Transnational Public Sector Knowledge Networks: Knowledge and Information Sharing in a Multi-Dimensional Context

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Abstract

Sharing of knowledge, information, and practices across cultural and national boundaries has become a means to address critical global problems. As government agencies increasingly collaborate with international counterparts on these issues, transnational knowledge and information sharing networks grow in importance as mechanisms for collaboration. This paper explores the nature of Transnational Public Sector Knowledge Networks (TPSKNs) and identifies critical contextual factors that shape their performance. In these networks, each participating organization operates within complex national, organizational, and information contexts. The contextual differences between participants produce distances in culture, politics, intentions, organizational factors, relationships, knowledge, resources, geography, and technology. These distances influence their ability to engage in the processes and interactions that are essential to network performance. The paper concludes with a conceptual dynamic model that accounts for the relationships among these factors which can guide further research in understanding knowledge and information sharing across national and cultural boundaries.

1. Introduction

Governments of the world are engaged in a complex global network of political, societal, and economic dependencies, enabled in part by the expanding capabilities of information and communication technologies. These international engagements demand new kinds of knowledge sharing networks and information systems that combine both social and technical dimensions. Slaughter (2004) describes these networks as a key feature of 21st century governance, arguing that the international system is not only one of formal relationships among sovereign states, but also one of less formal links among public, private, and nonprofit entities that interact with each other on the basis of expertise and interest rather than formal power. These networks rely heavily on informal interaction, persuasion, and information to deal with critical areas such as security, the global economy, and environmental protection. Several authors have discussed these networks conceptually and argue the possibilities of empowering them to build governance capacity around the world (Setzer, 2009; Betsill & Bulkeley, 2004; Slaughter, 2005; Raustiala, 2002). However, little research addresses empirically the complexities surrounding the knowledge and information sharing that represents the main processes in these networks. This paper begins to fill this gap by exploring the concepts, relationships, and processes embodied in knowledge and information sharing in transnational networks and offering a framework that can guide empirical study.

The structure of these networks can be vertical or horizontal (Slaughter, 2004). The main goal of vertical networks is to align national and supranational rules through different modes of enforcement, while horizontal networks rely on knowledge and information exchange to help

build capacity to develop and comply with global rules and policies. Vertical government networks are the traditional form, but horizontal networks are the usual structure for linking salient actors in a disaggregated world. Hence, the main structural feature of the networks we explore in this paper is a set of horizontal linkages among government agencies and officials in different countries. These networks involve organizational units within different countries below the level of the state. They can involve individuals at the highest ministerial levels who are directly responsive to national political processes as well as regulators and experts in lower level positions. Given this arrangement, the networks tend to be less formal and more flexible than is possible when working in official channels. Consequently, the information and knowledge exchange process can be richer, but it can also be more complex as it may contain different types of content (including knowledge, information, and technology) exchanged in a variety of ways across national borders and among individuals, groups, and organizations.

Many networks exist today, for instance, as part of a complex global environmental protection governance structure. Examples in this domain include the environmental enforcement network created by US, Mexican, and Canadian environmental agencies as part of North American Free Trade Agreement (NAFTA). In the collaboration between the US Environmental Protection Agency (EPA) and the Mexican Secretariat of Environment and Natural Resources (SEMARNAT), the agencies exchange information related to their existing policies in order to assess monetary penalties in administrative enforcement procedures as well as for criminal environmental enforcement. They exchange statistics on enforcement activities and accomplishments to identify gaps in methodologies and capabilities. Additionally, they meet regularly to exchange information on cross-border pollution issues. Moving from regional to global scale, the International Network for Environmental Compliance and Enforcement (INECE) founded by the EPA and the Dutch Ministry of Housing, Special Planning and Environment offers technical assistance, training, global conferences, and a website of information to aid environmental agencies world-wide to deal with environmental protection issues (Raustiala, 2002).

While these networks are established for a specific purpose such as capacity building, technical assistance, or harmonization of standards, once agencies begin to collaborate their goals are often extended to address additional issues that were not planned when the networks were initiated. Generally, if they reach a requisite level of trust, participants look for additional ways to benefit from the collaboration. Consequently, the exchange of knowledge and information in these networks can be conceptualized as a process that unfolds over time. For example, in the collaboration between EPA and SEMARNAT, the relationship began with technical assistance to Mexico through training activities to establish a largely US-trained environmental enforcement office. As the relationship evolved, the collaboration extended to joint projects to improve air quality along the US-Mexico border such as the design and construction of new brick kilns in Ciudad Juárez, Mexico. These brick kilns were capable of reducing emission of carcinogenic and other toxic compounds in the border region by over 80% compared to the traditional kilns in use at the time (Cresswell, et al., 2009; Currey & Pumfrey, 2006).

Finally, these networks and practices are expandable. When they succeed in achieving desired goals, these largely governmental networks become more attractive to participants from other sectors or nations either to imitate or to join. In the brick kiln example above, a university

and large and small businesses joined with national, state, and local government agencies to develop a mutually beneficial solution to one of the most serious air quality problems in the area. Raustiala (2002) points to another example in the emergence of INECE which began in 1985 with a Dutch request for technical assistance from US EPA. A similar request from Poland in 1991 was followed by a number of others. As EPA attempted to respond to a growing number of requests, it began to organize international conferences and created a website for streaming videos as ways to organize and share knowledge and information among regulators worldwide.

This paper reflects on a current research effort to analyze specific experiences of government and partner organizations in the United States, Mexico, and China as the basis for both conceptual models and practical tools for effective transnational knowledge sharing. We focus on transnational public sector knowledge networks in air quality monitoring and improvement, an area with significant domestic and international impact. The research addresses these questions:

- What are the main characteristics of these networks?
- How do participants perceive their roles, goals, and performance?
- What are the factors that may promote or hinder their success?
- Which strategies, tools, and behaviors are more likely to lead to successful transnational knowledge networks that benefit individuals, organizations, and communities?

We are exploring these questions in two case studies, one in North America and one in Asia, as vehicles for identifying and understanding the factors that shape transnational public sector knowledge networks (TPSKNs). Our research is also building, testing, and refining a methodology for conducting such work in more depth in the future.

The North American case involves the Joint Advisory Committee for the Improvement of Air Quality in the Ciudad Juárez, Chihuahua, El Paso, Texas, and Doña Ana County, New Mexico Air Basin (JAC) (JAC 2010). The JAC was formed in the 1990s in response to concerns about poor air quality in this US-Mexico border region. This network comprises members representing all levels of US and Mexican governments as well as academic researchers, industry, and environmental advocacy groups. Since the network's inception, the partners have worked collaboratively to share knowledge and information in an attempt to collectively address air pollution problems that span the border region. The JAC has influenced national, federal, state, and local air quality policies as well as facilitated joint US and Mexican projects that have reduced air pollution in the region. This initiative constitutes an operational transnational knowledge network (Cresswell, et al., 2009).

In the second case, a network is emerging in relationships involving the United States and China. This initiative, known as AIRNow-International (AIRNow-I) Shanghai, involves the US EPA, the Shanghai Environmental Monitoring Center (SEMC), and several other US and Chinese partners. The AIRNow-I Shanghai initiative is based on the US AIRNow program which provides the US public with easy access to air quality information for over 300 cities via a publicly available Web site. It also disseminates information to the media and other outlets including *USA Today* and the Weather Channel (AIRNow, 2010). The AIRNow-I program represents US EPA's efforts to update and enhance AIRNow in collaboration with international partners and is linked to an international voluntary effort to create worldwide sharing of data about the Earth and its environment, called the Group on Earth Observation (GEO). Shanghai is the first international partner in this initiative. Over the past four years, US EPA and its main contractor Sonoma Technology, Inc.; SEMC; and other partners have worked closely to revamp

the US AIRNow software for international application. The launch of the new Shanghai air quality reporting system occurred in May 2010 as part of the Shanghai World Expo. Because the AIRNow-I Shanghai effort is at an earlier stage of collaboration than the US-Mexico JAC initiative, it offers an opportunity to observe and analyze it as it develops.

The research team involves researchers who are native to each country to allow for working in multiple languages and to provide better understanding of the situations and norms prevalent in the participating organizations. The research data consist of documentary evidence and two dozen interviews with individual members of these organizations. The interviews focused on transnational knowledge and information sharing from the point of view of each organization, country, and culture. The case data will be analyzed according to the preliminary framework presented in this paper.

In the next sections we present the conceptual basis for an integrated framework to assess the contextual dimensions of TPSKNs. We start by identifying the main characteristics and processes embedded within TPSKNs. The paper then discusses the contextual factors that affect the individual participating organizations as they relate to three layers of complexity: information and knowledge context, organizational context, and the national contexts where the interaction takes place. We then discuss contextual "distances" that exist when organizations in different countries interact . This discussion is grounded in the literatures of Knowledge Transfer (KT), Cross-Boundary Information Sharing (CBIS) and Public Sector Knowledge Networks (PSKN). The paper concludes with an integrated conceptual framework and a discussion of the next phases of our research.

2. Defining and understanding TPSKNs

This section draws on research on cross-boundary information sharing and integration, public sector knowledge networks, and knowledge transfer to develop a definition of TPSKNs and to describe their contextual complexity.

2.1 Defining TPSKNs

In its simplest form (Figure 1) a transnational knowledge network can be understood as two governmental sub-units located in different countries involved in the exchange of knowledge, information, or both in order to address a mutual concern (Gharawi and Dawes, 2010). However, this simple conceptualization of TPSKNs masks their multi-dimensional and interdependent character and a high degree of complexity.

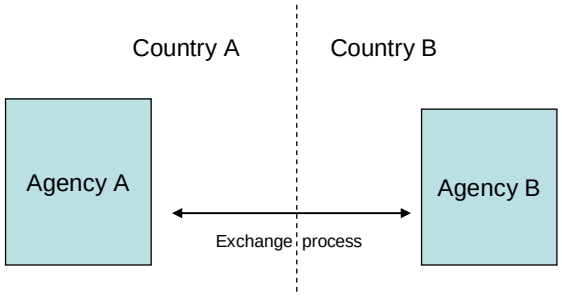

Figure 1. A Simplistic Model of Knowledge and Information Sharing in TPSKNs

Many policy domains have engaged in the development of organizational networks to improve knowledge and information sharing capabilities across traditional organizational boundaries. Public sector knowledge networks or PSKNs, for example, comprise a multidimensional combination of interorganizational relationships, policies, information content, professional knowledge, work processes, and technologies brought together to achieve a collective public purpose (Dawes, 2005). Similarly, recent research on cross-boundary information sharing and integration (CBIS) in public health and criminal justice in the United States has produced a useful definition that can be applied to TPSKNs. This work defines CBIS as a complex multidimensional phenomenon with four interrelated components: trusted social networks, shared information, integrated data, and interoperable technical infrastructure (Gil-Garcia, et al., 2005).

In line with this previous work, we conceptualize TPSKNs as multidimensional organizational phenomena of interdependent components that include political, social, organizational, and technical dimensions which influence performance. The knowledge and information sharing exchange that occurs in these networks is an unfolding process involving collaboration and learning as two facilitating processes.

These intertwined processes and their international setting give TPSKNs their main characteristics: They cross national borders and may include both government and non-governmental actors; they involve diverse types of knowledge and information content; the exchange and learning processes are bi-directional; and they operate at the sub-national level and therefore are influenced by but not closely controlled by the participating organizations' respective legislators or executives (Gharawi and Dawes, 2010).

2.2 Characteristics of Transnational Public Sector Knowledge Networks

Identifying the main characteristics of TPSKNs represents the first step to understand the network actors, the knowledge and information sharing processes that connect them, and the factors that may impede or promote network performance. Based on the previous discussion and the basic facts of our case studies, we have identified eight main characteristics:

- Transnational public sector knowledge networks involve relationships between government organizations in at least two different countries.
- Such networks form for different reasons including the need to address a specific problem or the need to build certain kinds of capability among network members.
- The network may involve a variety of social actors, including governmental sub-units, individuals, informal groups, or private, non-profit, or supra-national organizations.
- The network is legitimized, but not closely controlled, by the participating entities' respective legislatures or executives.
- The network operates under some form of internal network governance.
- The actors in the network are involved in multiple relationships and in other relevant networks both within their respective countries and across national borders.
- The relationships among network actors involve the exchange of knowledge and information content.
- The exchange process is bi- or multi-directional; each participating entity is both a source and a recipient of content.

3. TPSKNs: A contextual perspective

In order to understand how TPSKNs perform it is necessary to consider what internal and external factors or conditions influence the actors in the network. A fundamental challenge for network actors is the fact that every participant comes to the engagement deeply embedded in layers of context. Every participant, whether an individual or an organization, communicates, acts, and understands the world through well-established, but mostly invisible, contextual lenses. The following sections identify these contextual factors, discuss their influence, and incorporate them into an integrated model to aid better understanding of the full range of contextual complexity.

Literature from both cross-boundary information sharing research and knowledge transfer explore these contextual factors. The knowledge transfer literature contributes to understanding of the impact of cultural differences on overall effectiveness, and on exchange processes. It also emphasizes how the type and value of content can influence the outcomes of the exchange process. The cross-boundary information sharing literature offers a useful view of complexity, as well as the ways in which policies, management strategies, technology choices, and trust affect outcomes. Table 1 summarizes these factors and associates them with these two scholarly fields.

Layer	Factor	CBIS	KT
Knowledge and Information Context	Type		✓
	Degree of data standardization	✓	
	Value, sensitivity, and confidentiality	✓	✓
	Codifiability (articulability)		✓
	Embeddedness		✓
	Technological complexity and compatibility	✓	✓
Organizational Context	Goals and interest of participating organizations	✓	
	Trust and past relationships	✓	
	Executive support and organizational commitment	✓	
	Perception of risk, costs and benefits	✓	
	Organizational culture	✓	
	Leadership	✓	
	Authority and hierarchical structures	✓	✓
	Organizational rules, procedures, and regulation	✓	
	Resources	✓	
	Absorptive capacity		✓
National Context	Culture		✓
	Laws and policies	✓	
	Political support	✓	
	Language		✓
	Geographic location		✓
CBIS = Cross-boundary information sharing literature; KT=Knowledge transfer literature			

Many researchers argue the importance of contextual elements when studying knowledge utilization and sharing (Inkpen and Dinur, 1998; Alboni, et al., 1999). Based on extensive review of pertinent literature in e-government and international knowledge management, among others, we identified contextual elements that characterize the external and internal environments of the

individual organizations that participate in TPSKNs. These contextual factors can be organized into three layers: information and knowledge context, organizational context, and national context (Table 1). The first layer represents the main characteristics of the knowledge and information being exchanged. The organizational context embodies the structures, capabilities, and constraints of the involved organizations. The national context corresponds roughly to cultures and political systems (Gharawi & Dawes, 2010).

Table 1: Layers of Contextual Factors Influencing Organizations Participating in TPSKNs

3.1 Knowledge and information context

The knowledge and information content to be exchanged in TPSKNs can vary in several respects. Researchers have distinguished between two main types of knowledge: tacit and explicit (Nonaka, 1994; Polanyi, 1996). Tacit knowledge is hard to communicate and deeply rooted or embedded in action, involvement, and commitment within a specific context (Cohen and Bacdayan, 1994; Nonaka, 1994). Knowledge that is explicit and codifiable is more readily transferable (Zander and Kogut, 1995). Similarly, articulability, the degree to which knowledge can be expressed in language, numbers, formal procedures and explicit techniques, can affect the effectiveness of knowledge sharing (Bresman, et al., 1999).

The value of the content being exchanged may also influence the effectiveness of the exchange process especially when participating organizations perceive knowledge they have as a key organizational asset (Zander and Kogut, 1995). The degree of sensitivity, confidentiality and standardization also affect willingness and ability to share information. (Dawes, 1996).

When TPSKNs involve technology transfer, development of a joint information system, or exchange of data among different systems, effectiveness may also be influenced by the characteristics of the technology. These characteristics include complexity, or the degree to which transfer, implementation or use of the new technology is perceived as relatively difficult (Moore & Benbasat, 1991; Goodman & Darr, 1998; Kim & Lee, 2006) and compatibility or the degree to which technical transfer or exchange is perceived to be consistent with existing infrastructures, software, or information systems, (Moore & Benbasat, 1991). In addition, research has shown the difficulties of integrating heterogeneous information systems across different platforms, data standards, and schemas and documented the importance of “fit” with the organization’s current technology. (Dawes, 1996; Klischewski & Scholl, 2006; Landsbergen & Wolken, 2001; Zhang & Dawes, 2006).

3.2 Organizational context

Lane and Lubatkin (1998) argue that the ability of an organization to learn from another is jointly determined by the relative characteristics of the two organizations. Accordingly, research shows that many organizational level factors may influence the effectiveness of TPSKNs. Generally, organizational interests are rooted in goals, missions, and priorities. Participants’ perceptions of risks, costs, and benefits are additional critical factors that affect the success of knowledge networks (Dawes, 1996; Zhang and Dawes, 2006). Organizational structures and cultures (Tsai, 2002; Kim and Lee, 2006) and a variety of capabilities (Cresswell, et al., 2005) also play a significant role in the manner and success of information sharing activities.

In addition, trust is essential for establishing, developing, and maintaining inter-organizational relationships (Rousseau, et al., 1998; Lewicki, et al., 1998; Cresswell, et al., 2006). Trust is influenced by the history of past relations and has direct consequences for establishing and sustaining collaboration (Levinthal and Fichman, 1988).

Authority is another major influence on the performance of networks (Provan and Milward, 1995; Tsai, 2002), although formal authority alone is insufficient to ensure successful and willing participation in many settings (Eglene, et al., 2007; Schneider, 2002). Previous research has also demonstrated the importance of leadership, executive support and organizational commitment in promoting the success of information sharing (Anderson, et al., 2003; Basu, et al., 2002; Dawes and Pardo, 2002; Eglene, et al., 2007).

Finally, availability and compatibility of resources influence the ability of participants to evaluate, assimilate, and use external knowledge. Researchers refer to this as absorptive capacity and identify it as a main factor that may hinder or promote success of sharing across boundaries (Cohen and Levinthal, 1990; Kumar and Nti, 1998).

3.3 National context

Previous research demonstrates that difficulties associated with transforming and sharing knowledge through international collaboration result from differences in national, organizational, and professional cultures (Choi and Lee, 1997). Sharing activities in TPSKNs are likely to be influenced by the characteristics of the national environment such as prevalent norms and beliefs, language, political interests, and existing laws and policies (Dawes and Prefontaine, 2003). Lucas (2006) argues that the location of subsidiaries in multi-national corporations along cultural dimensions such as power distance or individualism-collectivism, (Hofstede, 1994), significantly impact knowledge sharing. Generational and gender-oriented differences as well as different time orientations can have similar impacts.

Language differences represent an obvious challenge in international collaborations as the need for both literal and conceptual translation adds complexity, difficulty, and opportunity for error (Duan, et al., 2006; Eglene and Dawes, 2006). Finally, as TPSKNs involve at least two organizations located in different countries, the institutional environment and, more specifically, the existing laws and policies of the participating agencies' respective countries will influence operation and success of TPSKNs. Similarly, the type and level of political support for the initiative also influences prospects for success (Eglene, et al., 2007).

4. Contextual Distances

The contextual factors discussed above all shape the way individuals perceive the world and the ways in which organizations work. They also create distance between the participating organizations that affect their ability to understand and engage with each other. The idea of contextual distance is a useful way to organize and examine these factors. We organize them into nine categories of distance: cultural, political, intention, organizational, relational, knowledge, resource, physical, and technical.

4.1 Cultural distance

The term "culture" refers to shared beliefs, values, and practices (Taylor and Osland, 2003; Narteh, 2008). Social scientists use the concept to differentiate among social collectives such as groups, organizations, and nations. Differences in beliefs, values, and practices strongly influence cross-cultural interaction, including knowledge and information exchange (Narteh, 2008).

Generally, knowledge sharing becomes more difficult as cultural distances increase. For example, more time has to be allocated for communication, development of common managerial approaches, and design of compatible work routines (Olk, 1997). These factors may extend the

time required to achieve the desired goals and consequently affect the performance of the TPSKN.

Additionally, cultural distance has negative consequences for collaboration and learning processes, which are integral to sharing activities in TPSKNs. In knowledge management research, Tiemessen et al. (1997) point to the potential problems that may result from differences in partners' national and organizational cultures. Lyles and Salk (1996) argue that cultural distance may lead to misunderstandings that may minimize flows of information and learning. Similarly, Ting-Toomey (1999) argues that intercultural interactions are often filled with second guesses and misunderstandings due to differences in language and communication styles as well as different value orientations. Moreover, Schlegelmilch and Chini (2003) assert "human capability to capture and understand complex facts is rooted in a cultural setting and, thus, tends to differ across cultural areas" (p. 220). Consequently, some researchers argue the importance of considering learning styles and techniques in various cultures (Risenberger, 1998).

On the positive side, however, as the duration of a cross-cultural relationship increases, trust is expected to improve (Gulati, 1995) and cultural distances tend to shrink (Meschi, 1997) These improvements occur as the partners become more familiar with each other's expertise and idiosyncrasies (Simonin, 1999). This kind of learning increases the effectiveness of sharing activities among participating agencies and consequently improves network performance.

4.2 Political distance

Political distance reflects the gaps and conflicts among the existing laws and policies, political interests, and agendas of the home countries of participating organizations. The influence of political distance may range from affecting the ability of participants to create a stable collaborative environment to restricting their ability to carry out specific kinds of activities. Laws governing intellectual property, trans-border data flow, privacy protection, contracting, and other topics may or may not match. In addition to the gap between laws and policies, the distance between political philosophies can present competing or conflicting views and agendas. For example, one view may favor open access to information, and another may favor restrictions or censorship.

In TPSKNs where interaction involves both developed and developing countries, aspects of the legal systems and infrastructures may be well-established on one side and missing or under developed on the other. In such cases, the political distance would be larger and participants may face legal barriers that may impede sharing activities. From the developing country side, barriers such as insufficient legal frameworks, ineffective enforcement , and frequent changes in the legal infrastructure are all possible challenges. On the other hand, the well established legal infrastructure on the developed country side may impose restrictions that limit the ability of participants to establish or sustain their engagement (Zheng, 2009).

4.3 Intention distance

Organizations may join a network or engage in exchange processes with other organizations for a variety of reasons, seeking to reach certain goals or to achieve certain outcomes as a result of the relationship. Intention distance signifies these differences in mission and goals (Dawes, 1996). While some goal differences are to be expected, commonality or compatibility of the primary goals of the participants appear to be necessary in order to establish and maintain useful relationships. Thus, when shared or compatible goals are present in the network, mutual understandings, accommodations, and exchanges of knowledge, information and other resources

are more likely to take place. Shared vision and goals can be viewed as a bonding mechanism that helps network actors integrate knowledge (Inkpen and Tsang, 2005). Similarly, Samaddar, Nargundkar, and Daley (2005) discuss the role of goal congruence on interorganizational information sharing. They contend that the degree to which the participants perceive a match in their goals may impact the nature and amount of knowledge and information they are willing to share with each other. For example, Samaddar et al. argue that when interorganizational relationships are formed, divergent interests may increase the chances of opportunistic behavior. In order to mitigate this, they suggest goal congruence as a governance mechanism that can lead to mutually beneficial performance (2006).

4.4 Organizational distance

Many organizational level factors strongly influence the effectiveness of TPSKNs. Inkpen and Dinur argue that "the differences between organizational units stand at the core of understanding their ability to utilize and share knowledge" (1998, p. 6). Organizational distance also refers to the "degree of dissimilarity between the partners' business practices, institutional heritage, and organizational culture" (Simonin, 1999, p. 473). Similarly, Schlegelmilch and Chini (2003) define organizational distance as differences in structures, processes, and values. Narteh (2008) argues that organizational differences in many respects such as decision-making processes, norms, objectives, and organizational structures that define authority and responsibility relationships are likely to affect the ways employees interact and consequently the effectiveness of the knowledge sharing process.

Differences in absorptive capacity, or the ability to evaluate, assimilate, and use external knowledge introduces different learning rhythms that influence the facilitative effect of learning on knowledge sharing processes (Kumar and Nti, 1998). Additionally, Khamseh and Jolly (2008) argue that stable, unstable, unilateral or disputed relations are explained by variations in the absorptive capacity of participants.

4.5 Relational distance

The extent to which participating organizations know and relate to each other also influences TPSKN performance. Relational distance is shaped by the duration and type of historical interactions among the participating organizations. The distance is greatest when participating organizations collaborate for the first time. As time passes, the distance tends to decrease. Inpken (1998) argues that organizations that have worked together in the past are more likely to have a basic understanding of each other's skills and capabilities, which provides impetus for learning. Previous positive ties can establish an adequate level of trust that allows participants to forgo the relationship-building processes which are necessary for participants working together for the first time. Simonin (1999), studying knowledge transfer in strategic alliances, states the importance of contrasting more established alliances with more recent ones. He notes the duration of the relationship has a counterintuitive moderating effect on organizational distance which was found to be nonsignificant for more recent alliances and significant for longer-established ones. This perhaps reflects an unrealistic honeymoon period at the beginning and a more complete understanding of differences as the relationship develops over time.

Thus, relational distance implies challenges that may impede the collaboration and learning that facilitate sharing in TPSKNs. Generally, a prior positive relationship can facilitate trust, which is a main promoter of collaboration in any network. Such prior relationships also enhance the ability to resolve conflicts. Norman (2002) argues that over the course of long relationships

participants develop behavioral expectations and understanding of each other, and become subject to norms of reciprocity. These effects enhance collaboration in a variety of ways that may contribute to the overall success of TPSKNs.

4.6 Knowledge distance

Knowledge distance refers to differences in the existing knowledge bases of the participating organizations. Cummings and Teng (2003) find that an appropriate overlap of knowledge is conducive to the success of knowledge transfer. Conversely, there is a negative relationship between the extent of knowledge distance and transfer success.

Generally, knowledge distance influences the learning process which facilitates sharing activities in TPSKNs. Grant (1996) contends that learning performance is negatively influenced when the object of learning is not related to what is already known and when a common language for interpreting experience does not exist. Similarly, Powell et al. (1996) state that what can be learned is significantly influenced by what is already known. According to Szulanski (2000), participants that engaged in related business prior to knowledge transfer are likely to possess similar knowledge bases that reduce the difficulty of transferring knowledge from one organization to another.

However, Inkkpen (1998) found that as knowledge distance shrinks, the chances for participating organizations to locate and access new knowledge from each other decreases and this effect may influence their willingness to collaborate further and reduce their ability to solve novel problems.

4.7 Resource distance

Resource distance reflects differences in both the amount and type of resources participants need from or contribute to the network. When participating organizations are at different levels of development, have different stature in their countries, or enjoy different amounts or kinds of funding, staff, physical plant, or discretion over spending, their ability to contribute to the work of the TPSKN will reflect those differences. Perceptions about resource dependence and equality or inequality have strategic implications for the participating organizations including strategies for dealing with interdependence and uncertainty (Gulati and Gargiulio, 1999).

For the network as a whole, good performance tends to be associated with the ability to marshal a variety of resources ranging from finances to diverse skills (Dawes and Pardo, 2002). Thus, similar to knowledge distance, the relationship between resource differences and the willingness to build an interorganizational relationship appears to be curvilinear. As gaining access to useful resources not possessed by an organization is one the main motivations to engage in networks, collaboration among organizations with complementary strengths and weaknesses will probably yield more benefits than will relationships among highly similar peers (Todeva & Knoke, 2006).

4.8 Physical distance

Physical distance generally refers to the relative geographical locations of participating organizations. Some researchers discuss the difficulties that physical distance presents for conducting face-to-face meetings which are necessary for establishing relationships and for transferring tacit knowledge (Davenport and Prusak, 1998; Cummings and Teng, 2003). Others point to the influence of physical distance on the development of social capital which is crucial for the development of good communication and the sustainability of the network (Cohendet, et

al., 1999). When participants are widely dispersed across geographic areas, effective communication among people in different locations and smooth transmission of information and knowledge may be hindered. In addition, in multi-participant efforts, those in closest physical proximity tend to engage more often and more fully, while those farther away are less involved. (Zheng, 2009).

The problem of physical distance is a frequent focus for applications of information and communication technology, but there is strong evidence that face-to-face engagement remains essential for group formation and for complex communication and group-level creativity (Cummings and Keisler, 2005).

4.9 Technical distance

TPSKNs, may involve information sharing, data integration or interoperability of systems across national boundaries. Technical factors may enhance or impede these processes.. Technical distance is shaped by the differences in the IT infrastructures and capabilities of the participating organizations. Previous research in information systems points to different levels of complexity of IT infrastructure and telecommunications as a pressing concern for development of systems that cross national boundaries (Ives and Jarvenapaa, 1991).

Similarly, transnational digital government studies emphasize the roles that technical distances and capabilities may play in the performance of TPSKNs. For instance, Tsugawa et al. (2008) identify issues that result from differences in hardware, software and data schemes as critical to the success of transnational data sharing networks. Additionally, they contend these differences may exacerbate socio-political and sustainability issues by preventing the deployment of IT services that are essential for interoperability.

Some authors observe that technical distance in TPSKNs tends to shrink over time. In his study of transnational information systems, Cavaye (1998) argues that technical diversity is not a long-term challenge but instead tends to lessen as standardization of IT infrastructure and systems takes place among participants.

5. Discussion

The world faces a growing number of regional and global problems that no nation has the authority, capability, or resources to solve on its own. Transnational public sector knowledge networks are emerging as a form of collaboration that operates across national and cultural boundaries on the basis of expertise and information rather than through the traditional channels of diplomacy among sovereign powers. However, our ongoing research into TPSKNs strongly suggests that sovereignty, unique cultural characteristics, and national contexts introduce conflicts and distances that complicate transnational cooperation beyond the difficulties associated with organizational and information-related factors. It appears that much of the work of a transnational network is embodied in the effort to bridge or shrink these often invisible contextual distances so that the participants can create shared meaning and productive collaboration and problem solving.

Based on several research literatures, and a preliminary look at the two cases, we propose an integrated dynamic model that depicts the contextual complexity and multifaceted nature of TPSKNs (Figure. 2). The model emphasizes the importance of context in two ways. First, it depicts the influence of three layers of context surrounding each participating organization. These layers represent the cultural and political, organizational, and informational elements as national context, organizational context, and knowledge and information content. These multi-

dimensional environments strongly influence the perceptions, behaviors, and options for action for each network actor. For the sake of simplicity, the model depicts two countries and several organizations in each. However, these elements could be multiplied many times to represent networks involving a large number of countries with many organizations within each one, all operating in somewhat different contexts. These within-country network actors generally have inter-organizational relationships that further influence their behavior.

Second, the layers of context and domestic relationships among network actors in each country contribute to a set of contextual distances that represent the differences in kind or degree between the international actors on a set of influential dimensions: culture, politics, goals and intentions, organizational factors, ability to form relationships, types and extent of knowledge, types and extent of resources, physical location, and available technologies. Variations on these dimensions in each country create contextual differences that influence the nature and performance of the processes and interactions. As they unfold over time, the processes and interactions exert their own influences on these distances serving to narrow or widen them depending on the actors' options, choices, and situations. The results of these dynamics are conceptualized as both hard and soft products. Hard products could include formal decisions, laws, software or systems, events, data resources, funding, or new organizations. Soft products refer to such elements as generated techniques, trust, distrust, power sharing, volunteerism, or informal relationships.

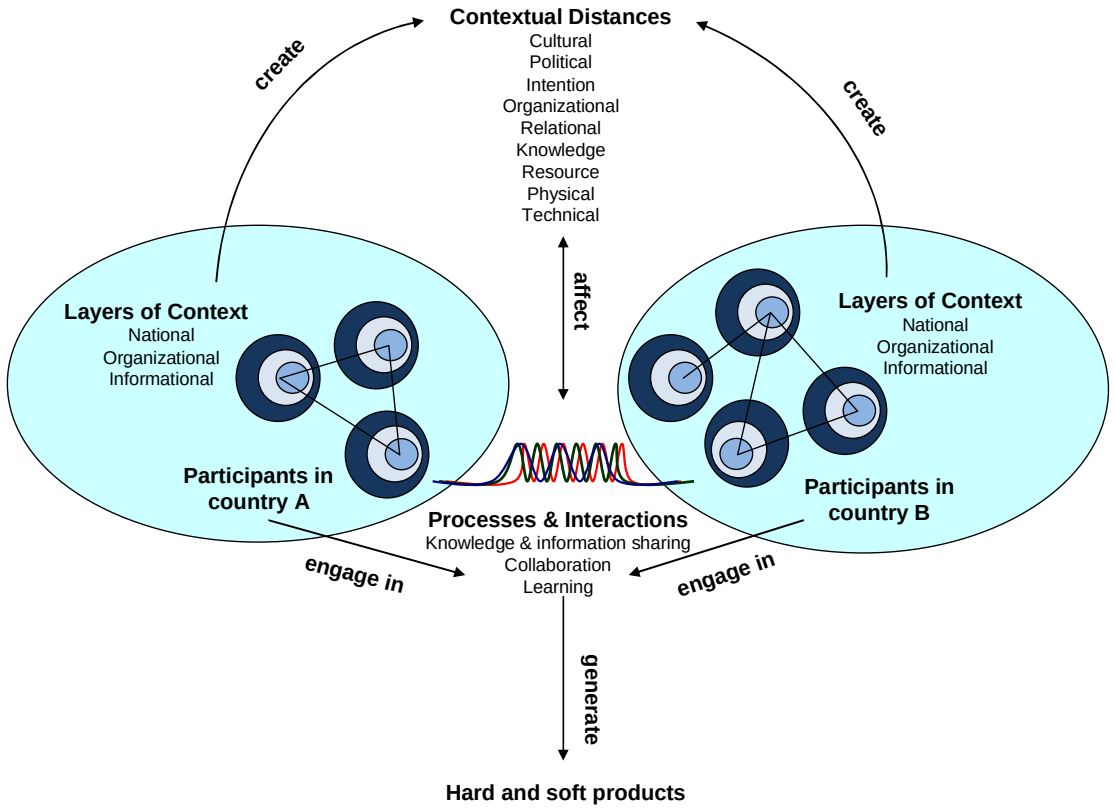

Figure 2: Dynamic Model of Transnational Knowledge Networks

The proposed model contributes to theory by bridging a gap between the literature of cross-boundary information sharing and knowledge transfer. Researchers in the first area have studied public sector knowledge and information sharing at three organizational levels, intra-organizational, inter-organizational, and intergovernmental within the same country (Dawes, et al., 2009; Gil-Garcia, et al., 2005). Strategic management research, including knowledge transfer, has addressed international engagement but within the private sector, and mainly within the boundaries of a single multi-national company. This model addresses knowledge and information sharing at the trans-governmental level where almost no empirical work has been conducted.

This research not only begins to fill a gap in theory, it also coincides with the emergence of transnational knowledge networks in many fields of practice where the number of practitioners engaged at all levels of authority is likely to grow. However, very few are prepared to work across cultural boundaries, languages, or different political systems. The better we understand the structure and dynamics of these networks, the more likely we will be to understand the conditions and employ the structures, preparation and strategies that will help them work well. This research could therefore eventually produce not only new theory but practical guidelines or educational programs that help the participants in these networks understand and bridge the underlying differences in world view that contextual distances represent.

This work is also exploring ways to conduct transnational research, experimenting with multi-national research teams, dealing with physical, time, and language distances, and exploring how native researchers can understand data collected in a familiar setting and "translate" it both literally and culturally for their colleagues in other countries. The model therefore also provides a framework to guide data collection and comparative analysis as well as a way to reflect on and improve the research strategy.

6. Conclusion and Future Research

In this paper we emphasize the importance of context in knowledge and information sharing at the trans-national level and discuss the influence of both country-specific environments and broader contextual differences among participants on the overall prospects for TPSKN performance. The proposed model lays the foundation for future work that goes beyond description to build a more robust theory of transnational knowledge and information sharing for addressing global problems. We propose that organizations in a TPSKN cross the boundaries between nations through a variety of processes and interactions that comprise information and knowledge sharing, collaboration, and learning. However, they engage in these processes under the strong influence of their own environments and domestic relationships. These environments and relationships contribute to a set of contextual distances between the actors in the different countries that influence and are influenced by interactions among participants as they seek to produce results. These two treatments of context represent a systematic approach to understanding the different perspectives, strengths, and weaknesses that participants bring to the network. They also provide a useful way to observe changes over time, as the interactions in the network may help to close these distances or produce strategies that bridge gaps (such as physical distance) that cannot be narrowed. Moreover, contextual distance helps us consider how differences and similarities among participants contribute to different degrees of success for the stability of network structure, for the effectiveness of the interactions that take place, and for its substantive performance regarding its main purpose and goals.

In the next phase of this research, we will elaborate on the basic ideas presented here with the goal of a refined theoretical model and a set of practical observations and recommendations for

enhancing the performance of transnational public sector knowledge networks. This will entail detailed analysis of the JAC and AIRNow-I Shanghai case data and a cross-case analysis to refine the model. We also plan to use these cases to assess the strengths and weaknesses of different methodological approaches to transnational research involving native researchers working in their own national contexts and also in concert with colleagues in other countries

In addition, we plan to expand the research to address other policy domains. For example, one doctoral dissertation is underway to explore the ongoing collaboration between the US and Saudi Arabia in the domain of public health. This study will test the model within another national culture and in a different policy domain, using research methods consistent with the AIRNow-I Shanghai case to assure comparability. The two cases will then be compared to identify similarities and differences, with special attention to domain-specific factors.

Further research could also address the structural and governance aspects of TPSKNs as well as the role of leadership and the influence of formal authority in their operation and performance. Larger networks and networks of truly global scale would also be excellent venues for developing greater understanding of the formation, operation, limitations and benefits of TPSKNs.

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