section 1. Introduction

Theory suggests that social capital plays an important role in enabling effective networked governance. Huppé, Creech and Knoblauch (2012) showed how the efficacy of a networked governance approach is a factor of both the complexity of the policy problem being addressed by a given governance network and the collective social capital of the network. Problems of higher complexity oblige a higher level of social capital to enable effective problem solving. In that earlier piece, we developed a few important concepts, such as collaborative visioning, creating shared value, institutional brokering, applying social network analysis and the role of learning, and acknowledged how these might be applied to networked governance initiatives.[1] In this present paper, we seek to hone in on the concept of social capital, especially how to maintain and enhance it in order to improve the effectiveness of networked governance initiatives. Keeping social capital front and centre, we deepen concepts developed in our earlier research, and present them here in a manner that makes it easier for practitioners to apply them to their initiatives. Where possible, we suggest specific tools and methods to be of use to foster social capital in lock-step with the demands of the various stages that compose networked governance.

When problems attain a certain level of complexity, it is thought that capacities for problem solving are widely distributed among societal actors that are located both within governments (or centralized governance agencies) and outside of them. Networked governance proposes that these distributed capacities can be integrated by means of governance networks, which allow these diverse actors to self-organize, within the bounds of the network, to support and carry out certain governance and policy-making functions. In this approach to governance, it is assumed that network actors, although representing diverse interests, share a certain level of interdependence between them. With sustainable development, for example, heterogeneous stakeholders may be acting under the belief that certain goals and collective outcomes that are common across all or several subsets of network actors may only be achieved if there is a certain level of strategic alignment between them. Where network actors collaborate towards shared visions of sustainable development, with a certain level of strategic alignment, they can create shared value, which might otherwise have been difficult or impossible to achieve were each acting on their own. However, the deep interdependence between the actors raises the risk of opportunistic behaviour and power struggles that may be detrimental to achieving positive governance outcomes. Therefore, it is necessary that the governance network embody a sufficient level of social capital to enable participants to attain these positive objectives.

Like in innovation economics, governance or policy innovation is not linear; it is an evolutionary, cumulative and feedback process that can only be realized by cooperation and interaction across the diverse actors that harbour the distributed capacities for technological, organizational and social innovation (Freeman & Soete, 1997; Grupp, 1998). The Triple Helix innovation model of university-industry-government interactions is one such example (Etzkowitz & Leydesdorff, 2000). In this model, the three sectors operate within a highly networked framework, and simultaneously enact processes in different systems and organizations, wherein organizations in one sector adapt to the strategies of the other for mutual value creation. In networked governance, network actors engage in a similar game of shared value creation and reflexive governance. In collaborative watershed partnerships, for example, a number of interdependent actors from civil society, the private sector and governmental agencies at the local, regional, federal and indigenous levels seek to resolve wicked problems that span multiple administrative boundaries (Lubell & Leach, 2005). Such

---

[1] The theory of networked governance and the concepts that IISD developed are based on our own experience with action research of the networks and partnerships that IISD hosts, case study research, workshops and electronic conferences with other practitioners, and on a comprehensive review of relevant literature on the subject.

initiatives provide a forum in which management plans and implementation actions are negotiated and then turned over to member agencies for formal actions (Sabatier, Focht, Lubell et al., 2005). Seeking foremost to create win-win solutions to a variety of problems facing different stakeholders, such partnerships complement and transform, rather than replace, traditional top-down agencies. Similar networked behaviour is observable in areas as diverse as health and human services, investment banking, venture capital and various forms of strategic alliances in the private sector (Provan & Kenis, 2008)

In this paper, we conceptualize social capital as the fabric of trust, shared values and understanding that allows diverse participants to work together towards collective outcomes and common goals, but we acknowledge here that the process of creating it is closely related to the ability of the network to experience significant psychological shifts, particularly among those actors who see their position in absolute terms (Putnam, 2004; Putnam, Burges & Rover, 2003). Such a shift is sometimes called "mutual recognition" (Saarikoski, 2000) or "joint appreciation" (Gray, 1989; Plummer & Fitzgibbon, 2004), and occurs when participants update their mental frames and models of reference according to the underlying principles of interdependence, non-linearities, and cumulative and feedback processes that make up the governance context (e.g., Nersessian, 2002). A mental frame of perception contains the actor's knowledge, assumptions, interests, values and beliefs, and determines what they see as being of interest, and what interests they perceive as conflicting with others (Schön & Rein, 1994; Fischer, 2000), and thus has an important impact on the actor's construction of meaning of information, shaping his or her policy positions and attitudes towards the policy-making process (Kolkman, Kok & van der Veen, 2005).

Governance or policy innovation is dependent upon certain collective cognitive processes and shared cognition among groups of network actors (Langan-Fox, Wirth, Code et al., 2001), and cognition is built upon and influenced by the mental models held by those who are involved in the process (Beratan, 2007). Effective collaboration towards positive governance outcomes—for example, common goals and collective outcomes of sustainable development—is tied to the ability of the network to create these cognitive conditions that foster social capital and enable a certain level of collaboration. The development of these conditions is seen here in this paper as part of a larger collaborative learning process (e.g., Daniels & Walker, 2001). For example, Dray et al. (Dray, Perez, Jones, Le Page, D'Aquino, White and Auatabu, 2006; Dray, Perez, Le Page, D'Aquino, White and Auatabu, 2007) describe how diagrammatic interview methods were used to elicit understandings of causal dynamics of groundwater management in the atoll of Tarawa, Republic of Kiribati. Various understandings from the diverse stakeholder groups were collected and combined with visual interpretations and a spatial mapping exercise to build a "collective representation" of the groundwater system, which described causal dynamics, interdependencies and other characteristics of the governance context. The collective representation was used as a frame of reference and collective model throughout stages of the collaborative process. As stakeholders interacted with each other and with the shared model and frame of reference, participants were able to explore and challenge their own and others' mental models, serving as a basis for learning and collaboration (Dray et al., 2007), and developing a collective cognition of the context. Similar strategies were used for governance and policy innovation in areas such as dealing with lake eutrophication (Ozsemi & Ozsemi, 2004), storm water management (Kolkman & van der Veen, 2006) and rangeland management (Abel, Ross & Walker, 1998).

In this paper, we place a strong emphasis on social interaction and discourse, and their roles in enhancing social capital in governance networks. These interactions are part of a larger collaborative learning process in which significant psychological shifts, which allow a certain level of collective cognition, occur. In networked governance, knowledge of the system that is being targeted for governance or policy innovation is widely distributed across network actors

(Ostrom, 1990; Olsson, Folke & Hahn, 2004), and an essential part of this knowledge is tacit rather than explicit in nature (e.g., Berkes, 1999). Interaction is necessary to create shared understanding of the target system, and of the interdependencies between network actors.

Many of tools and methods that we present in this paper are based on the notion that language and cognition are closely interlinked. This notion is supported by evidence that shows that people think in analogies rather than using analogies as a convenient way of talking about other domains (Gentner & Gentner, 1983; Collins & Gentner, 1987). Collins and Gentner (1987, p. 243) stated that thinking in analogies allows people to "create new mental models that they can then run to generate predictions about what should happen in various situations in the real world." Moreover, storytelling is another means by which people communicate complex information. As Stone (2002) has shown, narrative stories provide explanations of how the world works, and explains the connections between people, places, events and things that are significant in a given context. A collaborative learning process that transfers tacit knowledge and complex information efficiently therefore depends on constructive discourse among participants. Tacit knowledge, which is personal and contextual, may only be transferred in this way (Lam, 2000), and it is by having conversations with others, and having the opportunity to compare what they say (verbally and non-verbally) with their actions, that we may modify our understanding of their positions and the interdependencies and common goals that characterize our relationships (Beratan, 2007; Stone, 2002). Discourse in a networked organization is critical to its ability to innovate (Addleson, 1996; Dooley, 1997). The adaptive policy-making approach, for example, makes extensive use of multistakeholder deliberations (Swanson & Bhadwal, 2009).

Taking stock of the theory thus far outlined in this paper reveals a critical piece of understanding: constructive dialogue and interaction depends on a certain level of social capital across network actors, and, in turn, enhancing social capital in the network is dependent upon a certain level of interaction across these actors.

Section 2. Social Capital

As stated earlier in this paper, we define social capital broadly as the fabric of trust, shared values and understanding that allows diverse participants to work together towards collective outcomes and common goals. This definition is common among scholars such as Fukuyama (2002), who takes social capital to represent the "shared norms or values that promote social cooperation, instantiated in actual social relationships" (p. 27), and Cohen and Prusak (2001), who describe it as "the stock of active connections among people: the trust, mutual understanding and shared values and behaviours that bind the members of human networks and communities and make cooperative action possible" (p. 4). In this sense, the concept of social capital that we use in this paper to assess the ability of a network to achieve common goals and collective outcomes is more accurately described as *collective* social capital, as opposed to individual social capital, which refers to the benefits that individuals derive from their own networks of social relations. In our operationalization of the concept, we have found the typology of Canada's Policy Research Initiative (Franke, 2005)[2] to be most helpful. In this typology, which we present in Appendix 1, there are three levels of social capital: micro, meso and macro.

In this paper, our principle focus is on the micro and meso levels of social capital, although we acknowledge that these are embedded in the larger macro framework that limits or promotes the stock of capital in governance networks and the ability of these networks to maintain and enhance this capital at both the micro and meso levels. Collective social capital, as conceptualized in this paper is a means to achieving positive outcomes of networked governance. We discussed earlier an example from innovation economics in which university, industry and government actors acknowledge certain interdependencies and align their efforts to create shared value. Such models of innovation are reliant on a certain level of social capital to safeguard exchanges, and foster the ability of the group to innovate creative, collaborative and complex solutions, while mitigating the risk of destructive opportunistic behaviour (Huppé et al., 2012).

Silicon Valley is the perfect example of the power of social capital in enabling collaborative relationships. Studies have shown that the economic success of the region was largely due to productive interactions among various interdependent institutions, instruments and entities, such as leading research universities (e.g., Stanford University, U.C. Berkeley, U.C. San Francisco), United States government policy, venture capital firms, law firms and other business networks (Cohen & Fields, 1999). Similarly, Putnam (1993) describes the success of regional governments in Italy as dependent upon networks of civic engagement in communities, which strengthened the fabric of trust, shared values and understanding. And Dalzell (1987) describes how a group of investors in the late 1700s who had a shared vision of their role in society and a reputation for keeping their investments in their ventures over time were able to create relationships among businesses in the cotton industry, which had historically been fragmented, and thereby created a thriving American industry with a production process integrated all the way from raw cotton to cloth.[3]

---

[2] The Policy Research Initiative is now part of Policy Horizons Canada. PRI's Social Capital Project was formally launched in January 2003 as an interdepartmental project to investigate the relevance and usefulness of social capital as a public policy tool, and to develop a relevant analytical and measurement framework for the federal Government of Canada. The project spanned two years and culminated in three capstone reports (Franke, 2005). See http://www.horizons.gc.ca.

[3] These three examples from Siliicon Valley, Italy and the United States cotton industry feature three forms of social capital. The first form, bonding social capital, features most prominently in the Italian example. The other forms are bridging and bracing. Bridging features prominently in the American cotton industry example. Bracing is a combination of bonding and bridging and ties together actors across multiple scales, as is discussed in Section 3 on institutional brokering.

Along with these cases, there is ample evidence to suggest that social capital is a critical ingredient in the most dynamic business clusters and regions of innovation (Henton, Melville & Walesh, 1997; Montana, Reamer, Henton, Melville & Walesh, 2001). As the process of globalization continues, social capital that is embedded at the local level, and yet necessary to safeguard the exchange of distributed capacities at the regional or even international level, will become an essential component for regional competitiveness (Gertler & Wolfe, 2004; Maskell, 1999). Social capital is thought to play a similar role in governance networks, and the efficacy of networked governance approaches.

Using an institutionalist approach (e.g., Ostrom, 1990; Rydin, 2006) proposes that the performance of governance networks can be explained, for the large part, with two key concepts, namely institutional capacity and social capital. In an earlier paper, Huppé et al. (2012) added another concept: problem complexity. It is assumed that the more complex the policy problem, the more widely distributed will be the institutional capacities, and that the governance network that seeks to integrate these capacities will be required to be more heterogeneous. It is also assumed that, for a given policy problem, the higher the level of social capital within the governance network, the more self-organization and autonomy will be conducive to achieving problem solving functions, positive governance outcomes and tasks of greater complexity. Following Davoudi and Evans (2004) and others (Healy et al., 1999, 2002; Innes, Gruber, Neuman & Thompson, 1994), we take institutional capacities to fall under four categories: intellectual, social, material and political.[4] We describe these four categories in Appendix 2.

Governance networks are the structures through which distributed capacities are integrated, and collective social capital is the stock that allows these capacities to be exchanged within the network and across the diverse actors towards positive collective outcomes. Absent sufficient social capital, it is likely that initiating collaborative processes will be futile, counterproductive, wasteful of resources, and may even contribute to destructive opportunism that could further erode social capital.

FIGURE 1. ELEMENTS OF SOCIAL CAPITAL.

In this paper, we take problem complexity (and network heterogeneity) and the diversity of network actors to equate the extent to which institutional capacities are widely distributed. Our analysis assumes that governance networks benefit from social capital, and that a certain minimal amount of this capital is needed at each of the four sequential stages of the networked governance process, each stage requiring more social capital than the last. These stages, which we discuss is Section 7, are network architecture, preparing the grounds, collaborative visioning and reflexive governance. Based on the three key concepts of networked governance (problem complexity, social capital and institutional capacities), we present a series of recommendations and related tools that may be of use to those considering such a process. The result is a lock-step social capital approach that considers both the social capital demands of each stage and the methods by which social capital may be sufficiently enhanced during each of these to enable the governance network to tackle tasks and functions of greater complexity at the next stage. This framework accounts for the mediating effect of cognitive elements.

---

[4] Some authors (e.g., Amin & Thift, 1994, 1995) used the concept to identify the qualities of networks that promote innovation and related economic development.

By social capital, we mean the collective social capital implied by membership, norms, activities and structure of the governance network. Like Rydin (2005), social capital is understood as being based on trust, mutuality and reciprocity, constituted by dense networks of relationships between actors. Trust refers to the positive expectation that other actors will refrain from opportunistic behaviour, even when they have the opportunity to do so (Edelenbos & Klijn, 2007), and is thought to be especially important when dealing with complexity because vertical means of control are difficult given the interdependencies between actors (Klijn, Steijn & Edelenbos, 2010; Lane & Bachman, 2001). Mutuality is the recognition of mutual interdependence and common interest between actors, and reciprocity refers to a relationship whereby the behaviour of one actor occurs in the justified belief of another actor behaving in a certain way (e.g., positive actions by one actor is reciprocated by positive action by another). A greater sense of trust between actors strengthens common norms of mutuality and reciprocity, and vice versa. A trusting actor will take all relevant actors' interests into account in the interaction process (Rousseau, Sitkin, Burt & Camerer, 1998; Nooteboom, 2002), and is more likely to invest his resources in collaborative processes, including the investment of resources into forming and maintaining relationships (Agranoff & McGuire, 2003). Moreover, trust stimulates actors' learning from each other, provides a sense of stability in relationships and provides actors with a stronger basis for collaboration; this, in turn, promotes norms of mutuality and reciprocity.

Interdependence creates a strong motive for collaboration, and is seen as the starting point for any networked governance process (Brinkerhoff, 1999; Imperial, 2005; Short & Winter, 1999). Even when there is a prehistory of antagonism or a lack of trust among stakeholders, their recognition of interdependencies can serve as a common basis for trust building (Andranovich, 1995; Futrell, 2003; Gray, 1989; Margerum, 2001; Vangen, 2003). Trust, mutuality and reciprocity are built upon interactions and a certain history of collaboration, in what is often understood as a virtuous cycle of communication, trust, commitment, understanding and outcomes (Huxham, 2003; Imperial, 2005)—an iterative process that is important across all stages of networked governance.

Where there is a high degree of interdependence among actors, it is likely that trust that leads to reciprocating positive behaviour will result in mutually beneficial outcomes—outcomes that subsequently generate a higher level of trust among relevant actors (Ostrom, 2000). In this sense, we take the view that an actor's trustworthiness ensues from his quest for reputation; an interdependent, self-interested actor behaves in a manner that promotes reciprocation, from relevant other actors, with the goal of maximizing his or her own personal gains overtime (Fudenberg & Maskin, 1986; Kandori, 1992; Tirole, 1996). In this way, interaction contributes to the formation of norms in the network. The various forms and degrees of connectedness among actors, and the reputation effects stemming from them, result in collaborative behaviour (Annen, 2003). An actor's assessment of another's trustworthiness is typically based on past experiences and future incentives.
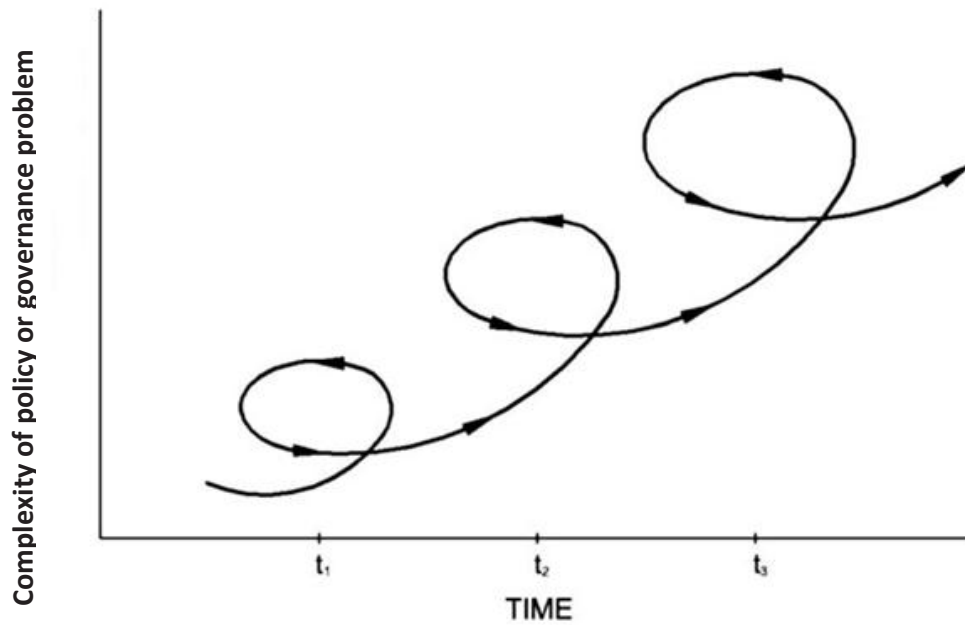
FIGURE 2. THE EVOLUTION OF TRUST IN NETWORKED GOVERNANCE AND THE ABILITY TO TACKLE MORE COMPLEX PROBLEMS. As actors learn through their engagement in processes of networked governance, they experience increasing levels of trust and the ability to tackle more complex problems. Each loop in the figure goes through observation-planning-action-outcome phases, followed by a period of reflection.
Adapted from from Berkes (2009).

Section 3. Institutional Brokering

3.1   Knowledge Brokering

In a seminal article called "Structural Holes and Good Ideas," Ronald S. Burt (2004) demonstrates how "brokerage across structural holes between groups provides a vision of options otherwise unseen" (p. 349), and finds empirical evidence to support the claim that brokerage affects network performance through his proposed "vision advantage," which promotes "good ideas" in the network. Burt conceives that behaviour, opinion and information are more homogeneous within than between groups, and that holes in the flow of information are created as a result of people focusing on activities inside their own groups.

In organizational literature, groups alongside structural holes are conceptualized as "domains." Domains emerge within organizations that reflect and reinforce few interactions between subgroups (Hargadon, 2002). For example, informal norms, such as competition for scarce resources, and the development of specialized languages and perspectives within domains, reduces the interaction between groups (Dougherty & Hardy, 1996; Bechky, 1999). Because interrelations within domains tend to be dense and characterized by repeated interactions, they are usually subject to socially shared but individually held mental frames (DiMaggio, 1997; Hargadon & Fanelli, 2002), which stems intra-group communication, knowledge sharing, and thus the ability of the group to innovate. Domain-specific logics constitute and constrain an individual's understanding of certain situations, and thus what he or she sees as being appropriate actions for perceived roles.

Brokerage becomes very important when dealing with complex problems. Complexity requires a certain level of specialization and division of labour at social scales, and many studies have shown that failures in problem solving result not from the lack of appropriate knowledge, but from the inability to recognize when and how that knowledge is appropriate in a new situation (Lave, 1988; Reeves & Weisberg, 1994; Thompson, Gentner & Lowenstein, 2000). Thus, to innovate, problem-solvers must disentangle this extant knowledge learned in the context of one domain in order to see how it might be valuable in another (Hargadon, 2002). Integrating knowledge from one domain to solve the problems in another and linking old knowledge to new situations are processes that are described as analogical reasoning, and must occur across individuals and groups over time in a process of collective learning (Reeves & Weisberg, 1993, 1994). Such learning, however, takes place in a social context across groups, and a special concern for collective cognition is important (we discuss social learning in Section 4). For example, collective processes may take into account the fact that individuals and groups tend to learn only partially, relying on their environment to provide the missing pieces, and relying on situational cues to recall or replace particular knowledge (Bruner, 1979; Lave, 1988; Lave & Wegner, 1991).

It is emphasized that ideas come from a variety of paths and sources (e.g., von Hippel, 1988), but idea generation at some point involves brokerage that moves knowledge from this group to that, or combines knowledge across groups. For example, Locke (1995) contrasts the economy of Turin and that of Milan and finds that Milan's is a "polycentric" network, in which opposing associations and interest groups are linked to one another through many horizontal ties that are characterized by frequent communications, and in which a large number of intermediaries mute conflicts and keep lines of communication open. In Turin, the absence of brokering between groups in opposing camps created a

structural situation in which cognitive and normative pressures reinforced isolation and made conflicts more likely. Companies in Milan were able to follow complex negotiated processes to resolve problems with labour unions and other interest groups, while those in Turin resorted to repression tactics. The region of Milan benefited from superior economic performance as a result. Similarly, it has been shown that the formation of integrative policy in the health care sector was highly dependent upon government brokers who facilitate communication among various groups who would not otherwise interact (Fernandez & Gould, 1994).

Hargadon (2002) used microsociology to explain innovation as the disassembling, reassembling of extant ideas, artifacts, and people in organizations, and described the recombination of these resources as an act of innovation "because, while the social world is typically viewed as a seamless web, it is fragmented into many small domains" (p. 44). This fragmentation makes it difficult to disentangle resources from one domain into another. Therefore, brokers, which bridge multiple domains and span otherwise disconnected subgroups, move ideas to where they are known to where they are not and thus introduce new, more optimal configurations. Ideas in one domain that are valuable but previously unknown in the other are introduced to produce new knowledge configurations and more innovative solutions (Burt, 1992; DiMaggio, 1992).

According to Burt (2004), brokerage consists of four levels of activities that are critical to learning and creativity in organizations. The first is to make people on both sides of a structural hole aware of interests and difficulties in the other group. Transferring best practices is the second level of brokerage. The third level is drawing analogies between groups that are seemingly irrelevant to one another. For example, a broker may recognize that the way a group thinks or behaves may have implications for the value of operations in another group, and thus, by analogy, elements of the group could be brought in and applied to the operations of the other and enhance value. The fourth level of brokerage is synthesis, which is the ability to recognize and communicate new ideas or behaviours that combine elements from both groups. Hargadon (2002) suggests that brokerage allows and facilitates four different learning activities:

1. Learning about the existing resources of each new domain

2. Learning the related problems in that domain

3. Learning what others in their own organization know

4. Learning how to learn

This learning accumulates knowledge of the extant resources and problems of different domains in ways that enable it to become the raw material for innovation. We have discussed briefly the concept of collective cognition and its social dynamics. Such cognition across diverse groups with heterogeneous but valuable knowledge presents the possibility of collective creativity, which allows pooling of resources from these diverse network actors and, rather than relying on individual cognitive skills, presents social interactions as a shared thinking process that spurs the search for novel interpretations of problematic situations and novel solutions. Collective cognition thus provides the organization with more ways to comprehend a situation and more ways to respond. Shifting individuals' mental frames of a given situation or problem, for example, allows them to recall knowledge that was not easily recalled from their previous perspective, making salient different aspects of the situation which in turn prompts insight from other participants into other potential frames (Fiske & Taylor, 1991). This practice of analogical reasoning is central to processes of knowledge sharing, social learning and collaborative visioning (Sections 4 and 5).

3.2   Relational Brokering

So far, we have emphasized the brokering of knowledge, but it is important to note that another type of brokerage is of particular importance, especially in the case of governance networks, which are usually composed of groups with not only extremely disparate knowledge, but also very different interests and motivations. Moreover, because the various stakeholder groups are differently motivated, network dynamics are especially sensitive to changes in the contextual factors of the network. This type of brokering, which mediates network relationships according to internal and external conditions and dynamics of the network, is what we call "relational brokering." Both knowledge brokering and relational brokering are necessary to build sufficient social capital within the network, and they are mutually reinforcing: improving relational skills within the network allows greater knowledge transfer across groups, and greater knowledge transfer improves the capacity for mutual understanding of another's positions and their possible contributions to the networked governance process. In networked governance, such brokering has been shown to reduce the transaction costs of collaboration by providing incentives for stakeholders to invest in building trust, identify common interests and resolve conflicts (Hahn, Olsson, Folke & Johansson, 2006). For example, well documented Millennium Ecosystem Assessment cases show that managing social-ecological systems often requires social networks that span multiple levels of organization to mobilize and integrate dispersed information from various sources (Capistrano, Samper, Lee & Raudsepp-Hearne 2005; Fabricius, Folke, Cundill & Schultz 2007; Hahn et al., 2006).

3.3   Organizational Bridging and Leadership

The distribution of knowledge is thought to be subject to what Cash and Moser (2000) have termed "scale-specific comparative advantages," wherein local institutions are best informed about the local level (e.g., the state of local forests, needs of villagers and farmers, etc.), and the state has a regional and national vantage point and a repertoire of tools and techniques (e.g., scientific databases, remote sensing) not normally available to local institutions (Reid, Berkes, Wilbanks & Capistrano, 2006). Linking these different levels of knowledge systems requires individuals or organizations (e.g., NGOs) taking active roles as coordinators and facilitators of collaborative processes (e.g., Halls, Arthur, Bartley, Felsing et al., 2005). To this effect, two mechanisms—bridging organizations and leadership—are critical for institutional brokering in networked governance initiatives.

Bridging organizations provide an arena for knowledge co-production, trust building, sense making, collaboration and conflict resolution, and may serve as catalysts and facilitators among various levels of governance, promoting the integration of different resource and knowledge systems (Folke, Hahn, Olsson & Norberg, 2005; Hahn et al. 2006). To demonstrate this role of the bridging organization, we consider the case of the Kristianstads Vattenrike Biosphere Reserve in Sweden. In studying this Swedish example, Olsson, Folke, Galaz, Hahn and Schultz (2007) describe how a bridging organization enabled the matching of multilevel governance systems that were previously fragmented in organizational and institutional structures. This matching entailed "creating the right links at the right time around critical issues in multilevel governance systems" (p. 28) and was enabled by one organization: the Ecomuseum Kritianstads Vattenrike (EKV), which was created for that special purpose. Olson et al. (2004) describe EKV as follows:

The EKV was established in 1989 to help the Municipality of Kristianstad manage the ecosystems of the lower Helgeå River catchment (Kristianstads Vattenrike, KV). It is a flexible and dynamic organization, promoting a management within KV that treats humans as part of ecosystems and includes social, economic, and ecological dimensions. The EKV is part of the municipality's organization and reports directly to the municipality board, like a municipality administration. However, it is not an authority and has no power to make or enforce formal rules. It plays a key role as a facilitator and coordinator in local collaboration processes that involve international associations, national, regional, and local authorities, researchers, non-profit associations, and landowners to maintain and restore the natural and cultural values of the area. The EKV is also involved in developing policy, designing projects, resolving conflicts, coordinating and administering conservation and restoration efforts, and developing goals for KV, as well as producing management plans, agreements, follow-up reports, and updates for specific areas.

The EKV provided bridges between previously unconnected networks and nodes that were concerned with different objectives (bird conservation, water quality, cultural heritage), and provided leadership to produce a comprehensive vision and goals (Figure 3). Through the facilitation of EKV, these networks and nodes self-organized to undertake tasks and solve problems. Such an organization may not engage the entire group, but only those parts of the network that may have a particular interest or expertise in the problem. Typically, however, these nodes would cut across two or more levels of organization, and usually involve knowledge generation, co-production and experimentation (learning by doing) (Olsson et al., 2007). Berkes (2009) provides the example of a particular node that may tackle the problem of minimizing damage to farmers from migratory cranes. In this case, the problem-solving node involved local farmers, bird conservationists and some government representatives. Such nodes and the networks forming around these nodes around specific issues can be said to constitute "learning communities," which are groups of people with a shared interest in collaborative learning, or "communities of practice," which are a group of people who have common concerns (domain area) and pursue knowledge through regular interactions based in practice (shared frameworks) (Berkes, 2009). The importance of learning through participation, shared practices and concepts is emphasized, wherein each round of problem solving may lead to another (Napier, Branch & Harris, 2005; Wenger, 1998). For example, when the wetland area in Vattenkrike was first set aside for conservation, it became overgrown due to the halting of grazing. The EKV responded by coordinating deliberations and the co-production of knowledge between those related to the unintended impact of conservation. Through this collaborative process, consensus was reached on the desirability to provide incentives to farmers to make grazing economically viable (Olsson, Folke & Hahn, 2004). Bridging organizations can take many forms. In some cases, such as caribou co-management in the Beverly-Qamanirjuaq community, it was the Board itself that functioned as the bridging organization between various stakeholders by providing a forum for knowledge exchange and trust building (Kendrick, 2003). In the case of the Arctic Borderlands Ecological Knowledge Co-op, it was the annual general meeting that provided the needed forum (Eamer, 2006). In the Tohono O'odham case, it was a group of scientists who facilitated the knowledge sharing functions (Arnold & Fernandez-Gimenez, 2007).
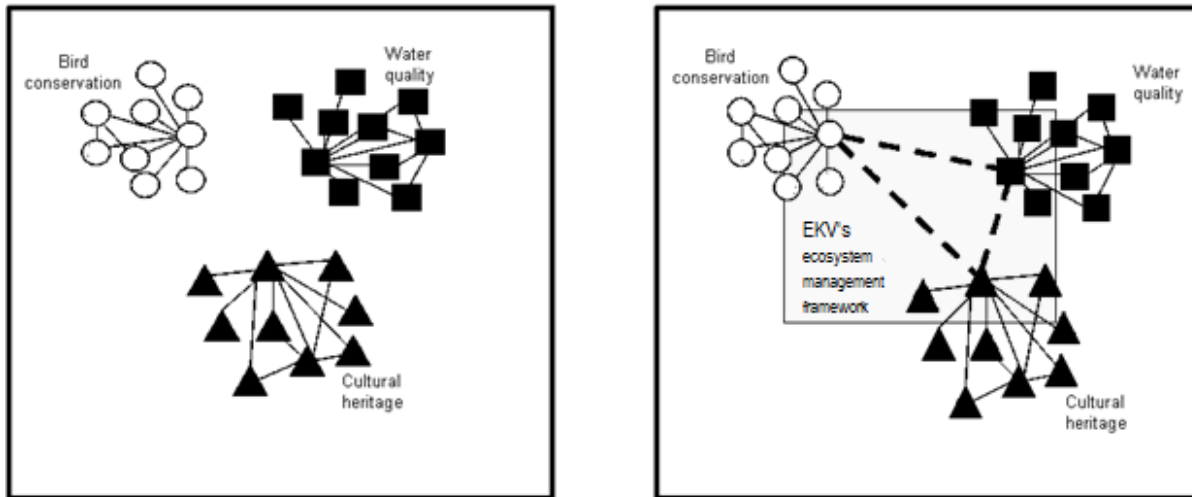
FIGURE 3. THE ROLE OF THE BRIDGING ORGANIZATION (EKV) IN SWEDEN'S KRISTIANSTADS VATTENDRIE BIOSPHERE RESERVE. Institutional brokering allowed organizations that were previously disconnected to collaborate towards innovative solutions.

Adapted from Olsson, Folke & Hahn (2004).

According to a study by Wilson, Ahmed, Siar & Kanagaratnam (2006), collaborative partnerships between NGOs and governmental units at different levels of organization, and the active support and participation of these agencies towards the networked governance initiative, are critical to integrating the various forms of resources and knowledge across these levels of organization. In a study of community-based conservation projects from the United Nations Development Program (UNDP) Equator Initiative, it was shown that partnerships typically spanned four levels of organization (local, regional, national and international) and involved between 10 and 15 partnerships each (Berkes, 2007). Imperial (1999) argued that such polycentric arrangements create an institutionally rich environment that can "encourage innovation and experimentation by allowing individuals and organizations to explore different ideas about solving problems."

Institutional brokering and the creation (co-production) of knowledge requires that key people exchange information with others, identify common interests, and gather support for such interests within their own organization or stakeholder groups. Such strategic interactions require leaders to elicit common goals, create trust, broker contributions between organizations and individuals, and deploy resources according to a strategic plan (Bardach, 1998). Thanks to these people, organizations that do not appear to have much in common may develop crucial links that enable a certain level of collaboration that was previously not possible. In the case of Kristianstads Vattenrike, it was EKV staff that played the major leadership roles, but leadership roles can exist apart from bridging organizations. Bridging organizations can also support leadership roles in other organizations.

In a case study of co-management in the lobster fishery in Maine, success was attributed to two factors: the existence of a neutral area for discussion (Maine Fishermen's Forum) and the effective leadership of the Marine Resource Commissioner, who was a well-networked person in the fishing community (Acheson, 2003). Beem (2007), who

analyzed why the Maine lobster fishery was so successful while the Chesapeake Bay blue crab fishery was not—despite the presence of a formal bridging organization and many other ingredients necessary for successful networked governance—found that it was the top-down nature of the proposed Chesapeake Bay arrangements and the poor networking leadership that lead to its failure within the fishing community. Leadership is needed to balance social forces and interests that enable such organization (e.g., Kooiman, 1993)—like a type of steering that would help hold the network together (Bardach, 1998).

In networked governance, leaders are key individuals who help construct compelling visions of the target system and frame self-organizing processes (Agranoff & McGuire, 2001, Westley 2002). They are especially important since social networks emerge as self-organizing processes, mostly through key individuals who share common interests, despite representing different stakeholder groups (McCay, 2002). However, despite its central importance, it should also be noted, as Gonzales and Nigh (2005) point out, that networking leadership is no guarantee of more democratic decision-making, but it can be part of hierarchical command-and-control structures where policies are implemented in a top-down fashion.

In the exemplary case of EKV, one individual played a particularly significant role in creating and shaping organizational change, meeting with other concerned individuals and groups, developing a social network based on trust and dialogue, compiling existing ecological knowledge and experience found within the network in a project proposal, and linking people and ongoing projects in the area (Olsson, Folke & Hahn 2004). Key EKV staff played leadership roles in merging existing networks, developing new networks and bringing in outside networks for ecosystem management. However, leadership can also come from outside the bridging organization.

Section 4. Knowledge Sharing and Social Learning

Institutional brokering facilitates processes of collective learning and knowledge sharing. Where each governance actor has a limited view of the whole and restricted ability to influence outcomes (Smith & Stirling, 2007), learning between policy-makers, policy co-producers and stakeholders can foster the collective cognition that is necessary to take on policy-making functions of greater complexity (Huppé et al., 2012). Like Bandura (1977), we see social learning occurring and co-evolving at both the individual and collective levels of the network; individuals learn by observing other participants and their social interactions within a group, where there is an iterative feedback between the learner and his or her environment, the learner changing the environment and these changes affecting the learner.

Pahl-Wostl and Hare (2004) and Pahl-Wostl (2006) discuss a case study of a networked governance initiative called Harmonizing Collaborative Planning (HarmoniCOP), which made use of a social learning framework for natural resource management. The framework, which is presented in Figure 4, was developed in the HarmoniCOP project to account for learning processes. According to this approach, social learning for resource management is embedded in the context of governance structures and natural environment, and it is emphasized that social involvement (e.g., enhancing social capital, and developing relational skills and social practices) is as important as content management (e.g., the development and creation of knowledge about the natural system which is the target of policy). The outcomes of such a process are described in terms of both technical qualities, such as an improved state of the natural system, and relational qualities, such as an improved ability of the network to collaborate towards collectively desirable outcomes. Pahl-Wostl and Hare (2004) identified the following capacities that are crucial for the ability of the network to engage in social learning:

- Awareness of each other's different goals and perspectives

- Shared problem perception

- Understanding actors' interdependence

- Understanding the complexity of the management system

- Learning to work together

- Trusting each other

- Creating informal as well as formal relationships
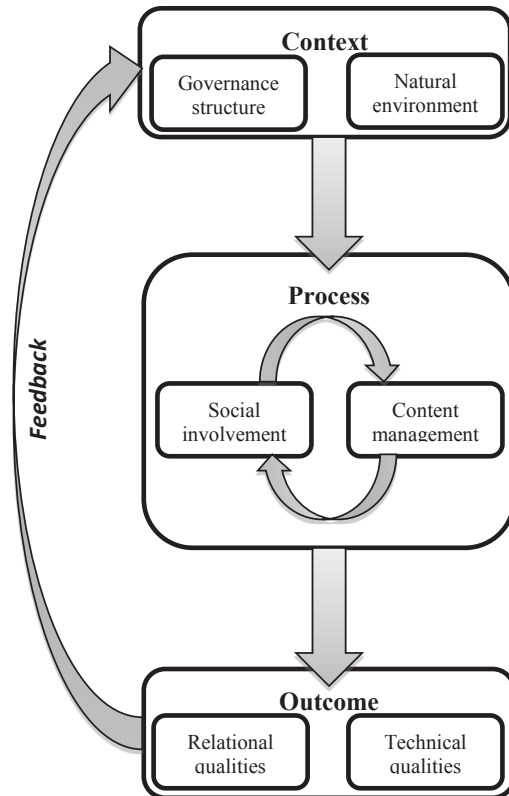
FIGURE 4. CONCEPTUAL FRAMEWORK FOR SOCIAL LEARNING IN RESOURCES MANAGEMENT.

Adapted from Craps (2003) in Pahl-Wostl and Hare (2004).

They also stress that "hard" (factual data on the target system) and "soft" (relational) information must be combined (Johnson, 2000; Pahl-Wostl, 2002) by using a combination of:

- Hard systems analysis: data collection and quantitative analysis

- Soft systems analysis: knowledge elicitation and engineering (Feigenbaum, 1977; McGraw & Harbison-Briggs, 1989)

- Group model building (Vennix, 1996)

- Qualitative analysis (Glaser & Strauss, 1998)

By combining hard and soft data, network actors may build a collective representation of the complex dynamics of the social system that consists the governance network, while developing an integrated model of the social-ecological system that is the target of policy. The European FP5 project, Freshwater Integrated Resource Management with Agents (FIRMA), is one such example where policy co-producers combined participatory approaches with agent-based social simulation with the aim to improve the management of water resources. By using agent-based social simulation, network actors were able to interactively combine, through participatory processes, insights from different domains, and thus build individuals' systems intelligence of the target system and the governance context (Hare & Deadman, 2004). Like group model building (Vennix, 1996), the actors who are supposed to later use the models for decision-making and strategic planning participate and contribute to the entire modelling process. In this way, the model used is more likely to capture the issues that are of relevance to the actors involved. Additionally, the agent-based aspect of the resulting model allows the actors themselves to be represented in the model so that their subjective perceptions and expectations are also captured within it (Pahl-Wostl & Hare, 2004). This model is then used by actors as a way to reflect upon their own goals, beliefs and perspectives, and those of others. Modelling as such is seen as part of the greater interactive process of social learning (Pahl-Wostl, 2002).

Pahl-Wostl and Hare (2004) discussed the techniques used in the case of FIRMA to provide the following ingredients for social learning:

- Awareness of others' perspectives: Hexagon modelling (Hodgson, 1992) is used to quickly elicit from subgroups or individuals ontological, relational and structural knowledge about the target system. This information is then entered directly into a graphical model representation ready for discussion. Facilitators may help individuals or subgroups generate their own models in a private setting. Participants are then asked to present their models to the rest of the network. Views of each actor or subgroup are openly shared and discussed, thus providing the bases for the learning process to begin.

- Eliciting soft data: The card-sorting technique is used to elicit soft data about the actors and how these may interact (Rugg & McGeorge, 1997). In the case of FIRMA, each actor was given a set of cards; written on each of these cards is the name of an actor within the network. Each actor was then asked to sort the cards into meaningful groups, to state the criterion for the sorting and the categories used to group particular actor cards together. This task was repeated with various criteria until there were no longer any criteria suggested. Taking this categorization together with the results of hexagon modelling provided the material to produce a map of how the actors may interact in various aspects of the target system, and within networked governance.

- Understanding actors' interdependence and system complexity: A simple role-playing board game was

developed to represent an agent-based model of the target system in the context of networked governance, representing each actor's role in the system (Hare, Heeb & Pahl-Wostl, 2002). Instead of playing their own role, each actors in the system was asked to take on another actor's role. This allowed perspective sharing, and the actors learned about how their own actions affect and interact with other actors' decisions. In the case of FIRMA, for example, some actors realized how vulnerable the finances of the water utility could be to decisions made by authorities and commercial water users.

- Learning to work with others: Joint interactive use, which is the interactive use of a single model by a group of actors (Benbasat & Lim, 2000), was the model used to promote collaboration. In the case of FIRMA, the project team integrated the mental models elicited through the above-mentioned techniques into one joint model. The network was then asked to use the model to test the direct and indirect outcomes of various policies they had discussed and selected for further analysis in earlier discussions, and represent these outcomes as cause-and-effect relationships on the joint model. In this process, the network was encouraged to consider how effects on one variable could influence variables in other subsystems of the model (i.e., sales of water-saving technology can reduce water use, but also increase profits to manufacturers of the technology, which may lead to other spillover effects). The network would discuss, in an interactive manner, the impacts that might follow another until no more influences remained unchecked.

- Creating trust: Trust was promoted by making sure that project goals, actors' roles and rules for the actors' platforms were discussed at the beginning of the process.
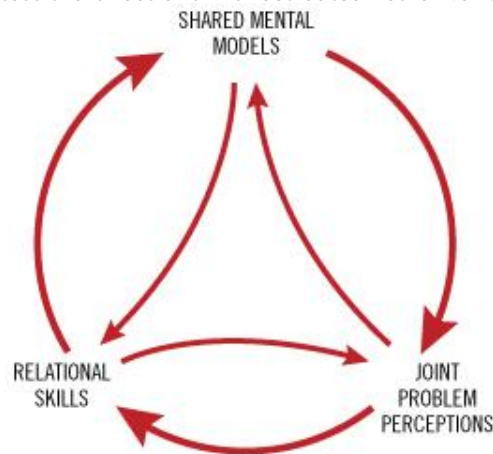

FIGURE 5. ELEMENTS OF COLLECTIVE COGNITION.

During the social learning process, the governance network may create the conditions for enhancing social capital within the group. As defined earlier, social capital is a factor of trust, mutuality and reciprocity. By raising awareness of each individual or subgroup's goals and perspectives, creating shared problem perceptions, fostering an understanding of actors' interdependence and the complexity of the system being targeted by policy, the network is developing actors' perceptions of their mutually dependent interests, and thereby promoting a sense of mutuality. Through social learning, actors learn to work together and create formal and informal relationships, thus also contributing to a certain sense of reciprocity in the network. Through working together collaboratively to support certain policy-making functions, network actors will, little by little, experience the creation of trust.

As long as trust, mutuality and reciprocity is not undermined, but enhanced during stages of the networked governance process, the network will continue to experience the creation of social capital, and thus benefit from an improved ability to achieve tasks of greater complexity, and improved organizational efficiency. In essence, the actors' ability to work together, collaboratively, is enhanced, and the creation of social capital through social learning can be seen as a process of creating collective cognition. Since knowledge of the social system that makes up the governance network, and of the target system that is the object of policy, is widely distributed across network actors, creating this collective

cognition within the group is necessary in order to permit the functions of institutional brokerage that allow the group to envision futures and pathways that are more sustainable, or more in line with the mutual interests, common goals and collectively desirable outcomes across diverse actors (see Section 5). Collective cognition is fostered by creating joint problem perceptions, shared mental models and relational skills, all of which are based on processes of interactive learning and the enhancement of social capital by promoting trust, mutuality (an understanding of interdependencies between diverse actors) and reciprocity across the network.

It is thought that processes of social learning must precede collective decision-making (Pahl-Wostl & Hare, 2004; Huppé et al., 2012). Literature in natural resource management identifies various techniques to foster social learning, including but not limited to Conceptual Content Cognitive Map (3CM) and Actors Resources Dynamics and Interactions (ARDI) (Jones, Ross, Lynam, Perez & Leitch, 2011). The purpose of 3CM is to externalize the cognitive maps (or mental models) of network participants, bringing these maps to the surface so that they can be examined, compared, and discussed (Kearney & Kaplan, 1997). The technique involves asking participants to identify the components and aspects of an issue that they consider important to a domain. Once the participant feels that he has identified all the relevant factors, he or she is asked to organize these factors spatially as to demonstrate their relationships to one another. Spatial mapping as such is thought to be highly compatible with human information processing (Pezdek & Evans, 1979) and cognition that is not only language-based, but also imaged-based, with verbal and imagistic thought carried out by two distinct though partly connected systems (Kearney & Kaplan, 1997). 3CM has been used to explore diverse network actors' perspectives, using a combination of quantitative and qualitative analyses to determine similarities and dissimilarities in stakeholders' views in the context of forest management (Tikkanen, Isokaanta, Pykalaninen & Leskinen, 2006), lake eutrophication (Ozesmi & Ozesmi, 2004) and groundwater management (Dray et al., 2006). FIRMA's use of hexagon-modelling and card-sorting techniques can be seen as constituting a 3CM approach. ARDI is a similar participatory modelling technique that seeks to elicit mental models from individuals or groups in order to build a shared mental model of the target system to support collective decision-making (Etienne, Du Toit & Pollard, 2011; Mathevet, Etienne, Lynam & Calvet, 2011). It asks specifically, either individually or as a group, who and what are the key actors, resources, processes and dynamics within a system and what are the relationships between these elements. The end result of this process is an individual or group influence diagram that serves as a systems model, which can then be used as a foundation to support dialogue and guide decision-making. This technique has been used in the context of water management (Mathevet et al., 2011).

Section 5. Collaborative Visioning and Creating Shared Value

At the onset of a networked governance initiative, participants with diverse worldviews, interests, motivations, relationships, power and other resources often hold disparate visions of what is possible or desirable from their individual standpoint. As network actors share knowledge and build relational skills during the first stages of networked governance, they may experience the creation of shared mental models that are more representative of the elements and dynamics that characterize the target system and the interdependencies among the diverse actors that make up the governance network. Through this first stage of knowledge sharing and social learning, network actors experience a form of strategic alignment because of certain psychological shifts that occur following their realizations of trustworthiness, mutuality and reciprocity between participants. Knowledge sharing, which builds the foundation for this learning and which leads to the creation of collective cognition, serves as a foundation that enhances social capital, thus allowing the network to address tasks of greater complexity, such as collaborative visioning.

Collaborative visioning is the third stage of the networked governance process. During this stage, network actors engage in a process of "constructing and shaping political reality" by going from abstract notions of the problem frame, to positive projections of desirable futures and possible pathways and intermediate actions, and backward again between problem definitions and assessments of desirable futures (Voss, Smith & Grin, 2009). It is a process of continuously testing concepts that could accommodate the views of the diverse participants whose support is needed to make the policy work (Kemp & Rotmans, 2009; Smith & Kern, 2009), while anticipating interpretations, structures and activities of network participants (Bardach, 1977; Kingdon 2003). In this process, participants continue to build their systems intelligence through first-, second- and even third-order learning (Pahl-Wostl, 2009). First- and second-order learning theories are based on the work of Argyris and Schön (1978), who describe single-loop (first-order) learning as being that which does not challenge the underlying assumptions of individual and organizational behaviour, while double-loop (second-order) learning achieves a new level of insight through actors' revisions of their assumptions within their value-normative framework. Figure 6 presents the sequence of learning cycles in the concept of triple-loop learning.
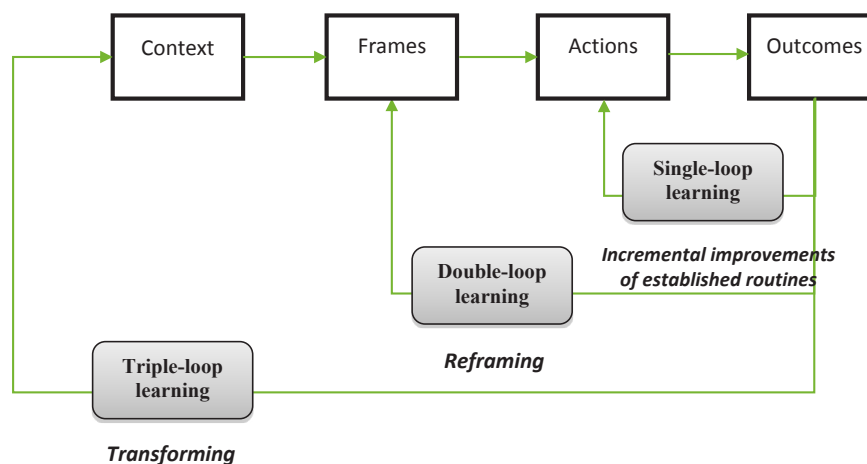
FIGURE 6. SEQUENCE OF LEARNING CYCLES IN THE CONCEPT OF TRIPLE-LOOP LEARNING.
Adapted from Pahl-Wostl (2009).

The third level of learning, often called triple-loop or epistemic learning, occurs when learners start to reconsider underlying values, beliefs and world views, if assumptions within a world view do not hold anymore (e.g. Bawden, 1994; Keen, Brown & Dyball, 2005; Pahl-Wostl, 2009). This multi-level view of learning has become widely adopted in management literature with respect to the perceived links between second- and third-order learning and transformative change in organizations (Hargrove, 2002). For instance, Armitage, Marschke & Plummer (2008), who apply the multilevel learning concept to environmental and resource management associate triple-loop learning with changes in governance norms and protocols. Pahl-Wostl (2009) goes so far as to propose that many kinds of double-loop learning can only be effective if accompanied by triple-loop learning since the dominating frame of reference is often strongly influenced by the structural context and thus effective reframing may not be possible without third-order learning. However, multilevel learning is assumed to proceed in a stepwise fashion, moving through the phases of single to double to triple. Since higher levels of learning are associated with higher costs, it is plausible that higher levels of learning are entered only when constraints at the lower level are encountered. Giddens's (1984) structuration theory, which proposes that organization change relates to a reproduction and reinterpretation of structure by agency, supports this iterative, stepwise process. In the context of social, self-organized learning through collaborative visioning processes, based on the work of Armitage et al. (2008), we would consider the following three learning theories: experimental learning, which is a process of creating knowledge through the transformation of experience and learning by doing (Keen & Mahanty, 2006); transformative learning, which is a reflective process that enables the alteration of individuals' perceptions and consciousness (Mezirow, 1996) and which includes communicative and instrumental learning (Sinclair & Didcuk, 2001); and social learning, which is a process of iterative reflection that occurs when experiences and ideas are shared with others (Keen et al., 2005).

Collaborative visioning and vision sharing is seen by organizational scholars as a crucial foundation for proactive learning because it provides direction and a sense of commitment and purpose among members (Day, 1994). Like Senge (1990), we differentiate between the personal visions that participants hold before a networked governance process, and shared visions, which is the aim of collaborative visioning. Shared visions enable participants to understand each others' expectations, what outcomes to measure and what theories are in application, and collaborative visioning aims to identify attractive system innovations and the commitment for collaborative governance.

During the visioning process, it is important to carefully consider issues of problem framing as deeply intertwined with structural and agency-level processes of organization, behaviour and cognition (Brown, 2008). With networked governance, the process by which governance strategies are formulated is not located outside the target system, but embedded within the social and political processes it seeks to influence and deeply intertwined with the implementation process (Stone, 1988). Therefore, problem solving relies on continuously testing concepts that could accommodate the views of the diverse participants whose support is needed to make the policy work, while anticipating interpretations, structures and activities of network participants. In this way, fostering shared visions of sustainability can promote the creation of shared value.

Brown (2008) describes governance networks as interconnected knowledge cultures. At the lowest level, all knowledge is embedded in the minds of individuals, and contributes to the knowledge base of various communities, and specialized knowledge draws evidence from contributing communities, with each having a particular perspective on the policy problem. This local knowledge must then be drawn together in an informed decision that integrates these distributed capacities that compose the network. A holistic understanding of the policy problem and a relational ability to access these negotiated capacities must weave through the connected knowledge and social systems so

that the contributions may be shared across the network. This process is described by Brown as a learning cycle between the individual and collective levels of learning, which occurs in four stages: what should be (clarifying existing ideas: the range of ideals from each knowledge culture); what is (documenting the parameters of the project: sets of facts from each knowledge culture); what could be (accessing new ideas: creative ideas for collective change); and what can be, in practice (testing ideas for action: innovative program for collaborative action). These same cycles can occur collectively by including the diverse stakeholder groups at each learning stage, and thus guiding collaborative action toward a common purpose. Collective learning would thus occur as part of the network's search for desirable futures and pathways that are more fully reflective of the interdependencies. Collaborative visions emerge through a co-evolutionary process wherein learning that occurs at the individual or stakeholder group level affects learning at the collective level, and vice versa. Figure 7 presents this "collective learning spiral."
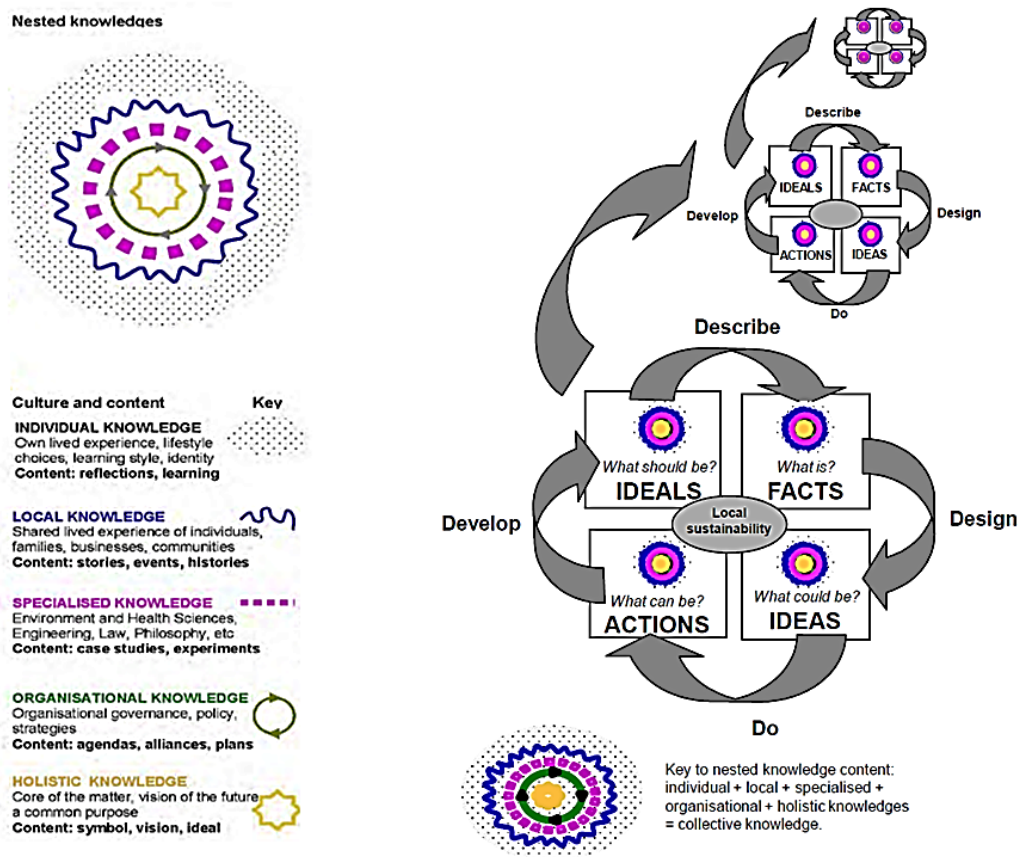
FIGURE 7. KNOWLEDGE CULTURES AS NESTED SYSTEMS AND THE COLLECTIVE LEARNING SPIRAL.
Adapted from Brown (2008) in Griffith, Brown, (2010).

Creating shared value is a process of creating strategic alignment between network participants. Being deeply intertwined with collaborative visioning, it is achieved when network actors recognize the common goals and collective outcomes that are achievable when diverse but interdependent actors engage in coherent efforts and align their individual strategies according to shared visions of sustainable development (Huppé et al., 2012). Although there are certain futures on which diverse various stakeholders and network participants may not agree, it is possible that, by creating shared visions of sustainable futures, network participants may recognize their interdependent roles in achieving positive outcomes (Constanza, 2000; Inayatullah, 2003; Meadows, 1996; Rotmans, Kemp & Van Asselt, 2001; Schwartz, 1991). The visioning process facilitates the transfer of tacit knowledge (e.g., Crona & Bodin, 2006; Crona, 2006), creates social capital within the group and allows network participants to work collaboratively to achieve collectively desirable outcomes that would have been impossible were each participant and his or her organization to be acting on their own, outside the networked governance process. In a co-evolutionary manner, various groups with a wide range of interests and ambitions attempt to get their own themes placed on the political agenda, and it is by negotiation, adaptation, co-production and learning that actors may change their own vision, redefine their own position and change their perception of the problem at hand. This perspective is based on the "advocacy coalition framework" of Sabatier and Jenkins-Smith (1999) and the concept of "partisan mutual adjustment" of Lindblom and Woodhouse (1993).

The approach to creating shared value can be compared to Pahl-Wostl and Hare's (2004) description of a co-management process as "not a search for the optimal solution to one problem but an ongoing learning and negotiation process where a high priority is given to questions of communication, perspective sharing, and the development of adaptive group strategies for problem solving" (p. 193). Kendrick (2003) described the process as learning to respect differences. We suggest that another essential component is learning to appreciate similarities. For example, in the Northern Highland Lake District (NHLD), collaborative visioning was spearheaded by a group of scientist who, through a series of meetings and outreach activities, evoked dialogue about alternative futures with the various groups that eventually made up the governance network.[5] Ahead of the collaborative visioning process, there was a central disconnect among Native Americans, lakeshore owners and local nontribal people who were highly dependent on exploitation patterns that a growing number of people believed were untenable. Also, the interests of the actors that made up the prevailing governance system were somewhat different across stakeholder groups, including the interests of lake associations, which are in place to perform the adaptive co-management of lakes or lake chains, and those of local actor groups such as local tribes, recreational users, the forest product and construction industries, NGOs and the state management agency. However, by engaging in collaborative visioning that fostered shared visions of the target system, the diverse but interdependent actors experienced the creation of strategic alignment, which allowed them to make the step toward reflexive governance, allowing them to achieve collective outcomes and common goals that they may have been unable to achieve if each acted on their own. Visioning served as a starting point for enhancing social capital and subsequently allowed the group to start a process of evaluating policy options in terms of how these would shape the ability of NHLD to respond to potential risks and opportunities. Similarly, collaborative visioning during the 1980s and 1990s helped shape alternative visions for the future of the Everglades in Florida, and played an important role in the search for and exploration of policy options.

---

[5] For more information on the NHLD, see: http://lakefutures.wisc.edu

If there is sufficient strategic alignment between stakeholder groups and diverse network actors then it may be possible for the governance network to surpass what we call the efficacy frontier of reflexive governance, and engage in the exploration, innovation, selection and implementation of policy options in a reflexive manner (Huppé et al., 2012). For example, transition management literature describes a process, based on sustainability visions, in which transition paths are developed and a common transition agenda is formulated collaboratively by network actors (Loorbach, 2007). This transition agenda contains a number of joint objectives, action points, projects and instruments to realize collective outcomes, and makes it very clear what party is responsible for which type of activity, project or instrument that is being developed. The next step, which they call the technical stage is to translate the visions into transition paths and establish a series of intermediate objectives, which, as they come closer, can be formulated more quantitatively. Most of the focus is aimed at the structures of the regime, and at affecting the regulatory, institutional, economic, technological, behavioural and other barriers that may influence the system to move in one direction or the other. The implementation stage relies on experimentations and continuous learning. Transition management approaches have been promoted by the Dutch government in such areas as green energy transition, sustainable transportation and waste management.
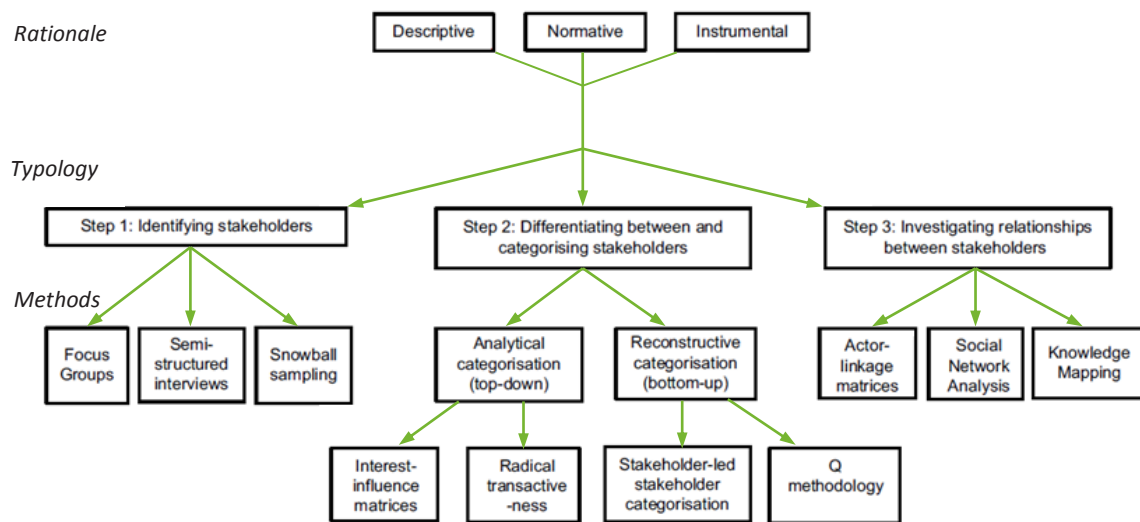
Section 6. Using Stakeholder Analysis

Most networked governance initiatives make use of a combination of stakeholder analysis and social network analysis to help identify stakeholder categories, ensure key groups are included and specify representatives that are well connected and respected with the groups they need to represent (Prell et al., 2009; Reed et al., 2009). In particular, such analyses can help generate information on the behaviour, interests, agendas, and influence of various actors with regards to certain policy-making processes and thus facilitate the transparent implementation of decisions or objectives, understand the policy context and assess the feasibility of future policy options (Brugha & Varvasovky, 2000). For instance, the 4Rs tool analyzes how people relate to one another over natural resource use by categorizing stakeholders' rights, responsibilities and revenues (benefits) and then assessing the relationships between these categories (Salam & Noguchi, 2006; Tekwe & Percy, 2001). In natural resource management, stakeholder analysis is used to safeguard the principle of inclusivity, helping ensure that marginal groups are empowered (e.g., Chambers, 1994; Johnson, Lilja, Ashby & Garcia, 2004). Ultimately, it is hoped that applying these may help mobilize knowledge from the broad base of actors (Borsuk, Clemen, Maguire & Reckhow, 2001; Bryson, 2004; Grimble & Wellard. 1997; van de Riet, 2003).

Of interest to networked governance, there are two main approaches to stakeholder analysis: normative and instrumental. Reed et al. (2009) describe the normative approach as one that has been advocated increasingly for its use in policy, development and natural resource management circles, which emphasize the legitimacy of stakeholder involvement and empowerment in decision-making processes, using stakeholder analysis to legitimize the decisions that are made, through the involvement of key and/or representative figures (e.g., Donaldson & Preston, 1995), or to identify who decision-makers are morally accountable to (Friedman & Miles, 2002). Normative analysis thus supports the collective process of negotiation and consensus building to come to an agreement that works for those involved, often requiring that stakeholders engage in interactive processes of learning, validating and understanding before reaching an agreement. In this way, it is thought that stakeholder analysis can "facilitate a 'constructivist' approach to stakeholder participation, which recognizes multiple perspectives of the 'truth', where 'reality' is socially constructed" (Reed et al., 2009, p. 1936). Instrumental stakeholder analysis is thought to be more pragmatic, and largely devoted to understanding how organizations, projects and policy-makers can identify, explain and manage the behaviour of stakeholders to achieve desired outcomes (Reed et al., 2009). In policy, development and natural resource management circles, such analyses have been used, for example, to overcome obstacles to the adoption of new technologies, adapt technologies to relevant user groups, or to disseminate the same technologies in different ways to different groups (Johnson et al., 2004). Finally, Reed et al. (2009) describe how normative justifications for stakeholder analysis can lead to instrumental outcomes. For example, normative analysis can lead to instrumental ends if it leads to the transformation of relationships and the development of trust and understanding between participants.

Both normative and instrumental approaches are applied to networked governance. If analysts have an intimate knowledge of stakeholders or considerable documentary evidence, then the analysis can be conducted without the involvement of stakeholders. Reed et al. (2009) provide a schematic representation of rationale, typology and methods (Figure 8). Stakeholder analysis follows three steps: 1) identifying stakeholders; 2) differentiating between and categorizing stakeholders; and 3) investigating relationships between stakeholders. Some methods, such as stakeholder-led stakeholder categorization and the Q methodology, are based on active stakeholder participation and may be used as methods to share knowledge and foster social learning across network actors. These methods are what Reed et al. (2009) refer to as reconstructive (bottom-up) categorization because they allow categorizations

and parameters to be defined by the stakeholders themselves so that the analysis reflects their concerns more closely (Dryzek & Berejikian, 1993). In fact, most stakeholder analysis methods can be used in this participatory manner to foster learning across network actors, but they can also be used on a purely observatory basis if the analyst has sufficient understanding or considerable documentation to perform the analysis without their involvement.

FIGURE 8. SCHEMATIC REPRESENTATION OF RATIONALE, TYPOLOGY AND METHODS FOR STAKEHOLDER ANALYSIS.

Adapted from Reed et al. (2009).

Knowledge mapping can be especially useful to foster collaborative relationships and innovative outcomes in governance networks. Using a combination of social network analysis, and semi-structured interviews to identify interactions and knowledges, the analysis aims to depict the linkages in a knowledge system (the governance network) and to identify and evaluate the information exchange mechanisms within this system. This mapping can also provide an overview of the power and control structure, thus giving an indication of whose interests are being met and which groups may be underrepresented in problem-solving processes (Food and Agriculture Organization, 1995; Reed et al., 2009). The knowledge map captures the knowledge of different stakeholders across time, people and locations (Nissen & Levitt, 2004); identifies the dominant flows of knowledge (Eppler, 2001); identifies knowledge bottlenecks and areas of latent knowledge; locates and explains knowledge; assists individuals within the system to understand the other types of knowledge of different individuals and groups within the system; and helps researchers to group stakeholders more effectively in order to promote learning. Actor-linkage matrices and social network analysis[6] can be especially useful to help inform institutional brokering strategies; these analyses help identify structural holes in governance networks, and can also help inform methods to optimize structures along desired dimensions of centralization, density, nature and strength of relationships and leadership.

---

[6] These two concepts are discussed at length in Huppé et al (2012).

Interest-influence matrices place stakeholders on a grid according to their relative interests and influence. This matrix is usually constructed in focus group settings or individually by a stakeholder during an interview. The outcome of the analysis makes explicit the power dynamics of the network, and can thus be used to prioritize stakeholders for inclusion. Radical transactiveness is undertaken with the goal of opening communication channels with stakeholders that would otherwise be considered peripheral to networked governance processes. The analysis uses snowball sampling to identify stakeholders, and then aims to develop strategies to address their concerns, which may be fed into the problem-solving process. As such, it allows the governance network to include issues and stakeholders that might otherwise be missed. Through radical transactiveness, powerful and fringe stakeholders can influence each other and avoid potentially disruptive relationships in the future (Hart & Sharma, 2004). These methods share parallels to conflict analysis (Howard, 1989). In conflict analysis, actors are assumed to be rational agents whose behaviour is guided by a combination of their objectives and the actions under their control, called options. As a practical application of game theory, conflict is analyzed by investigating the actors, their preferences, binary options and the rules of the game (Kilgour & Hipel, 2005).

Another approach of interest is consensus analysis. Consensus analysis assumes that cultural domains are learned and shared, and the extent of sharing can vary among participants and subgroups (Stone-Jovicich, Lynam, Leitch & Jones, 2011). It makes use of informant responses to systematic interview questions, and applies rigorous statistical analyses to assesses the degree of shared knowledge within and between groups (Romney, Weller & Batchhelder, 1986), with the aim of understanding "whether there is a culturally central or a more diversified understanding of the domain within the local knowledge system" (Caulkins & Hyatt, 1999). It is a method that is commonly used in anthropology to analyze cultural domains, and has been used in a diverse range of issue areas, including fisheries management (Miller, Kaneko, Bartram, Marks & Walesh, 2004), organizational change (Caulkins & Hyatt, 1999) and traffic safety (Kim, Donnell & Lee, 2008). The statistical estimates that it produces address the following three questions:

1. To what extent does a group of respondents share a single cultural model (i.e., a single shared mental model)?

2. If there is consensus, to what extent does each respondent agree with the group's cultural beliefs (i.e., the group's mental model)?

3. What are the "culturally appropriate answers" to each item mentioned by the group?

For example, studying water use and management in the Crocodile River catchment in South Africa, Stone-Jovicich et al. (2011) used consensus analysis to elicit and compare the mental models of conservationists and irrigators with respect to: (1) who were the major water users of the Crocodile River catchment, (2) what were the causes of the current problems with flows in the Crocodile River, (3) what would be the consequences of the river not flowing and (4) what should be the priorities for future use. They sought to understand if the mental models regarding water use and management in the Crocodile River catchment were shared, weak, multi-centric, or fragmented, and found that between the irrigators and conservationists they interviewed, there was no consensus, as a whole group or as separate groups, regarding major water users, the causes of the river flow problems and future priorities for the Crocodile River catchment. As a participatory tool, consensus analysis revealed the plurality of views and provided a vehicle for negotiating. Where there was mistrust, misconceptions and misunderstandings, consensus analysis helped build

bridges between groups by giving "equal voice" to all, and helped identify differences and convergences in mental models to facilitate policy-making processes.

The remaining stakeholder analysis methods according to Reed et al.'s (2009) schematic representation—focus groups, semi-structured interviews and snowball sampling—are used to help identify stakeholders for inclusion in governance networks.

## Section 7. Collective Social Capital: A Lock-Step Social Capital Framework for Networked Governance

Effective networked governance, which leads to creating shared value and reflexive governance, demands a certain level of social capital across network actors to enable collaborative processes. In governance networks, constructive dialogue and interactions are dependent upon a certain level of social capital across network actors, and, in turn, the enhancement of social capital in the network depend upon a certain level of interaction across these actors. This intertwined, reciprocal relationship between network interactions and social capital is central to our understanding of the fundamentals of effective networked governance.

Two noteworthy frameworks address the interplay of social capital, constructive interactions and networked governance effectiveness. The first of these frameworks is Ostrom's Institutional Analysis and Development (IAD) framework (Ostrom 1990, 1998). In this framework, network actors engage in what Ostrom calls the "action arena," which is structured by three sets of variables: the biophysical structure of the resource under consideration, the attributes of the community and institutional rules-in-use. Taken together, the decisions and behaviours of actors within the structural constraints of the "action arena" produce the observable patterns of interaction and outcomes in a particular policy setting. Based on Libecap's (1989) model of contracting for property rights and, more generally, on the literature on neo-institutional economics and transaction costs (Eggertsson, 1990; North ,1990), the political contracting framework developed by Lubell et al. (2002) is the other noteworthy framework. Lubell et al. (2002) build on Ostrom's IAD framework and incorporate factors affecting benefits and transaction costs and thus the likelihood that partnerships will develop. For example, analyzing watersheds, they found empirical evidence that partnerships emerge due to the increasing complexity and significance of given policy problems, and due to the weakness of existing institutions to manage these problems. In these situations, networked governance may be Pareto superior to command and control arrangements. However, their evidence shows that benefits of partnerships accrue only if network actors overcome second-order collective action problems of institutional supply (Bates, 1988), which exacerbate the costs of collaboration for the actors involved. The higher the transaction costs of collaborative behaviour, which is required to develop and maintain partnerships, the less likely it is that partnerships will emerge.

Both, Ostrom's IAD framework and the political contracting framework of Lubell et al. (2002) are based on Institutional Rational Choice theory, which assumes that actors are self-interested but subject to Simon's (1957) notion of bounded rationality. These frameworks are useful to the extent that they can be used by analysts to help identify arenas conducive to collaborative behaviour. To some extent, they can also help identify methods that may encourage collaboration towards networked governance. For example, Lubell et al. (2002) consider the impact of prior institutional structures and institutional rules on transaction costs and the ways in which institutional support in the networked governance arena can help offset these costs. Similarly, Ostrom (1998) considers the behavioural and cognitive components underlying trust, reputation and reciprocity, as factors that allow diverse groups to "overcome the strong temptations of short-run self-interest" (p. 1) and achieve mutually beneficial outcomes. She argues for the need to place reciprocity, reputation and trust at the core of an empirically tested, behavioural theory of collective action, postulating that "we can expect many groups to fail to achieve mutually productive benefits due to their lack of trust in one another or to the lack of arenas for low-cost communication, institutional innovation, and the creation of monitoring and sanctioning rules" (p. 16). These frameworks on institutional rational choice demonstrate the close, intertwined, reinforcing and reciprocal relationship between social capital, cognition and effective networked governance.
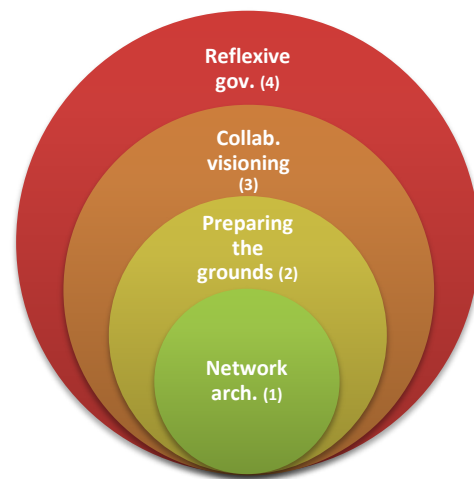
Our lock-step social capital framework for networked governance takes *social capital* to be composed of the elements of trust, mutuality and reciprocity; *collective cognition*, the elements of shared mental models, joint problem perceptions and relational skills, and; *networked governance*, the elements of shared vision, strategic alignment and collective problem solving. As stated earlier and in Huppé et al. (2012), effective networked governance processes lead to creating shared value and reflexive governance across diverse but interdependent actors and stakeholder groups. Creating shared value is achieved when these actors align their strategies according to shared visions of sustainable development, and implement strategies that are mutually or collectively beneficial. Reflexive governance occurs when they engage in a process of exploring, innovating, selecting and implementing policy options. Networked governance requires a certain level of social capital to enable the achievement of creating shared value and reflexive governance in a collaborative manner. Huppé et al. (2012) conceptualized these social capital requirements as the collaborative visioning frontier (the social capital threshold which is minimally required for collaborative visioning, which promotes creating shared value through a process of promoting shared visions and strategic alignment and collective problem solving) and the efficacy frontier of reflexive governance (the social capital threshold which is minimally required for the network to explore, innovate, select and implement policy options in a reflexive manner).
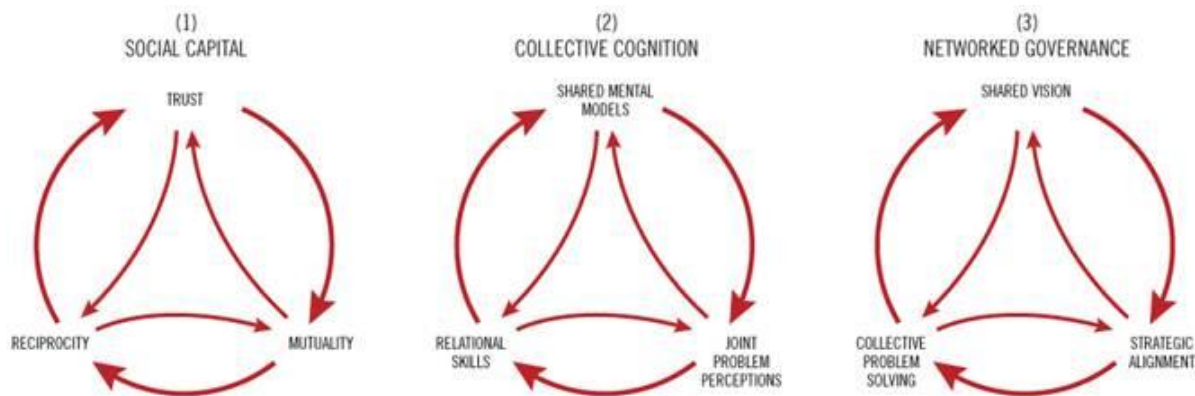
FIGURE 9. COMPONENTS AND ELEMENTS OF NETWORKED GOVERNANCE.

Networked governance initiatives are composed of four sequential stages: network architecture, preparing the grounds, collaborative visioning and reflexive governance (Figure 10). Each of these stages require more social capital than the last. Network architecture consists of using stakeholder analysis and social network analysis methods to identify and select stakeholders for participation in the governance network and to assess the implications of prevailing network structures on the ability of various stakeholder groups to contribute fully to collaborative processes. Institutional brokering is also considered at this stage: the role and structure of a bridging organization is assessed and implemented if deemed important, and mechanisms are put in place to instill network leadership. These actions are undertaken with the dual goal of ensuring a certain level of diversity to allow a comprehensive representation of the required institutional capacities within the governance network, while ensuring a network structure that is conducive to maintaining and enhancing social capital so that positive policy and governance innovation may be achieved by way of the networked governance process that is to follow. Network architecture should help facilitate a network structure that promotes trust, mutuality and reciprocity.

The second stage is preparing the grounds. Here the network should engage in activities of knowledge sharing and social learning using techniques like hexagon modelling, card sorting, role playing, joint interactive use, 3CM (Conceptual Cognitive Mapping), ARDI (Actors Resources Dynamics and Interactions), Q methodology, stakeholder-led categorization and other participatory approaches (see Section 4). During this process, network actors build shared mental models of their target system and of the way in which various stakeholders are linked to this system and to each other. At this stage, shared mental models are created, relational skills are built and conditions are put in place to allow the network to jointly perceive policy problems in a manner that fosters collective cognition. This means that network actors should come out with a better understanding of their interdependencies (mutuality). By interacting through those processes, they will also be building a history of collaboration that should foster trust and reputation, and also promote a certain level of reciprocity. During the subsequent stage, collaborative visioning, network actors engage in a process of envisioning the positive images of the future, and the pathways and intermediate actions that could lead to this future. Visioning in this collaborative manner allows the network actors and stakeholder groups to imagine sustainable futures that may be impossible if each were working on their own. Such strategic foresight should account for the interdependencies that characterize the target system, the links of the actors' to this system and the links between themselves. By visioning images of the future that are collectively desirable, actors build on and deepen their shared mental models, joint problem perceptions and relational skills. Through the process, they enhance social capital and the elements of trust, mutuality and reciprocity. By aligning their strategies according to shared visions of sustainable development, the governance network promotes the creation of shared value, the attainment of common goals and collectively desirable outcomes.

By building the stock of social capital at each stage of the initiative, the governance network can surpass the social capital threshold implied by the efficacy frontier, and may be in a position to engage in a process of exploring, innovating, selecting and implementing

FIGURE 10. STOCK OF SOCIAL CAPITAL AND STAGES IN THE NETWORKED GOVERNANCE PROCESS

policy options in a reflexive manner. Reflexive governance consists of integrating the capacities for problem solving in a manner that allows network actors to innovate superior policy and governance solutions. As an extension of the visioning process, collaboration relies on continuously testing concepts that could accommodate the views of the diverse participants whose support is needed to make the policy work (Kemp & Rotmans, 2009; Smith & Kern, 2009), while anticipating interpretations, structures and activities of network participants (Bardach, 1977; Kingdon 2003).

This lock-step view of how networked governance initiatives are developed and maintained based on social capital and collective cognition paints a unique picture of the process of developing effective processes, and maintaining and enhancing the stock of social capital. Based on this understanding, cognitive elements mediate the relationship between effective networked governance processes and the development of social capital, where creating shared value and reflexive governance are at the centre of this framework, in what is seen as institutional innovation. The development of collective cognition and social capital is seen as organizational innovation (or network innovation). Institutional innovation (policy and governance innovation) is the ultimate purpose of networked governance

initiatives. Organizational innovation is the instrumental purpose. In order to achieve effective networked governance, these initiatives must develop conditions of social capital and collective cognition sufficiently through this instrumental process that we call organizational innovation. Organizational innovation sets the preconditions that will allow the network to integrate distributed capacities for networked governance; by lowering the transaction costs of collaboration, it enables diverse but interdependent actors to overcome the strong temptations of short-run self-interest, promoting the achievement of collectively desirable outcomes. Each stage of the networked governance process is undertaken with an aim to enhance the stock of social capital sufficiently to move on to the subsequent stage.
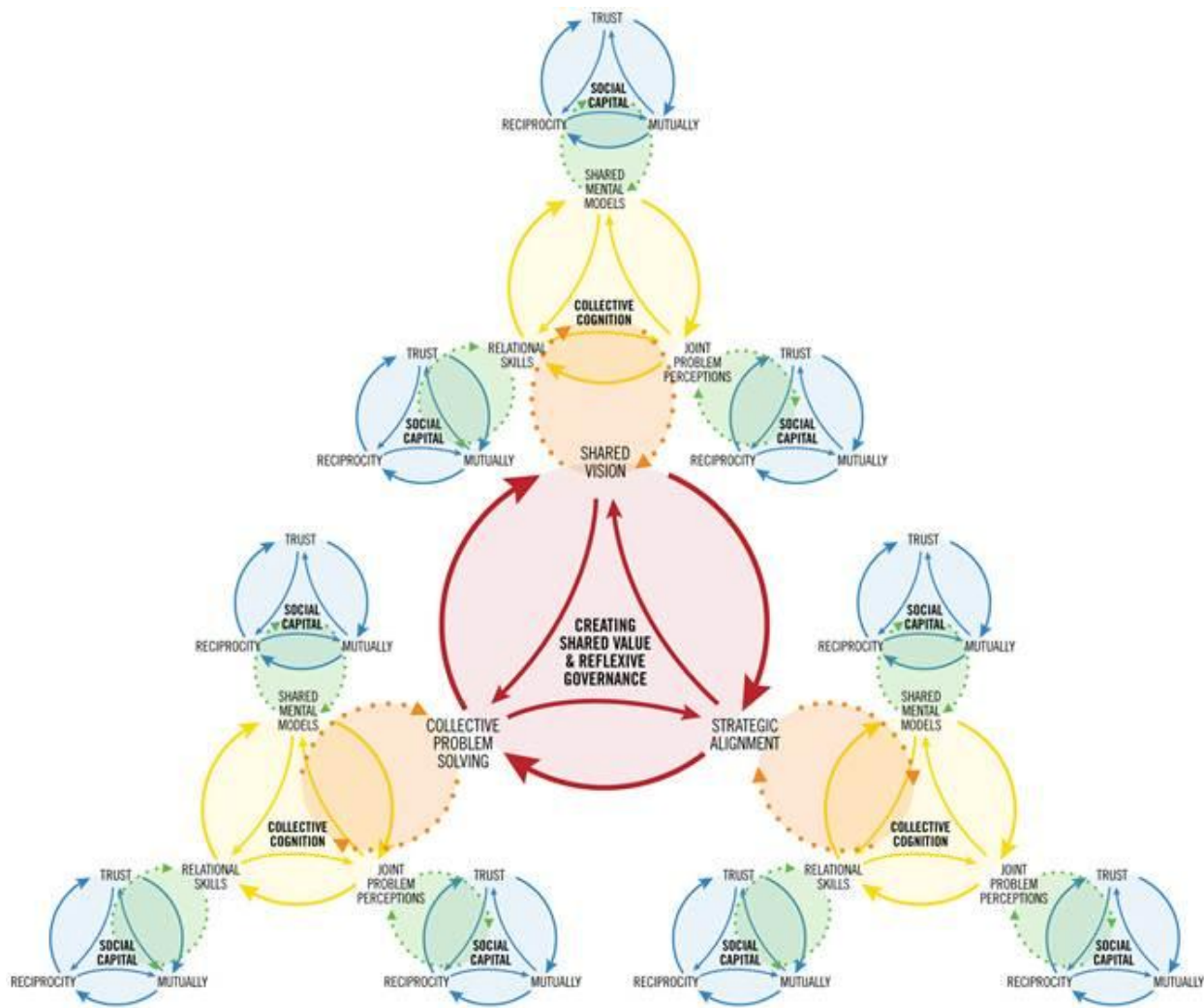
FIGURE 11. INSTITUTIONAL AND ORGANIZATIONAL INNOVATION IN GOVERNANCE NETWORKS AND THE INTERPLAY OF COMPONENTS AND ELEMENTS.

Figure 11 depicts this interplay between the elements of social capital, collective cognition and networked governance (creating shared value and reflexive governance). Effective networked governance depends upon a certain level of social capital and collective cognition, to enable the integration of distributed capacities towards the creation of innovative solutions. There is a reciprocal causation between the development of networked governance initiatives, and the maintenance and enhancement social capital and cognitive elements. Both effective networked governance and the instrumental stock of social capital are embedded in the elements of collective cognition (shared mental models, joint problem perceptions and relational skills), which allow the integration of diverse elements across heterogeneous actors and stakeholder groups. The elements of networked governance—shared visions, strategic alignment and collective problem solving—each depend upon and contribute to the development of collective cognition. Engaging in the process of collective problem solving, for example, enhances cognitive conditions by fostering relational skills, building joint problem perceptions and enhancing shared mental models. Developing these cognitive elements, in turn, promotes the enhancement of social capital conditions. Fostering joint problem perceptions, for example, promotes a sense of mutuality, encourages reciprocity and creates an incentive to develop trust. Similarly, enhancing conditions of social capital will promote collective cognition by improving relational skills, and facilitating the creation of shared mental models and joint problem perceptions. In turn, this will enhance the ability of the group to develop the elements of networked governance, promoting collective problem solving, encouraging a certain level of strategic alignment and fostering shared visions of sustainable development. Social capital and collective cognition are organizational innovations that may be facilitated by the activities of institutional brokering, knowledge sharing and social learning, and collaborative visioning. Only when the network has achieved a certain level of organizational innovation is it enabled to create shared value and engage in reflexive governance.
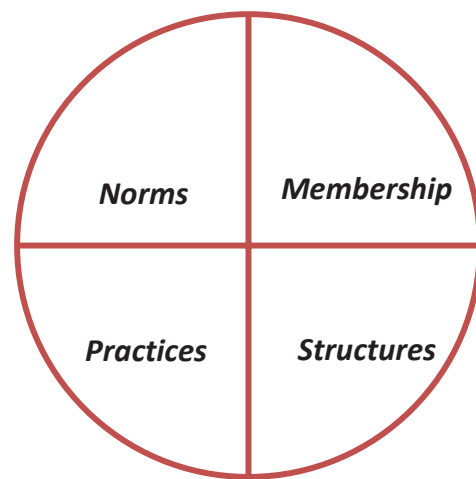
FIGURE 12. FOUNDATIONS OF SOCIAL CAPITAL.

Four fundamental concepts underlie social capital and intersect with its elements of trust, mutuality and reciprocity. These are network norms, membership, practices and structure. The Policy Research Initiative's conceptual framework on social capital provides a good model to assess the stock of social capital within a given governance network. Focusing on collective social capital, it evaluates a network's structural properties, dynamics, and the external context in which it is embedded (Franke, 2005). It examines two levels of collective social capital:

1. Intra-organizational: With regards to networked governance initiatives, it is the social capital contained within an individual stakeholder group or a subgroup of the network. We will refer to this level as *stakeholder-group* social capital.

2. Inter-organizational: With regards to networked governance initiatives, it is the social capital contained across all stakeholder groups and individual actors that make up the governance network. We will refer to this level as *network* social capital.

Appendix 3 provides a list of indicators for the concepts of structure, dynamics and context. In Policy Research Initiative's framework, the concepts of network norms and practices are folded under network dynamics. The practices that we discussed, including institutional brokering, knowledge sharing, social learning and collaborative visioning all contribute to the stock of social capital. Norms are the implicit or explicit rules that shape behaviour within the network. For example, norms of reciprocity promote the expectation that actors will respond positively to actions that are in the long-term, collective interest of the network. Explicit norms regarding procedural rules that promote trust, mutuality and reciprocity across diverse actors and groups may help promote social capital. The process of creating these rules can follow a collaborative approach, and thus create relational skills and an understanding of interdependencies across network actors. Implicit norms will develop as the network learns to work together. Optimally, these norms should promote the enhancement of social capital and the development of collective cognition. Network membership is especially important. The network needs not only those actors that harbour the knowledge required for policy and governance innovation, but also those that can help integrate and configure the diverse sources of knowledge towards innovative outcomes that are mutually or collectively beneficial. There is a need for network actors that can serve as effective intermediate modulators between different organizations across diverse domains, sectors, and scales. Selecting actors and groups for membership should therefore account for this need for groups that can facilitate or support relational skills in the network.

International
Institute for
Sustainable
Development

Institut
international du
développement
durable

Section 8. Conclusion

Networked governance organizes processes of interactive learning. When problems attain a certain level of complexity, it is thought that the capacities for problem solving are widely distributed across interdependent actors from different scales and sectors of society. Only by interacting collaboratively through processes of networked governance, which promotes the elements of trust, mutuality and reciprocity, and those of shared mental models, joint problem perceptions and relational skills can actors begin to align their strategies according to shared visions of sustainable development, and achieve common goals and outcomes that are mutually beneficial and collectively desirable. Only by creating these enabling organizational conditions of social capital and collective cognition can networked governance initiatives allow the creation of shared value and reflexive governance. In the introduction, we discussed the need for psychological shifts, especially among those who see their position in absolute terms. Through institutional brokering, knowledge sharing and social learning, and collaborative visioning, individuals may experience this cognitive transformation that would enable them to network to reach mutually beneficial outcomes. These shifts not only promote the elements of collective cognition, but also those of social capital.

Due to advances in technology and global trade, we live in a world that is increasingly interconnected. As we grapple with challenges of sustainable development, which often span multiple administrative boundaries and fragmented institutions, it is likely that the weaknesses of policy-making methods that prevail today will require significant transformations to account for the fact that capacities for problem solving are widely distributed outside centralized agencies, to include participation from governments, the private sector and civil society spanning multiple scales and domains of expertise. In the future, failures in problem solving would result not from the absence of adequate knowledge or resources, but from an inability to recognize when and how these should be applied. Through a more decentralized, polycentric approach, it is possible to surpass current limitations. Our research has demonstrated the importance of social capital and collective cognition in enabling such arrangements. However, it is important to note that such a networked approach does not replace traditional, top-down governance, but rather enhances and complements it. Some problems are too complex, are mired by a history of antagonism, suffer from a lack of adequate brokerage or are subject to other negative conditions. More research is needed to identify where networked governance should or, perhaps more importantly, should not be pursued at the risk of inaction, ineffectiveness and inefficiency.

References

Abel, N., Ross, H. & Walker, P. (1998). Mental models in rangeland research, communication and management. *Rangeland Journal*, *20*, 77–91.

Acheson, J.M. (2003). *Capturing the commons: Devising institutions to manage the Maine lobster industry*. Lebanon, NH: University Press of New England.

Addleson, M. (1996). Resolving the spirit and substance of organizational learning. *Journal of Organizational Change Management*, *9*(1), 32–41.

Agranoff, R. & McGuire, M. (2003). *Collaborative public management: New strategies for local governments.* Washington, D.C.: Georgetown University Press.

Agranoff, R. I. & McGuire, M. (2001). Big questions in public network management research. *Journal of Public Administration Research and Theory, 11*, 295–326.

Amin, A. & Thift, N. (Eds.). (1994). *Globalisation, institutions and regional development*. Oxford: Oxford University Press.

Amin, A. & Thift, N. (1995). Globalisation, "institutional thickness" and the local economy. In P. Healey, S. Cameron, S. Graham & Madani-Pour (Eds.), *Managing cities: The new urban context* (pp. 91–108). London: John Wiley.

Andranovich, G. (1995). Achieving consensus in public decision making: Applying interest based problem-solving to the challenges of intergovernmental collaboration. *Journal of Applied Behavioral Research*, *31*, 429–45.

Annen, K. (2003). Social capital, inclusive networks, and economic performance. *Journal of Economic Behavior and Organization*, *50*(4), 449–463.

Argyris, C. & Schön, D.A. (1978). *Organizational learning: A theory of action perspective*. Reading, MA: Addison-Wesley.

Armitage, D., Marschke, M. & Plummer, R. (2008). Adaptive co-management and the paradox of learning. *Global Environmental Change*, 18, 86–98.

Arnold, J.S. & Fernandez-Gimenez, M. (2007). Building social capital through participatory research: An analysis of collaboration on Tohono O'odham tribal rangelands in Arizona. *Society and Natural Resources*, *20*, 481–495.

Bandura, A. (1977). *Social learning theory*. Englewood Cliffs, NJ: Prentice-Hall.

Bardach, E. (1977). *The implementation game: What happens after a bill becomes a law*. Cambridge, MA: MIT Press.

Bardach, E. (1998). *Managerial craftmanship: Getting agencies to work together*. Washington, D.C.: Brookings.

Bates, R. H. (1988). Contra contractarianism: Some reflections on the new institutionalism. *Politics and Society*, *16*, 387–401.

Bawden, R. (1994). *Systemic development: A learning approach to change*. Sydney: UWS Centre for Systemic Development.

Bechky, B. A. (1999). *Crossing occupational boundaries: Communication and learning on a production floor.* (unpublished doctoral dissertation), Stanford University, Stanford, CA.

Beem, B. (2007). Co-management from the top? The roles of policy entrepreneurs and distributive conflict in developing co-management arrangements. *Marine Policy, 31*, 540–549.

Benbasat, I. & Lim, K.H. (2000). The role of multimedia in changing first impression bias. *Informational Systems Research*, *11*(2), 115–136.

Beratan, K.K. (2007). A cognition-based view of decision processes in complex social-ecological systems. *Ecology and Society*, *12*(1), 27.

Berkes, F. (1999). *Sacred ecology: Traditional ecological knowledge and resource management*. Philadelphia: Taylor & Francis.

Berkes, F. (2007). Community-based conservation in a globalized world. *Proceedings of the National Academy of Sciences of the United States of America*, *104*, 15188–15193.

Berkes, F. (2009). Evolution of co-management: Role of knowledge generation, bridging organisations and social learning. *Journal of Environmental Management*, *90*, 1692–1702.

Borsuk, M., Clemen, R., Maguire, L. & Reckhow, K. (2001). Stakeholder values and scientific modeling in the Neuse River watershed. *Group Decision and Negotiation*, *10*(4), 355–373.

Brinkerhoff, D.W. (1999). Exploring state-civil society collaboration: Policy partnerships in developing countries. *Nonprofit and Voluntary Sector Quarterly, 28* (Suppl. 1), 59–86.

Brown, V.A. (2008). *Leonardo's vision: A guide to collective thinking and action*. Rotterdam: Sense.

Brugha, R. & Varvasovsky, Z. (2000). Stakeholder analysis: A review. *Health Policy and Planning, 15*, 239–246.

Bruner, J. S. (1979). *On knowing: Essays for the left hand* (Expanded ed.). Cambridge, MA: Belknap Press of Harvard University Press.

Bryson, J. (2004). What to do when stakeholders matter. *Public Management Review*, *6*(1), 21–53.

Burt, R.S. (1992). The social structure of competition. In N. Nohria & R. Eccles (Eds.), *Networks and organizations: Structure, form, and action* (pp. 118–139). Cambridge, MA: Harvard Business School Press.

Burt, R.S. (2004). Structural holes and good ideas. *American Journal of Sociology, 110*, 349–99.

Capistrano, D., Samper, K.C., Lee, M.J. & Raudsepp-Hearne, C. (Eds.). (2005). *Ecosystems and human well-being: Multiscale assessments* (Vol. 4). Washington D.C.: Millennium Ecosystem Assessment and Island Press. Retrieved from: www.millenniumassessment.org/en/Multiscale.aspx

Cash, D.W. & Moser, S.C. (2000). Linking global and local scales: Designing dynamic assessment and management processes. *Global Environmental Change, 10*, 109–120.

Caulkins, D. & Hyatt, S.B. (1999). Using consensus analysis to measure cultural diversity in organizations and social movements. *Field Methods*, *11*, 5–26.

Chambers, R. (1994). Participatory Rural Appraisal (PRA): Challenges, potentials and paradigm. *World Development, 22*, 1437–1454.

Cohen, D. & Prusak, L. (2001). *In good company: How social capital makes organizations work*. Cambridge, MA: Harvard Business School Press.

Cohen, S. & Fields, G. (1999). Social capital and capital gains in Silicon Valley. *California Management Review, 41*(2), 108–130.

Collins, A. &D. Gentner. (1987). How people construct mental models. In D. Holland & N. Quinn (eds.), *Cultural models in language and thought* (pp. 243–268). Cambridge, U.K.:Cambridge University Press.

Costanza, R. (2000). Visions of alternative (unpredictable) futures and their use in policy analysis. *Conservation Ecology, 4*(1).

Craps, M. (Ed.). (2003). *Social learning in river basin management*. Workpackage 2 of the HarmoniCOP project. Retrieved from: www.harmonicop.info/_files/_down/SocialLearning.pdf

Crona, B. & Bodin, O. (2006). What you know is who you know? Communication patterns among resource users as a prerequisite for comanagement. *Ecology and Society, 11*.

Crona, B.I. (2006). Supporting and enhancing development of heterogeneous ecological knowledge among resource users in a Kenyan Seascape. *Ecology and Society, 11*, 32.

Dalzel, R.F. (1987). *Enterprising elite*. New York: W.W. Norton.

Daniels, S. & Walker, G.B. (2001). *Working through environmental conflict: The collaborative learning approach*. Westport, CT: Praeger.

Davoudi, S. & Evans, N. (2004, July 1–4). *The challenge of governance in regional waste planning*. Paper presented at the AESOP Conference, University of Grenoble, France.

Day, G.S. (1994). The capabilities of market-driven organizations. *Journal of Marketing, 58* (October), 37–52.

DiMaggio, P.J. (1992) Nadel's Paradox revisited: Relational and cultural aspects of organizational structure. In N. Nohria & R. Eccles (Eds.), *Networks and organizations: Structure, form, and action* (pp. 118–139). Cambridge, MA: Harvard Business School Press.

DiMaggio, P.J. (1997). Culture and cognition. *Annual Review of Sociology, 23*, 263–287.

Donaldson, T. & Preston, L. (1995). The stakeholder theory of the modern corporation: Concepts, evidence and implications. *Academy of Management Review, 20*, 65–91.

Dooley, K.L. (1997). A complex adaptive systems model of organization change. *Nonlinear Dynamics, Psychology, and Life Sciences 1*(1), 69–97.

Dougherty, D. & Hardy, C. (1996). Sustained product innovation in large, mature organizations: Overcoming innovation-to-organization problems. *Academy of Management Journal, 39*(5) 1120–1153.

Dray, A., Perez, P., Le Page, C., D'Aquino, P. & White, I. (2007). Who wants to terminate the game? The role of vested interests and meta-players in the AtollGame experience. *Simulation and Gaming, 38*, 494–511.

Dray, A., Perez, P, Jones, N., Le Page, C., D'Aquino, P., White, I. & Auatabu, T. (2006). The AtollGame experience: From knowledge engineering to a computer-assisted role playing game. *Journal of Artificial Societies and Social Simulation, 9*, 6.

Dryzek, J.S. & Berejikian, J. (1993). Reconstructive democratic theory. *American Political Science Review, 87*, 48–60.

Dunn, W.N. (1993). Policy reforms as arguments. In F. Fischer and J. Forester (Eds.). T*he argumentative turn in policy analysis and planning* (pp. 254–290). Durham, NC: Duke University Press.

Eamer, J. (2006). Keep it simple and be relevant: The first ten years of the Arctic Borderlands Ecological Knowledge Co-op. In W.V. Reid, F. Berkes, T. Wilbanks, & D. Capistrano (Eds.), *Bridging scales and knowledge systems* (pp. 185–206). Washington D.C.: Millennium Ecosystem Assessment and Island Press.

Edelenbos, J. & Klijn, E.H. (2007). Trust in complex decision-making networks: A theoretical and empirical exploration. *Administration and Society*, 39(1), 25–50.

Eggertsson, T. (1990). *Economic behavior and institutions*. New York: Cambridge University Press.

Eppler, M.J. (2001). Making knowledge visible through intranet knowledge maps: Concepts, elements, cases. *Proceedings of the 34th Hawaii International Conference on System Sciences 2001*. Maui, HI: IEEE Computer Society.

Etienne, M., Du Toit, D.R. & Pollard, S. (2011). ARDI: A co-construction method for participatory modeling in natural resources management. *Ecology and Society, 16*(1), 44.

Etzkowitz, H. & Leydesdorff, L. (2000). The dynamics of innovation: From national systems and 'Mode 2' to a triple helix of university-industry-government relations. *Research Policy, 29*, 109–123.

Fabricius, C., Folke, C., Cundill, G. & Schultz, L. (2007). Powerless spectators, coping actors, and adaptive co-managers: A synthesis of the role of communities in ecosystem management. *Ecology and Society 12* (1), 29. Retrieved from: www.ecologyandsociety.org/vol12/iss1/art29

Food and Agriculture Organization. (1995). *Understanding farmers' communication networks: An experience in the Philippines*. Communication for Development Case Study No. 14. Rome: FAO. Retrieved from: www.fao.org/docrep/V9406E/v9406e00.htm

Feigenbaum, E.A. (1977). *The art of artificial intelligence. I. Themes and case studies of knowledge engineering*. Paper presented at the 5th International Joint Conference on Artificial Intelligence (IJCAI-77). Los Altos, CA: William Kaufmann.

Fernandez, R. M. & Gould, R.V. (1994). A dilemma of state power: Brokerage and influence in the national health policy domain. *American Journal of Sociology, 99*, 1455–1491.

Fischer, F. (2000). *Citizens, experts, and the environment: The politics of local knowledge*. Durham, NC: Duke University Press.

Fiske, S.T. & Taylor, S.E. (1991). *Social cognition*. New York: McGraw-Hill.

Folke, C., Hahn, T., Olsson, P. & Norberg, J. (2005). Adaptive governance of social-ecological systems. *Annual Review of Environment and Resources, 30*, 441–473.

Franke, S. (2005) *Measurement of social capital: Reference document for public policy research, development, and evaluation*. Ottawa: Policy Research Initiative. Retrieved from: http://policyresearch.gc.ca/doclib/Measurement_E.pdf

Freeman, C. & Soete, L. (1997) *The economics of industrial innovation* (3rd ed.). London: Pinter Publishers.

Friedman, A.L. & Miles, S. (2002). Developing stakeholder theory. *Journal of Management Studies, 39*, 1–21.

Fudenberg, D. & Maskin, E. (1986). A folk-theorem in repeated games with discounting and with incomplete information. *Econometrica, 54*, 533–554.

Fukuyama, F. (2002). Social capital and development: The coming agenda. *SAIS Review, 22*(1), 23–37.

Futrell, R. (2003). Technical adversarialism and participatory collaboration in the U.S. chemical weapons disposal program. *Science, Technology, & Human Values, 28*, 451–82.

Gentner, D., & Gentner, D.R. (1983). Flowing waters or teeming crowds: Mental models of electricity. In D. Gentner and A. Stevens (Eds.), *Mental models* (pp. 99–130). Hillsdale, NJ: Lawrence Erlbaum.

Gertler, M.S., & Wolfe, D.A. (2004). Local social knowledge management: Community actors, institutions and multilevel governance in regional foresight exercises. *Futures, 36*(1), 45–65.

Giddens, A. (1984). *The constitution of society: Outline of the theory of structuration*. Berkeley, CA: University of California Press.

Glaser, B.G. & Strauss, A.L. (1998). *Grounded theory: Strategien qualitativer Forschung*. Bern: Verlag Hans Huber.

Gonzalez, A.A. & Nigh, R. (2005). Smallholder participation and certification of organic farm products in Mexico. *Journal of Rural Studies, 21*, 449–460.

Gray, B. (1989). *Collaborating: Finding common ground for multi-party problems*. San Francisco, CA: Jossey-Bass.

Griffith, R., Mitchell, M., Walkerden, G., Brown V. & Walker, B. (2010, December). *Transformation for resilient landscapes and communities*. Working Paper 1, Report No. 61, Albury, Australia: Institute for Land, Water and Society, Charles Sturt University.

Grimble, R. & Wellard, K. (1997). Stakeholder methodologies in natural resource management: A review of principles, contexts, experiences and opportunities. *Agricultural Systems, 55*(2), 173–193.

Grupp, H. (1998). *Foundations of the economics of innovation: Theory, measurement and practice*. Cheltenham: Edward Elgar.

Hahn, T., Olsson, P., Folke, C. & Johansson, K. (2006). Trust-building, knowledge generation and organizational innovations: The role of a bridging organization for adaptive co-management of a wetland landscape around Kristianstad, Sweden. *Human Ecology, 34*, 573–592.

Halls, A.S., Arthur, R.I., Bartley, D., Felsing, M., Grainger, R., Hartmann, W. et al. (2005). G*uidelines for designing data collection and sharing systems for co-managed fisheries. Part 1: Practical guide*. FAO Fisheries Technical Paper. No. 494/1. Rome: Food and Agriculture Organization.

Hare, M. & Deadman, P. (2004). Further towards a taxonomy of agent-based simulation models in environmental management. *Mathematics and Computers in Simulation, 64*, 25–40.

Hare, M., Heeb, J. & Pahl-Wostl, C. (2002). The symbiotic relationship between role playing games and model development: A case study. In *Proceedings of the 7th Biennial Conference of the International Society for Ecological Economics, Sousse, Tunisia*. Retrieved from: www.neptune.c3ed.uvsq.fr/eee/ISEEtunisia2002.html

Hargadon, A. & Fanelli, A. (2002). Action and possibility: Reconciling dual perspectives of knowledge in organizations. *Organization Science, 13*, 290–302.

Hargadon, A.B. (2002). Brokering knowledge: Linking learning and innovation. In B.M. Staw & L.L. Cummings (Eds.), *Research in organizational behavior* (Vol. 24) (pp. 41–85). Greenwich, CT: JAI Press.

Hargrove, R. (2002). *Masterful coaching.* (Rev. Ed.). San Francisco, CA: Jossey-Bass/Pfeiffer, Wiley.

Hart, S.L. & Sharma, S. (2004). Engaging fringe stakeholders for competitive imagination. *Academy of Management Executive, 18*, 7–18.

Healey, P., de Magalaes, D. & Madanipour, A. (2002). Transforming governance, institutional analysis and institutional capacity. In P. Healey, G. Cars, A. Madanipour, & C. de Magalhaes (Eds.). *Urban governance, institutional capacity and social milieux*. Surry, U.K.: Ashgate.

Healey, P., Madanipour, A. & de Magalhaes, C. (1999). Institutional capacity-building, urban planning and urban regenerationprojects. *Futura, 18*(3), 117–137.

Henton, D., Melville, J. & Walesh, K. (1997). *Grassroots leaders for a new economy: How civic entrepreneurs are building prosperous communities.* San Francisco, CA: Jossey-Bass.

Hodgson, A.M. (1992). Hexagons for systems thinking. *European Journal of Operational Research, 59*, 220–230.

Howard, N. (1989). The manager as politician and general: The metagame approach to analysing cooperation and conflict. In J. Rosenhead (Ed.), *Rational analysis for a problematic world: Problem structuring methods for complexity, uncertainty, and conflict* (pp. 239–261). Chichester, U.K.: Wiley.

Huppé, G., Creech, H. & Knoblauch, D. (2012). *The frontiers of networked governance*. Retrieved from: http://www.iisd.org/pdf/2012/frontiers_networked_gov.pdf

Huxham, C. (2003). Theorizing collaboration practice. *Public Management Review, 5*, 401–23.

Imperial, M.T. (1999). Institutional analysis and ecosystem-based management: the institutional analysis and development framework. *Environmental Management, 24*, 449–465.

Imperial, M. (2005). Using collaboration as a governance strategy: Lessons from six watershed management programs. *Administration & Society, 37*, 281–320.

Inayatullah, S. (2003). Aging: Alternative futures and policy choices. *Foresight, 5*(6), 8–17.

Innes, J., Gruber, J., Neuman, M. & Thompson, R. (1994). *Co-ordinating growth and environmental management through consensus building*. California Policy Seminar Paper. Berkeley, CA: University of California.

Johnson, J. (2000). The "Can you trust it?' problem of simulation science in the design of sociotechnical systems. *Complexity, 6*(2), 34–40.

Johnson, N., Lilja, N., Ashby, J.A. & Garcia, J.A. (2004). Practice of participatory research and gender analysis in natural resource management. *Natural Resources Forum, 28*, 189–200.

Jones, N.A., Ross, H. Lynam, T., Perez, P. & Leitch, A. (2011). Mental models: An interdisciplinary synthesis of theory and methods. *Ecology and Society, 16*(1), 46.

Kandori, M. (1992). Social norms and community enforcement. *Review of Economic Studies, 5*(January), 63–80.

Kearney, A.R. & Kaplan, S. (1997). Toward a methodology for the measurement of knowledge structures of ordinary people: The Conceptual Content Cognitive Map (3CM). *Environment and Behavior, 29*, 579–617.

Keen, M., Brown, V. A., & Dyball, R. (Eds.). (2005). *Social learning in environmental management: Towards a sustainable future*. London: Earthscan.

Keen, M. & Mahanty, S. (2006). Learning in sustainable natural resource management: Challenges and opportunities in the Pacific. *Society and Natural Resources, 19*, 497–513.

Kemp, R. & Rotmans, J. (2009). Transitioning policy: Co-production of a new strategic framework for energy innovation policy in the Netherlands. *Policy Sciences, 42*(4), 303–322.

Kendrick, A. (2003). Caribou co-management in Northern Canada: Fostering multiple ways of knowing. In F. Berkes, J. Colding, & C. Folke. (Eds.), *Navigating social-ecological systems* (pp. 241–267). Cambridge, U.K.: Cambridge University Press.

Kilgour, D.M. & Hipel, K.W. (2005). The graph model for conflict resolution: Past, present, and future. *Group Decision and Negotiation, 14*(6), 441–460.

Kim, T.G., Donnell, E.T. & Lee, D. (2008). Use of cultural consensus analysis to evaluate expert feedback of median safety. *Accident Analysis and Prevention, 40*, 1458–1467.

Kingdon, J.W. (2003). *Agendas, alternatives, and public policies*. New York: Addison-Wesley Educational Publishers Inc.

Klijn, E.H., Steijn, B. & Edelenbos, J. (2010, June 28–30). *Steering for broad social outcomes in governance networks: The effects of participation and network management*. Paper presented at the International Public Network Conference, Department of Public Administration, Erasmus University Rotterdam.

Kolkman, M.J., Kok, M. & van der Veen, A. (2005). Mental model mapping as a new tool to analyse the use of information in decision-making in integrated water management. *Physics and Chemistry of the Earth 30*(4–5), 317–332.

Kolkman, M.J. & van der Veen, A. (2006). Without a common mental model a DSS makes no sense (a new approach to frame analysis using mental models). In A. Voinov (Ed.), *Proceedings of the 3rd Biennial Summit on Environmental Modelling and Software*. Burlington, VT: International Environmental Modelling and Software Society (iEMSs).

Kooiman, J. (Ed.). (1993). *Modern governance*. London, U.K.: Sage Publications.

Lam, A. (2000). Tacit knowledge, organizational learning, societal institutions: An integrated framework. *Organization Studies, 21*(3), 487–513.

Lane, C. & Bachman, R. (Eds.), (1998). *Trust within and between organizations: Conceptual issues and empirical applications*. Oxford: Oxford University Press.

Langan-Fox, J., Wirth, A., Code, S., Langfield- Smith, K. & Wirth, A. (2001). Analyzing shared and team mental models. *International Journal of Industrial Ergonomics, 28*, 99–112.

Lave, J. & Wegner, E. (1991). *Situated learning: Legitimate peripheral participation*. Cambridge: Cambridge University Press.

Lave, J. (1988). *Cognition in practice: Mind mathematics, and culture in everyday life*. Cambridge: Cambridge University Press.

Libecap, G. (1989). *Contracting for property rights*. New York: Cambridge University Press.

Lindblom, C.E. & Woodhouse, E. (1993). *The policy making process* (3rd ed.). New Jersey: Prentice Hall.

Locke, R. (1995). *Remaking the Italian economy*. Ithaca, NY: Cornell University Press.

Loorbach, D. (2007). *Transition management: New mode of governance for sustainable development*. Utrecht, The Netherlands: International Books.

Lubell, M. & Leach, W.D. (2005, February 3–4). *Watershed partnerships: Evaluating a collaborative form of public participation*. Paper presented at National Research Council's Panel on Public Participation in Environmental Assessment and Decision Making, Washington, D.C. Retrieved from: www7.nationalacademies.org/hdgc/Tab%20_6%20Watershed.pdf

Margerum, R.D. (2001). Organizational commitment to integrated and collaborative management: Matching strategies to constraints. *Environmental Management, 28*, 421–31.

Maskell, P. (1999). Globalisation and industrial competitiveness: The process and consequences of ubiquitification. In E.J. Malecki & P. Oinas (Eds.), *Making connections: Technological learning and regional economic change*. Surry, U.K.: Ashgate.

Mathevet, R., Etienne, M., Lynam, T. & Calvet, C. (2011). Water management in the Camargue Biosphere Reserve: Insights from comparative mental models analysis. *Ecology and Society, 16*(1), 43.

McCay, B.J. (2002). Emergence of institutions for the commons: Contexts, situations, and events. In E. Ostrom, T. Dietz, N. Dolsak, P. Stern, S. Stonich, and E. U. Weber (Eds.), *The drama of the commons* (pp. 361–402). Washington, D.C.: National Academy Press.

McGraw, K.L. & Harbison-Briggs, K. (1989). *Knowledge acquisition: Principles and guidelines*. London: Prentice Hall.

Meadows, D. (1996). Envisioning a sustainable world. In R. Costanza, O. Segura & J. Martinez-Alier (Eds.), *Getting down to Earth: Practical applications of ecological economics*. Washington, D.C.: Island Press. Retrieved from: www.sustainer.org/pubs/Envisioning.DMeadows.pdf

Mezirow, J. (1996). Contemporary paradigms of learning. *Adult Education Quarterly, 46*, 158–173.

Miller, M.L., Kaneko, J., Bartram, P., Marks, J. & Brewer, D.D. (2004). Cultural consensus analysis and environmental anthropology: Yellowfin tuna fishery management in Hawaii. *Cross-Cultural Research, 38*, 299–314.

Montana, J., Reamer, A., Henton, D., Melville, J. & Walesh, K. (2001). *Strategic planning in the technology-driven world: A guidebook for innovation-led development*. Collaborative Economics and the Economic Development Administration, US Department of Commerce, Washington, D.C. Retrieved from: www.eric.ed.gov/PDFS/ED465123.pdf

Napier, V.R., Branch, G.M. & Harris, J.M. (2005). Evaluating conditions for successful co-management of subsistence fisheries in KwaZulu-Natal, South Africa. *Environmental Conservation, 32*, 165–177.

Nersessian, N.J. (2002). The cognitive basis of model-based reasoning in science. In P. Carruthers, S. Stich & M. Siegal (Eds.). *The cognitive basis of science* (pp. 133–153). Cambridge, U.K.: Cambridge University Press.

Nissen, M.E. & Levitt, R.E. (2004). Agent-based modelling of knowledge dynamics. *Knowledge Management Research and Practice, 2*, 169–183.

Nooteboom, B. (2002). *Trust: Forms, foundations, functions, failures and figures*. Cheltenhal: Edgar Elgar.

North, D.C. (1990). *Institutions, institutional change, and economic performance*. New York: Cambridge University Press.

Olsson, P., Folke, C. & Hahn, T. (2004). Social-ecological transformation for ecosystem management: The development of adaptive co-management of a wetland landscape in southern Sweden. *Ecology and Society, 9*(4), 2.

Olsson, P., Folke, C., Galaz, V., Hahn, T. & Schultz, L. (2007). Enhancing the fit through adaptive comanagement: Creating and maintaining bridging functions for matching scales in the Kristianstads Vattenrike Biosphere Reserve, Sweden. *Ecology and Society, 12*(1), 28. Retrieved from: www.ecologyandsociety.org/vol12/iss1/art28

Ostrom, E. (2000). Collective action and the evolution of social norms. *Journal of Economic Perspectives, 14*, 137–158.

Ostrom, E. (1990). *Governing the commons: The evolution of institutions for collective action*. Cambridge: Cambridge University Press.

Ostrom, E. (1996). Crossing the great divide: Coproduction, synergy, and development. *World Development, 24,* 1073–1087.

Ostrom, E. (1998). A behavioral approach to the rational-choice theory of collective action: Presidential Address, American Political Science Association, 1997. *American Political Science Review, 92*(1), 1–22.

Ozesmi, U. & Ozesmi, S.L. (2004). Ecological models based on people's knowledge: A multi-step fuzzy cognition mapping approach. *Ecological Modelling, 176*, 43–64.

Pahl-Wostl, C. (2002). Towards sustainability in the water sector: The importance of human actors and processes of social learning. *Aquatic Sciences, 64*(4), 394–411.

Pahl-Wostl, C. (2006). The importance of social learning in restoring the multifunctionality of rivers and floodplains. *Ecology and Society, 11*(1), 10.

Pahl-Wostl, C. & Hare, M. (2004). Processes of social learning in integrated resources management. *Journal of Community & Applied Social Psychology, 14*, 193–206.

Pahl-Wostl, C. (2009). A conceptual framework for analysing adaptive capacity and multilevel learning processes in resource governance regimes. *Global Environmental Change, 19*, 354–365.

Pezdek, K. & Evans, G.W. (1979). Visual and verbal memory for objects and their spatial location. *Journal of Experimental Psychology: Human Learning and Memory, 5*, 360–373.

Plummer, R. & Fitzgibbon, J. (2004). Co-management of natural resources: A proposed framework. *Environmental Management, 3,* 876–85.

Prell, C., Hubacek, K. & Reed, M. (2009). Stakeholder analysis and social network analysis in natural resource management. *Society and Natural Resources, 22*, 501–518.

Provan, K.G. & Kenis, P. (2008). Modes of network governance: Structure, management, and effectiveness. *Journal of Public Administration Research and Theory, 18*(2), 229–252.

Putnam, L.L. (2004). Transformations and critical moments in negotiations. *Negotiations Journal, 20*, 275–95.

Putnam, L.L., Burgess, G. & Royer, R. (2003). We can't go on like this: Frame changes in intractable conflicts. *Environmental Practice, 5*, 247–55.

Putnam, R.D. (1993). The prosperous community: Social capital and public life. *American Prospect, 13*, 35–42.

Reed, M.S., Graves, A., Dandy, N., Posthumus, H., Hubacek, K., Morris, J. et al. (2009). Who's in and why? A typology of stakeholder analysis methods for natural resource management. *Journal of Environmental Management, 90*, 1933–1949.

Reeves, J.M. & Weisberg, R.W. (1993). On the concrete nature of human thinking: Content and context in analogical transfer. *Educational Psychology, 13*, 245–258.

Reeves, J.M. & Weisberg, R.W. (1994). The role of context and abstract information in analogical transfer. *Psychology Bulletin, 115,* 381–400.

Reid, W.V., Berkes, F., Wilbanks, T. & Capistrano, D. (Eds.). (2006). *Bridging scales and knowledge systems: Linking global science and local knowledge in assessments*. Washington, D.C.: Millennium Ecosystem Assessment and Island Press.

Romney, A.K., Weller, S.C. & Batchelder, W.H. (1986). Culture as consensus: A theory of culture and informant accuracy. *American Anthropologists, 88*, 313–338.

Rotmans, J., Kemp, R. & Van Asselt, M. (2001). More evolution than revolution: Transition management in public policy. *Foresight Volume: 3*(1), 15–31.

Rousseau, D., Sitkin, S.B., Burt, R.S. & Camerer, C. (1998). Not so different after all: A cross discipline view of trust. *Academy of Management Review, 23*(3), 393–404.

Rugg, G. & McGeorge, P. (1997). The sorting techniques: A tutorial paper on card sorts, picture sorts and item sorts. *Expert Systems, 12*(4).

Rydin, Y. & Falleth, E. (2006). *Networks and institutions in natural resource management.* Cheltenham, U.K.: Edward Elgar Publishing.

Saarikoski, H. (2000). Environmental impact assessment (EIA) as collaborative learning process. *Environmental Impact Assessment Review, 20*, 681–700.

Sabatier, P.A. & Jenkins-Smith, H.C.J. (1999). The Advocacy Coalition Framework, and assessment. In P.A. Sabatier (Ed.), *Theories of the policy process*. Oxford: Westview Press.

Sabatier, P.A., Focht, W., Lubell, M., Trachtenberg, Z., Vedlitz, A. & Matlock, M. (2005). Collaborative approaches to watershed management In P.A. Sabatier, W. Focht, M. Lubell, Z. Trachtenberg, A. Vedlitz, & M. Matlock (Eds.), *Swimming upstream: Collaborative approaches to watershed management*. Boston: MIT Press.

Salam, M.A. & Noguchi, T. (2006). Evaluating capacity development for participatory forest management in Bangladesh's Sal forests based on '4Rs' stakeholder analysis. *Forest Policy and Economics, 8*, 785–796.

Schön, D.A. & Rein, M. (1994). *Frame reflection: Toward the resolution of intractable policy controversies*. New York: Basic Books.

Schwartz, P. (1991). *The art of the long view*. New York: Doubleday.

Senge, P. (1990). *The fifth discipline: The art and practice of the learning organization*. New York: Doubleday.

Short, C., & Winter, M. (1999). The problem of common land: Towards stakeholder governance. *Journal of Environmental Planning and Management, 42*, 613–30.

Simon, H.A. (1957). *Models of man*. New York: Wiley.

Sinclair, A.J. & Diduck, A.P. (2001). Public involvement in EA in Canada: A transformative learning perspective. *Environmental Impact Assessment Review, 21*, 113–136.

Smith, A. & Kern, F. (2009). The transitions storyline in Dutch environmental policy. *Environmental Politics, 18*(1), 78–98.

Smith, A. & Stirling, A. (2007). Moving outside or inside? Objectification and reflexivity in the governance of socio-technical systems. *Journal of Environmental Policy and Planning, 9*(3/4), 351–373.

Stone, D. (2002). *Policy paradox: The art of political decision making* (2nd ed.) New York: W.W. Norton and Co.

Stone, D.A. (1988). *Policy paradox and political reason*. New York: Harper Collins.

Stone-Jovicich, S.S., Lynam, T., Leitch, A. & Jones, N.A. (2011). Using consensus analysis to assess mental models about water use and management in the Crocodile River Catchment, South Africa. *Ecology and Society, 16*(1), 45. Retrieved from: www.ecologyandsociety.org/vol16/iss1/art45

Swanson, D.A. & Bhadwal, S. (Eds.). (2009). *Creating adaptive policies: A guide for policymaking in an uncertain world*. Winnipeg: IISD; Ottawa: Energy and Resources Institute and International Development Research Centre., New Delhi: Sage.

Tekwe, C. & Percy, F. (2001). *The 4Rs: A valuable tool for management and benefit sharing decisions for the Bimbia Bonadikombo Forest, Cameroon*. Rural Development Forestry Network Paper 25. Retrieved from: www.odi.org.uk/resources/docs/1236.pdf

Thompson, L., Gentner, D., & Lowenstein, J. (2000). Avoiding missed opportunities in managerial life: Analogical training more powerful than case-based training. *Organizational Behaviour and Human Decision Processes, 82*, 60–75.

Tikkanen, J., Isokaanta, T., Pykalaninen, J. & Leskinen, P. (2006). Applying cognitive mapping approach to explore the objective-structure of forest owners in a northern Finnish case area. *Forest Policy and Economics, 9*, 139–152.

Tirole, J. (1996). A theory of collective reputations. *Review of Economic Studies, 63*(1), 1–22.

van de Riet, O.A.W.T. (2003). *Policy analysis in multi-actor policy settings: navigating between negotiated nonsense and superfluous knowledge.* The Netherlands: Eburon, Delft.

Vangen, S. (2003). Nurturing collaborative relations: Building trust in interorganizational collaboration. *Journal of Applied Behavioral Science 39*, 5–31.

Vennix, J.A.M. (1996). *Group model building: Facilitating team learning using system dynamics*. Chichester: Wiley.

von Hippel, E. (1988). *The sources of innovation*. Oxford University Press: New York.

Voss, J.-P., Smith, A. & Grin, J. (2009). Designing long-term policy: Rethinking transition management. *Policy Sciences 42*(2), 275–302.

Wenger, E. (1998). *Communities of practice: Learning, meaning and identity*. Cambridge, U.K.: Cambridge University Press.

Westley, F. (2002). The devil in the dynamics: Adaptive management on the front lines. In L.H. Gunderson & C.S. Holling (Eds.), *Panarchy: Understanding transformations in human and natural systems* (pp. 333–360). Washington, D.C.: Island Press.

Wilson, D.C., Ahmed, M., Siar, S.V. & Kanagaratnam, U. (2006). Cross-scale linkages and adaptive management: fisheries co-management in Asia. *Marine Policy, 30*, 523–533.

Appendix 1

BOX 1: LEVELS OF SOCIAL CAPITAL

Micro social capital emphasizes the nature and forms of cooperative behaviour, and deals with the propensity of actors to cooperate by way of forming relationships or by joining forces to attain certain objectives (Ahn & Ostrom, 2002). It is the product of an actor's motivations for forming relationships (his values and aspirations), his behaviour (types of relationships that define how he cooperates), and his perception of collective issues (cultural beliefs, influences, etc.). The World Bank refers to this as "cognitive social capital" (Grootaert and van Bastelaer, 2002). Micro is a source of individual benefit.

Meso social capital highlights structures that enable cooperation to take place. The World Bank refers to this approach as "structural social capital" (Grootaert & van Bastelaer, 2002). Social networks, the position of actors within these networks, the types of interactions, and the conditions in which they occur are all factors that determine the nature of resources that are brought to the network and the ways in which they are circulated. This type of social capital is seen as a property arising from the interdependence among individuals and among groups within a community (in our case, a governance network). Meso social capital is viewed as a resource that emerges from social ties and is then used by members (individuals or groups) of the community. Proponents of the meso approach are interested in social capital as a source of both individual and collective benefit.

Macro social capital focuses on the conditions (favourable or unfavourable) for cooperation. Like theories of institutionalism, it emphasizes a community's environmental, social and political structures that convey values and norms (primarily trust and reciprocity), which in turn create certain conditions for social engagement and civic and political participation. According to this conception, social capital is a product of these structures, and the more these structures instill trust and reciprocity, the more conducive they will be for social capital. The macro approach is interested in the impact of the institutional context on the stock of social capital that is available to governance networks, and the ability of the community to maintain and enhance this capital. The proponents of the macro approach are interested in social capital as a collective benefit (in our case, how can institutional frameworks positively affect the stock of social capital in governance networks, and the ability of these networks to maintain and enhance this stock?).

Adapted from of Policy Research Initiative, Franke (2005, pp. 1–2)

Appendix 2

> ### BOX 2: INSTITUTIONAL CAPACITIES
>
> **Intellectual capital** or, simply, knowledge is understood as a relational concept with an emphasis on interactive learning through the relationships in the network, rather than on knowledge as an asset that individual actors bring to the process. Knowledge is seen as socially constructed within these interrelationships, meaning all those claims that are recognized with the network. Four questions are posed by Healey et al. (1999) in relation to intellectual capital: Where is it located or who is considered to hold the accredited knowledge claims? What are the underlying mental frames that give meaning to the flow of information within the network? How is knowledge transferred within and across various actor groups that make up the network? What is the openness of actors to learning new knowledge, especially in relation to local traditions, and the potential for new knowledge to mesh with established ways of looking at the policy problem?
>
> **Material capital** is such an essential element of any network analysis that it tends to be taken for granted. Such analysis looks at the linkages among actors and the flow of resources through those linkages, and most of these resources are taken to be financial, political authority and the ability to exercise regulatory powers.
>
> **Individual social capital** is the second dimension included by Davoudi and Evans (2004). Their definition of the concept equates with the one that we use in the paper, only it adds the element of mobilization, which is seen as the ability to activate knowledge and relationships in a proactive manner. Mobilization is represented as a dynamic element and is characterized in terms of opportunity structure, arenas, repertoires and change agents. Opportunity structure refers to the perceptions among actors that change is possible and desirable, and actors` perceptions of constraints; it is linked to the selection of issues for mobilization, and the extent to which there is agreement on this issue agenda. Arenas identify the loci where mobilization may take place, and repertoires are the techniques that actors may use for mobilization. Finally, the need for innovators is pinpointed by the term "change agents," which, in governance networks, can be understood to mean policy entrepreneurs or institutional entrepreneurs.
>
> **Political capital** refers to the mix of capacities that give actors the power to achieve an objective, the capacity to act in Stone's (1989) terms. From the perspective of policy innovation, those with political capital are in a better position to generate transformation, as "change agents" or "policy entrepreneurs."

Adapted from Rydin (2005, pp. 27–31)

Appendix 3

		STAKEHOLDER-GROUP LEVEL	**NETWORK LEVEL**
NETWORK DYNAMICS	Size of network	Number of members in an organization	Number of partners in a network
	Density of network	Level of interconnections between members of an organization	Level of interconnections between partners in a network
	Diversity of network	Heterogeneity of the socioeconomic status of members of an organization	Heterogeneity of the organizational partners in a network
	Frequency of contact	Number and length of contacts between members of an organization	Frequency of communications between the organizations and number of networking activities
	Intensity of contact	Strength and nature of working relationships within the organization	Strength and nature of the relationships among organizational partners
	Spatial proximity of network members	Organizational members who meet face-to-face on a regular basis	Network partners who work in the same geographic area
NETWORK DYNAMICS	Mobilization of networks: conditions of access to resources	Autonomy and interdependence of organizational members	Autonomy and interdependence of partner organizations
	Mobilization of networks: gap between perceived and mobilized resources	Expectations about available support/resources and questions on the support/resources actually received	Expectations about available support/resources and questions on the support/resources actually received
	Relational competency and conditions of social integration	Stability of intra-organizational relations through various events that mark the organization's evolution	Stability of inter-organizational relations through various events that mark the collective project's evolution
	Norm and rules internal to the network	Quality and democratic aspect of interactions, openness, and respect of actors, common perception of issues, confidence in the contribution of each member of the organization	Quality and democratic aspect of interactions, openness, and respect of actors, common perception of issues, confidence in the contribution of each of the partner organizations
EXTERNAL CONTEXT	Structures and institutional arrangements	Formal/informal arrangements that help/hinder the interactions among members of the organization	Formal/informal arrangements that help/hinder the creation and functioning of inter-organizational partnerships

Adapted from Franke (2005, p.46–47)

www.iisd.org