

Conceptualizing Knowledge and Information Sharing in Transnational Knowledge Networks

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ABSTRACT

In the era of globalization, sharing of knowledge, information, and practices across cultural and national boundaries has been recognized as a key for handling the most critical problems. Consequently, the number of Transnational Knowledge Networks (TKNs) that aim to address critical global issues and problems continue to increase. As exchanging knowledge and information represent core components of these networks, this paper provides the foundations to study knowledge and information sharing in these emerging organizations. The paper starts by describing the structures, goals, and objectives of TKNs and presents a simplified conceptual model to demonstrate the main characteristics of these networks. Then, we review the pertinent e-government literature and argue the need to include findings from two additional research areas, cross-boundary information sharing and knowledge transfer. The paper discusses the ways in which contributions from these areas can enhance our understanding of the complexity surrounding the exchange process in these networks. The paper concludes with a summary of the elements of complexity and an overview of future research to empirically test these concepts.

Categories and Subject Descriptors

K.4 Computer and Society, K.4.1 Public Policy Issues, Transborder Data Flows

General Terms

Theory, Management

Keywords

Transnational Knowledge Networks, Knowledge Sharing, Information Sharing, Cross-Cultural Collaboration

1. INTRODUCTION

In the era of globalization, Transnational Knowledge Networks (TKNs) are increasingly emerging to address common problems on a global scale. These networks are described as a key feature of

world order in the twenty-first century in which government officials and organizations working outside the formality of sovereign states, exchange information and coordinate activity to address problems on a global scale [63]. As the number of these networks increases, studying the factors that may promote or hinder their success becomes more salient for both governments and scholars. Several authors have discussed these networks conceptually and argue the possibilities of empowering them to build governance capacity around the world [63][8][56][62]. However, there is little research that empirically addresses the complexities surrounding the knowledge and information sharing that represents the main processes in these networks. This paper begins to bridge this gap by exploring the concepts and relationships embodied in knowledge and information sharing in transnational networks and offering a framework that can guide empirical study.

The paper consists of three main sections. The first section describes the structures, goals, and objectives of these transnational networks and presents illustrations drawn from the domain of environmental protection. We then identify the main characteristics of knowledge and information sharing in TKNs. In the next section, we review research conducted within the e-government domain to explore knowledge and information sharing across national boundaries. The third section argues the necessity of incorporating concepts from two other well-established research areas, cross boundary information sharing and knowledge transfer, to study knowledge and information sharing in TKNs. This section demonstrates the importance of understanding the underlying assumptions of these areas and the ways in which their contributions can facilitate better understanding of complexity surrounding knowledge and information sharing in these emerging networks. We conclude with a summary of key concepts and a set of research questions that can be investigated in future empirical studies

2. TRANSNATIONAL KNOWLEDGE NETWORKS (TKNS)

During the past decade, sub-national networks of government officials and organizations have emerged that exchange information and coordinate activity to address common problems on a global scale [63][56]. In her book, *The New World Order*, Slaughter describes these networks as a key feature of 21st century governance and argues the necessity of exploiting the “soft power” of persuasion and information to deal with complex problems of global reach and magnitude (p. 4). She argues that the international system is not only one of formal relationships among sovereign states, but of less formal links among “disaggregated”

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public, private, and nonprofit entities that interact with each other on the basis of expertise and interest rather than formal power [63]. These networks constitute a new or additional form of governance in critical areas such as security, the global economy, and environmental protection.

The structure of these networks can be vertical or horizontal [63]. While the main goal of vertical networks is to align national and supranational rules through different modes of enforcement procedures, horizontal networks rely on knowledge and information exchange to help countries around the world 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 structural core of the networks that we explore in this paper is a set of horizontal linkages among governmental agencies and officials in different countries. These networks involve individuals at the highest ministerial levels who are directly responsive to the national political processes as well as regulators and experts in lower level positions. They also involve organizational units within different countries below the level of the state. Given this arrangement, the networks tend to be less formal and more flexible. Consequently, the information and knowledge exchange process can be richer, but it can also be more complex as the exchange may contain different types of content (including knowledge, information, and technology) exchanged in a variety of ways across national borders 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. The International Network for Environmental Compliance and Enforcement (INECE) founded by the EPA and the Dutch Ministry of Housing, Special Planning and Environment (VROM) offers technical assistance, training, global conferences, and a website of information to aid environmental agencies world-wide to deal with environmental protection issues [56].

While these networks are established for a specific purpose such as capacity building, technical assistance, or harmonization, 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 build 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 (PROFEPA). As the relationship evolved, the collaboration

extended to joint US and Mexican projects to improve air quality along the US and Mexican 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 by over 80% compared to the traditional kilns in use at the time [16][13].

Finally, it is important to note the expandability of these networks and practices. When they succeed in achieving desired goals, these governmental networks become more attractive to participants from other nations either to imitate or to join. Raustiala [56] points to the emergence of INECE which started in 1985 with a Dutch request for technical assistance from EPA. A similar request from Poland in 1991 was followed by a number of others. As EPA attempted to help all of them, it started international conferences and created a website for streaming videos that can be accessed by regulators around the world.

2.1 Characteristics of Transnational Knowledge and Information Sharing Networks

It is important to characterize the knowledge and information sharing process in these networks before making any attempt to address the factors that may impede or promote their performance. Based on the previous discussion we propose five main characteristics:

- First, trans-governmental networks involve government agencies located in at least two countries collaborating toward addressing a specific issue by exchanging knowledge and information. Thus, the exchange of knowledge and information crosses the borders of individual nations.
- Second, these networks may involve different types of social actors. While the sharing process typically involves governmental sub-units located in different countries, the exchange process may also include non-governmental actors including private, non-profit, and super-national organizations.
- Third, the exchange process is bi-directional with knowledge and information flowing in both directions among participants. Therefore, each participating entity is both a source and a recipient of the knowledge and information being exchanged.
- Fourth, the involved entities may exchange the same type of content such as statistical information or scientific knowledge, or they may exchange different types of content.
- Finally, the exchange of knowledge and information is perceived as a process that is not closely controlled by the participating entities' respective legislatures or executives.

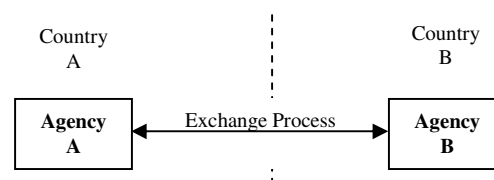


Figure 1. A Simple model of knowledge and information sharing in TKNs

Based on the listed characteristics, knowledge and information sharing in these networks can be depicted in its simplest form (Figure 1) as a process that involves exchange of knowledge, information, or both between two governmental sub-units located in two countries.

3. E-GOVERNMENT RESEARCH ON TRANSNATIONAL KNOWLEDGE AND INFORMATION SHARING

In this section we summarize recent research on transnational knowledge and information sharing which sheds some light on the kinds of networks described above. Overall, these studies have focused more on technical and organizational aspects and less on political, legal, institutional, and cultural ones. To date, no study has attempted to explore empirically knowledge and information sharing in trans-governmental networks as a complex and dynamic phenomenon where many factors may influence the exchange process.

The Center for Technology in Government (CTG) conducted a reconnaissance study to assess the current status of international digital government research and establish a baseline for the growth and development of this stream of work [27]. By reviewing the pertinent literature from 1994 to 2008, the study located 276 articles and reports that explicitly focus on understanding topics that cross the jurisdictions, cultures, or customs of different countries. Among these identified articles only 20 (7% of all articles found) fall into the transnational category which refers to studies that focus on issues or problems that involve either planned or unexpected interaction among two or more countries. An analysis of these studies reveals that most focus on Pan-European issues that address the unification goals of the European Union. In general, these studies concentrate on the technical aspects by proposing solutions and frameworks that have the potential to allow access to and interaction among the disparate systems and services of EU member states.

Tarabanis and Peristeras [66] analyze the requirements posed by the InfoCitizen project that aims to make feasible the realization of a pan-European view for public service provision. They also discuss the use of semantic web technologies for designing Pan-European e-government services [52][53]. Similarly, Sargi and Tiscornia [59] propose a technical solution that allows free access to legal information presented in six different languages by using a semantic lexicon. Others propose business-driven solutions to solve integration and sharing problems across member states [46]. Similarly, Adam et al. [1] discuss the importance of making business processes transparent to citizens in order to solve the integration problem in Pan-European administrative processes.

Studies conducted outside Europe are also generally oriented toward technical challenges. In a study focused on information exchange to combat drug traffic, Matsunaga et al. [40] propose a framework to transform transnational applications into web services that are secure, support interactivity, and do not constrain application functionality. Drawing from the same project, Su et al. [65] present a technical framework to achieve information sharing, event notification, and enforcement of policies, constraints, and regulations between Latin American countries.

Only a few studies explore the influence of contextual factors, such as legal or political aspects, on information access or exchange among different countries. For instance, Zheng [79]

addresses cross-national information policy conflicts by investigating the effects of US and Chinese information policies and practices on three multinational companies (Yahoo, Microsoft and Google) that work in a global regulatory environment. The study concludes with calls for multi-disciplinary approaches to tackle cross-national issues. Roy [58] explores the ways in which actions or issues of one country can affect others by examining the influence of US security policy on Canada's security policy post 9/11. In Europe, Corradini et al. [12] examine European identity management policies to identify the differences and explain their influence on the interaction among constituents in the public and private sectors. A study that examines the impact of existing laws on European e-governance [51] concludes that state structures and institutional and legal factors can be profoundly important in determining the nature, cost, and success of e-governance.

In two very recent studies, Navarrete and colleagues explore the challenges that the border environment brings to information sharing initiatives. In the first study [42], researchers integrate current research in cross-boundary information sharing with widely accepted theory on borders to develop a high-level framework of contextual factors that may influence these activities including market forces and trade flows, policy activities of multiple governments on adjacent borders, and the political and cultural characteristics of border communities. In the second paper [43] the authors propose an integrated model that draws from the literatures of networked government, inter-organizational collaboration, information integration, and border theory. They contend that certain factors influencing inter-organizational and inter-governmental information sharing in the cross-boundary information sharing literature also influence knowledge and information sharing at the trans-governmental level.

In summary, earlier studies have been mostly narrow in their focus as they emphasized the technical side of the challenges more than the social aspects influencing knowledge and information sharing across national and cultural boundaries. Also, there have been few attempts to explore the issue as a complex phenomenon, but these attempts still limited and additional work is required to provide more alternatives to understand knowledge and information sharing in these networks. Therefore, as this area still at its infancy, we argue the necessity of looking beyond the existing literature and mainly to relevant areas that have the potential to contribute to our understanding TKNs.

4. OTHER RELEVANT DOMAINS

Given the limitations described above, we looked at other research domains for concepts and approaches that could enhance our understanding. Cross-Boundary Information Sharing (CBIS) and Knowledge Transfer (KT) have the potential to offer insights into the phenomenon being studied. These two areas are well established within the e-government and international management domains and their contributions can add to our understanding of several key aspects that are essential to guide our understanding. However, in order to assess how findings in these areas might be applied to knowledge and information sharing at the transnational level, we return first to the simple definition proposed above. Basically, we define knowledge and information sharing in its simplest form as a process that involves exchange of knowledge, information, or both between two governmental sub-units located in two countries.

Alboni et al [2] suggested a framework that encompasses the context, the actors involved, the type of content being transferred, and the media for knowledge transfer. Based on this definition, we can identify four major components: the sharing process, knowledge and/or information, governmental sub-units, and the countries where these organizations are located. These components can be conceptualized as four layers of complexity (Figure 2). The inner core depicts the first component which refers to the exchange or sharing process. This layer is surrounded by three layers of context representing the remaining three components: information and knowledge content, organizational context, and external environment. The content layer represents the knowledge and information being exchanged through the process. The organizational context embodies the structures, capabilities, and constraints of the governmental sub-units involved in the exchange. The external environment corresponds to the countries where the interaction takes place and the factors at the national level that may affect the performance of the entire exchange process.

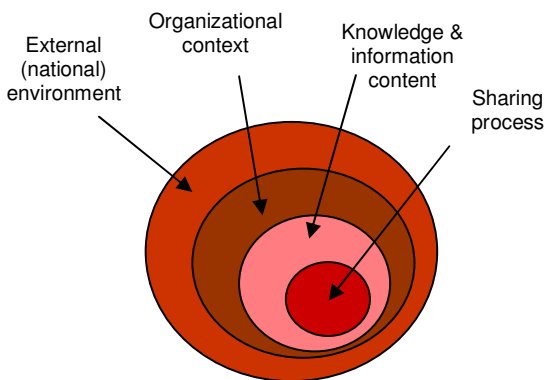


Figure 2: Layers of Complexity in Transnational Knowledge Networks

Below we discuss the underlying assumptions, basic foundations, and characteristics of the work conducted in cross-boundary information sharing and knowledge transfer as well as ways in which these two areas might enhance our understanding of the complexities involved in transnational knowledge networks.

4.1 Cross-boundary Information Sharing

Cross-Boundary Information Sharing focuses on collaborative information sharing and integration among groups, departments, and organizations. Researchers in this area have studied information sharing across different organizations and functional areas from both vertical and horizontal perspectives [78]. Public administration and e-government researchers have studied information sharing and integration at three organizational levels, intra-organizational, inter-organizational, and inter-governmental within the same country.

Previous research indicates that the factors influencing information sharing and integration at these three levels are similar, but complexity increases as focus moves from lower to higher levels of organizational interaction and from more focused to more diffuse purposes [18][25]. Figure 3, first presented by Gil-Garcia et al. [25], depicts this phenomenon in a two-

dimensional matrix. The first dimension refers to the level of organizational involvement. The second refers to the main purpose of the effort, which can be to address a specific need or problem, or to build systemic capacity to share and integrate information that can be mobilized whenever needed within a broad domain [25]. We contend that by adding another layer to the matrix to represent the transnational level of interaction, complexity will further increase.

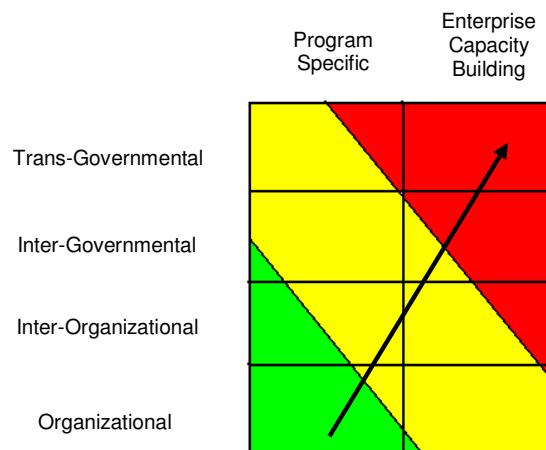


Figure 3: CBIS complexity matrix [25]

Our review of CBIS shows that some of the underlying assumptions of this work are consistent with the five characteristics of knowledge and information sharing while others are not. Basically, CBIS and transnational knowledge networks both focus on information and knowledge sharing as a process that implies collaboration between two or more governmental sub-units or agencies. This is main consistency between the two areas. However, studies in CBIS area have considered sharing between agencies that have in common at least the same national and cultural context, and often the same or similar political and legal contexts, as well as a common language. This assumption does not hold true in transnational networks. In addition, much but not all of this research gives information considerably more attention than knowledge as a medium of exchange.

Thus, CBIS can contribute to our understanding of the factors that may influence the performance of the exchange process at the organizational level more than at the national level. These organizational level factors are important especially for the creation and maintenance of inter-organizational relationships [50]. Our review points to many factors that can be applied to understand the organizational layer in TKNs. These factors include the goals and interests of participating organizations, risks, costs and benefits, trust, executive support, authority and hierarchical structures, organizational rules and procedures, organization culture, leadership, and resources.

Organizational interests are rooted in the presence of diverse goals, interests, missions, and priorities of participating organization [19][76]. In fact, while researchers in CBIS have found that parties participating in collaborative efforts often have conflicting goals [25], in TKNs the chances for both expected and unintended conflict are greater since participating organizations

are operating within different political and legal contexts. Therefore, the degree of alignment between the goals and interest of participating organizations represents a major influence of organizational context on the exchange process.

Participants' perceptions of risks, costs, and benefits are critical factors to the success of knowledge networks [17][77]. Because risks often arise in inter-organizational relationships, previous research discusses the importance of negotiation and the development of commitment as two strategies to overcome risks and promote collaboration in knowledge networks [48].

Trust represents another key factor in understanding TKNs. Trust plays a significant role in establishing, developing, and maintaining inter-organizational relationships [57][38][14][48]. Trust is also influenced by the history of past relations. Levinthal and Fichman [37] found that past history had a positive impact on future relations. Additionally, they found that the strength of the relation is a result of building trust and acquiring joint resources over a long period of time.

Executive support and organizational commitment are important to promote collaboration toward sharing knowledge and information [4][6][21][77]. Executive involvement influences cross-boundary information sharing initiatives as executives have the ability to affect the willingness of key actors to participate, dedicate the required resources, and maintain the autonomy of participating organizations [49].

Authority has been identified as another major factor influencing the performance of knowledge networks [55][71][4][21][33]. While research points to formal authority as an essential element to initiate information sharing initiatives, Eglene et al., [21] found that formal authority is insufficient to ensure successful and willing participation.

The impact of the formal authority can not be determined without examining organizational structures and cultures. For instance, centralization in hierarchal structure has been identified as a barrier to collaboration [25]. Additionally differences in formal rules, policies, guidelines, and procedures can present additional barriers to sharing knowledge and information [71][33][73]. Similarly, organizational culture plays a significant role in the success of information sharing [47][50].

Researchers in CBIS have also demonstrated the roles that leadership can play in promoting the success of information sharing [19][21][49]. As discussed earlier, in TKNs the exchange of knowledge and information is not closely controlled by the participating entities respective legislatures or executives. In such settings, leaders must have the ability to use their power to guide cooperation and develop influence without formal authority [61]. Thus, leadership is another key to understanding knowledge and information sharing in TKNs.

Finally, examining resources in terms of availability and compatibility is essential to understanding the complexity surrounding knowledge and information sharing in TKNs. Incompatibility between the technical resources of participating organizations may represent a major challenge [17][36][19][76]. Additionally, Zhang and Dawes [76] argue that individuals with limited technical expertise may impede personal and professional communications throughout the knowledge network and consequently limit the performance of the sharing process. Finally, without financial resources it will be extremely difficult

to initiate and sustain the collaboration that underlies sharing knowledge and information.

CBIS research can also help us understand the role of content and external environment. For instance, researchers have explored the influence of information sensitivity, and confidentiality on the sharing process [17][48]. Also, lack of data standards and definitions have been identified as factors influencing the performance of the sharing process [17][47][76].

Finally, although studies in CBIS have generally considered agencies that share similar political and legal contexts, some of these factors continue to be relevant even when the interaction involves organizations located in two different countries. These include the laws and policies of the participating agencies' respective countries [17][36][49], and the type and level of political support for the initiative [21].

4.2 Knowledge Transfer

Research on Knowledge Transfer (KT) typically focuses within the private sector through the study of multi-national companies (MNC), strategic alliances, or joint ventures. Studies in this area can be classified into two main categories. The first explores knowledge transfer between sub-units of a company located within one country. The second category refers to studies that address knowledge transfer between sub-units located in distinct cultures or different nations. While some of the studies in the first category can offer insights into some aspects of the process and content of information and knowledge sharing, those that consider knowledge transfer across cultural boundaries especially are important to our understanding of the influence of the external environment on the performance of knowledge and information sharing in TKNs.

Similar to the research on CBIS, investigations of KT rest on several basic assumptions. First, many studies in this area conceptualize knowledge transfer as a process, not as a transaction. This view is reflected in the various definitions that have been discussed in the knowledge transfer literature. Argote and Ingram [5] for example define knowledge transfer as a process through which one unit (e.g. a department or division) is influenced by the experience of another. This view is consistent with this paper as it points to the importance of recognizing and dealing with the exchange of knowledge and information as a process involving learning.

Second, a considerable amount of work KT explores knowledge transfer among two sub-units operating within distinct cultural and political contexts [7][15][60][10][31][9][39][72]. Such work can guide our understanding of the challenges imposed by some aspects related to the external environment. Finally, much of this research gives knowledge considerably more attention than information as a medium of exchange. Thus researchers have demonstrated the impact of various knowledge characteristics on the effectiveness of the transfer process [23][69][3][64][26].

Therefore, while the KT literature shares the above underlying assumptions with assumptions about transnational networks, two major differences also exist. The first is related to the degree of institutionalization of the exchange process. The transnational exchange process of interest in this paper is not closely controlled by the sub-unit's respective legislatures or executives. This is not the case in most knowledge transfer studies which focus on knowledge transfer within the context of MNCs, joint ventures, or

strategic alliances, where the actions of sub-units are closely controlled by corporate strategies, goals, and processes.

Second, with few exceptions (such as Cummings and Teng [15]; Nonaka and Toyama [45] who investigate “knowledge sharing” rather than “knowledge transfer”), the transfer of knowledge is conceptualized in the KT literature as being uni-directional, following a one-way path from a source to a recipient [35]. This assumption contradicts one of the main characteristics of the transnational knowledge and information sharing process where knowledge and information may flow in both directions and the participants are considered both sources and recipients.

Consequently, we can draw on the KT literature to enrich our understanding of the role of the external environment and knowledge and information content. One of the most important aspects is the role that cultural differences plays in the effectiveness of TKNs. Culture is a general term that refers to shared beliefs, values, and practices of a group of people and that these may vary among nations [41][68]. The term has been used by social scientists to differentiate among social collectives such as groups and nations [30]. As in any activity that implies cross-cultural interaction, the distance between shared beliefs, values, and practices has been identified as one of the critical factors influencing knowledge and information exchange [41]. Wilkesmann et al. [72] argue that the influence of cultural differences can be easily observed whenever it comes to cross-cultural interactions in business or private issues.

However, culture is one of the most complicated ideas to conceptualize [67]. KT researchers have relied on some of the major contributions in the area of intercultural research (e.g. [29, 70, 28]) to assess its influence on knowledge transfer activities. Hofstede’s contribution [29] represents one of the most popular conceptualization of culture in KT research. Hofstede uses five cultural dimensions to examine work related values, attitude, and behaviors of more than 140,000 IBM employees IBM during the 1980s. These five dimensions include power distance, individualism/collectivism, masculinity, uncertainty avoidance, and long-term orientation.

Power distance refers to the degree to which a culture considers inequality between individuals. Individualism/collectivism refers to the degree to which individuals are concerned with their own well-being versus the well-being of others. Uncertainty avoidance refers to the degree to which individuals within a society are willing to deal with ambiguity and embrace change. Masculinity/femininity reflects the degree to which societal values are associated with a masculine perspective, such as success, competition, assertiveness, and acquisition, or a more feminine nature such as quality of life and personal relationships. Long-term orientation reflects the degree to which a culture values actions and attitudes that affect the future.

Research in KT provides evidence that most of these cultural dimensions influence knowledge transfer (e.g. [31][9][39][72]). We expect these findings will hold true for knowledge and TKNs as knowledge and information is exchanged across cultural and national boundaries.

Also, Lucas [39] argues that the location of subsidiaries along power distance, individualism and collectivism, uncertainty avoidance, and masculinity/femininity significantly impact knowledge transfer in subsidiaries. Additionally, Kedia and Bhagat [31] state the importance of interactions among

technology and cultural variations in both social and organizational contexts. In subsequent work, they identify differences in cultural patterns (as characterized by individualism-collectivism and verticalness-horizontalness) as moderators for the effectiveness of knowledge transfer [9].

KT researchers also discuss the influence of language and physical distance on the performance of transfer. Duan et al. [20] identify language problems as one of the major barriers for effective knowledge transfer between Europe and China. Also, the practice of INTERREG IIB, a collaborative program that aims to facilitate exchange and creation of knowledge among 16 partners in 5 European regions, points to language as one of the main obstacles in knowledge transfer [32]. The distance between partners has been identified as another challenge [15][22][32]. Cummings and Teng [15] attributed the influence of physical distance to the difficulties, in terms of time requirements and expenses, participants would encounter when communicating or attempting to get together face to face.

Knowledge transfer research has also demonstrated the influence of content on the effectiveness of the transfer process. As discussed earlier, one of the major characteristics of the exchange process in TKNs is exchange of different types of content that can vary in several respects such as format, value, codifiability, and embeddedness—and each of these variations impose challenges that may hinder the effectiveness of the exchange process.

Generally, research in KT distinguishes between two types of knowledge, tacit and explicit, and clarifies the relation between these types and the ease and effectiveness of knowledge transfer [44][54]. While tacit knowledge is found to be hard to communicate and deeply rooted in action, involvement and commitment within a specific context [44], product-based knowledge that is explicit and codifiable is more readily transferable between units [75].

Cohen and Bacdayan [11] define embeddedness as the degree to which knowledge is situated in or generated by ongoing practice and learning by doing. Generally, knowledge can be embedded in individuals, products (or tools), organizational routines and best practices, or in multiple elements and sub-networks. All of these forms of embeddedness have been identified as barriers to knowledge transfer success [23][69][3][64]. Additionally, articulability which refers to the degree to which knowledge can be expressed in language, numbers, formal procedures, and explicit techniques, may represent an additional barrier toward knowledge sharing [10].

The value of 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. Such perception may hinder collaboration toward sharing knowledge as participants may think that sharing might diminish the value of the asset [34][75].

4.3 Synthesis of the Literatures

Based on the above discussion, we can draw on both cross-boundary information sharing research and knowledge transfer research to enhance our perspectives on transnational information and knowledge sharing networks. The knowledge transfer literature has the potential to contribute to our understanding of the impact of cultural differences on overall effectiveness, exchange as a process, and recognition that the type and value of

content can influence the outcomes of the overall 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 all affect outcomes. Table 1 summarizes the factors that can aid our understanding of complexity surrounding knowledge and information sharing in TKNs.

Table 1. Factors Influencing Knowledge and Information Sharing

Layer	Factor	CBIS	KT	References
Knowledge and Information Content	Type		✓	[44, 54, 75]
	Lacking for data standards and definitions	✓		[17, 47, 76]
	Value, Sensitivity, and confidentiality	✓	✓	[17, 34, 48, 75]
	Codifiability (Articulability)		✓	[10]
	Embeddedness		✓	[23, 69, 3, 64]
Organizational Context	Goals and interest of participating organizations	✓		[19, 25, 76]
	Trust and past relationships	✓		[14, 37, 38, 48, 57]
	Executive support and organizational commitment	✓		[4, 6, 21, 49, 77]
	Perception of risk, costs and benefits	✓		[17, 48, 77]
	Organizational culture	✓		[47, 50]
	Leadership	✓		[19, 21, 49, 61]
	Authority and hierarchical structures	✓		[4, 21, 33, 55, 71]
	Organizational rules, procedures, and regulation	✓		[33, 71, 73]
Resources	✓		[17, 19, 36, 76]	
External (National) Environment	Culture		✓	[9, 31, 39, 60, 72]
	Laws and policies	✓		[17, 36, 49]
	Political support	✓		[21]
	Language		✓	[20, 32]
	Geographic location		✓	[15, 22, 32]

5. FUTURE WORK AND CONCLUSION

E-government has been conceptualized in different ways that reflect different theoretical backgrounds [80][81]. According to Garson [80] e-government is typically conceptualized in one of four frameworks. The first is concerned with the promise that information technology provides to facilitate decentralization and democratization. The second emphasizes the limitations and contradictions of technology use in the public sector. The third

theoretical framework applies socio-technical approaches to underline the two-way interaction between technology and its organizational and institutional environment. The fourth places e-government within theories of global integration. Studies that draw from or contribute to the fourth theoretical framework are scarce compared to studies that reflect the other three frameworks.

In this paper we view transnational knowledge networks as a form of e-government within the global integration perspective, and provided a foundation for studying knowledge and information exchange, a fundamental aspect of e-government, at the transnational level.

Based on our review of existing trans-governmental networks, we described the international exchange process as having five main characteristics. We then reviewed previous e-government studies that focus on interaction among governments in two or more countries and identified gaps in this literature. From there, the paper explored the contribution of two other well-established research areas, cross-boundary information sharing and knowledge transfer, to better understand the complexity surrounding the exchange process in TKNs to develop a more complete understanding.

In the next stage of our work, we will rely on this more elaborated conceptualization of the exchange process to develop an integrated framework that we will use to study two transnational networks that have evolved to deal with environmental protection issues. The first case examines the Joint Advisory Committee established to improve air quality in the Ciudad Juárez, Chihuahua/El Paso, Texas/Doña Ana County, New Mexico Air Basin. The network has been highly successful in bi-national pollution mitigation activities and provides important lessons for building similar collaborative networks among a diverse set of stakeholders [13]. The second case is the AIRNow-International Shanghai initiative, which involves knowledge sharing and technology transfer between the US EPA and the Shanghai Environmental Protection Bureau for air quality monitoring in the city of Shanghai, China.

By exploring these two cases with a comprehensive and consistent framework, we plan to address the following kinds of questions about transnational knowledge networks:

- How do participants in different countries perceive the dimensions, stakeholders, benefits, and risks of engaging in intergovernmental systems for information and knowledge sharing?
- What are the similarities and differences in these perceptions? What cultural, political, economic, and social factors account for them?
- How do the participants attempt to create shared understanding of technologies, context, terms, processes, and contingencies that generate capabilities for effective action?
- Which strategies, tools, and behaviors are more likely to lead to successful international knowledge networks that benefit individuals, organizations, and communities?
- What preparation, methods, and tools are best suited for research and action on these questions?

The answers to such questions will lay a foundation for further research and enhanced practice in sharing knowledge and information across national boundaries.

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