Building and Sustaining a Transnational and Interdisciplinary Research Group: Lessons Learned from a North American Experience

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Abstract
This paper examines the process of formation and development of a transnational and interdisciplinary research group, structure creation for collaboration, and agenda development for research programs. It uses network analysis results to demonstrate the evolution of the network, and describes the process as four stage development, from initiation, reaching agreement, advancing research to sustaining the research group. It discusses the challenges involved in transnational and interdisciplinary research collaboration, and examines contribution factors to the collaboration at each stage of the process.

1. Introduction
Researchers are developing new collaborative relationships in order to tackle research problems of common interest. They work together in order to integrate different perspectives, develop comparative studies, and share their experiences [1]. Sustaining the involvement and the interest of the researchers in an interdisciplinary group is, however, challenging. Aside from the many difficulties documented by research collaboration (e.g., [2]) and interdisciplinary team (e.g., [3, 4]) literature, the group described in this research add the complexity by including practitioners and international participants in the team. The working group includes 25 academic and practitioner members from three countries: Canada, Mexico, and the United States. Eleven institutions are represented by the group. Two co-chairs led the effort, with one residing in a US university, and the other in a Mexican university. The success of collaboration, thus, depends highly on the process of creating the group, consolidating the research interests and perspectives, and advancing on a research agenda. In the life-cycle of the group, researchers may play different roles such as animating groups or sub-groups, leading efforts to develop papers, developing new relationships, and finally adapting their research skills to work within a multidisciplinary team. In a sense, the group has to handle the difficulties of managing a diverse and interdisciplinary team as they arise. In this process, the working group members are gaining useful insights into the processes of creating an international research community; exploring the role of technology to support collaboration among geographically dispersed researchers, developing strategies for creating research proposals that are relevant to funding organizations in multiple countries, and responding to the multiple research traditions and practitioner priorities in identifying priorities. This paper is developed based on these insights.

This paper discusses the processes involved in transnational research collaboration that focuses on inter-governmental or inter-organizational digital government research topics carried out by the North American Digital Government Working Group (NADGWG). The paper uses social networks’ analysis to demonstrate the progress of collaborative research networks, and it further examines critically the challenges encountered by the group, and reflects on the mechanisms used to deal with the challenges.

The rest of the paper is organized as follows. Section 2 includes a brief project description. Section 3 is a literature review on group working models, including transnational research, interdisciplinary collaboration, and knowledge network. Section 4 briefly explains the research design and methods used for this study. Section 5 presents the results of a social network analysis and evidence of the positive development of the research team as a network. Section 6 describes the processes of creation and development and highlights some success factors and challenges. Finally, section 7 provides final comments.
2. Project description (NADGWG)
The North American Digital Government Working Group (NADGWG) was formed in early 2007 by researchers and practitioners from a variety of institutions and disciplines in Canada, the United States and Mexico to build new understanding of and extend upon digital government research across geographic and political boundaries in the region. In particular, NADGWG is focused on the role that information and communication technologies play in responding to public problems within and across the three nations of North America. The domain of interest is comparative questions about inter-governmental or inter-organizational digital government initiatives in North America as well as questions related to initiatives that are transnational in nature.

This group was formed with the support of the National Science Foundation Digital Government Research Program and the home institutions of the members. The Working Group members meet face-to-face several times during the three years of formally funded period to produce a series of deliverables for academics and practitioners, including a research agenda that attends to comparative questions about intergovernmental and transnational digital government initiatives in North America, as well as academic papers, teaching cases, methodological notes among others.

The need for a Comparative, Transnational, Interdisciplinary team-based research.
The terms "digital government" and "e-government" have emerged over the last 15 years to refer to the use of ICTs in government, and its meaning has been evolving over time [5-7]. The terms were associated with the transformation of bureaucracy in order to provide better citizen services, including later applications related to democracy and improved relationships among citizens, government, the civil society and the private sector [8]. This requires that governments transform the way they are operating from a vision of a silo structure of governments, in which each ministry and public agency (MA) operates independently from other MA, to a transversal structure in which MAs operate all together. In this way, the field of e-government is located at the intersection of government, society and information and communication technologies. It deals with multi-disciplinary issues.

As the governments of the world evolve toward a more global perspective on the social, political, and economic issues facing our nations it is critical that research efforts are sensitive to and respond to this evolution as well. New requirements for cross-boundary collaboration driven by a global view demand new understanding about how individual nations respond to public problems and about how nations work together in response to transnational problems. New forms of government enabled by technologies and made possible through new models of cooperation and collaboration arise and need to be explored and tested.

The North American Digital Government Working Group (NADGWG) is a multidisciplinary team that has been created to maximize the learning from the three North American countries (United States, Canada, and Mexico) in digital government development. Although the three countries of North America are very different in many aspects (providing good variation), they have important similarities in government and federal systems. In addition, the three countries are closely related and interdependent in several political, economic, and social issues. Therefore, the results may also have important policy implications for each of the three countries and North America as a whole.

3. Literature review
We are informed by the following three areas of literature. We first review the transnational research in order to understand the methodological issues and implications when a transnational digital government research team is considered. Secondly, we borrow guidance from literature in the area of interdisciplinary research collaboration for documented challenges, processes, and critical success factors for managing interdisciplinary research team. Lastly, the literature of knowledge network is examined for network structure involved in knowledge exchange. The framework of this paper is formulated based on the integration of these three areas of research.

Transnational Research
The study on transnational phenomena has gained growing importance as the system of ties, interactions, and exchange between individuals or institutions across the border of nation-states become ever more prevalent and function intensively in a globalized world [9]. A wide variety of topics have been covered in this stream of study, such as transnational communities, transnational corporations (TNCs), trade, migration, international non-governmental organizations (INGOs), and inter-governmental agencies [9]. One type of transnational research pays attention to the political engagement taking transnational framework as frame of reference to solve global or regional problems that cannot be addressed effectively simply by national politics. The research focus of the NADGWG was motivated by similar questions—the need to understand new models of collaboration required by the global nature of
government problems as well as the role of technology in facilitating these inter-organizational initiatives. Although an important research area, transnational research suffers from a lack of well-defined theoretical framework and analytical rigor [11], and consequently, a lack of in-depth and comparative empirical studies. Transnational digital government research, for example, focused mostly on the technical side of interoperability and the majority of the publications addresses on pan-European issues [12]. More social science studies are needed to understand the motivations, patterns, and effectiveness of the transnational interactions[9]. This empirical gap can be partly attributed to limitations of methodology employed in transnational studies. In outlining the future directions for research, Guarnizo and Smith [13] stated that “future research centered on the comparative analysis of diverse cases of transnationalism would clearly advance the field. Comparative studies are needed at different scales and may take different forms” (p. 27). Similarly, Marcus [14] recognized that instead of a single-site strategy, it is essential to incorporate multi-sited approach into the design of transnational study. Acknowledging the advantages of such approach, Hannerz [15] further see the need for multi-disciplinary collaboration in a variety of locations.

Thus, based on the observation and recommendation from transnational research, it is important to consider multi-sited and comparative design in transnational research.

In general, comparative studies are interested in indentifying, understanding, explaining, and interpreting similarity and differences across societies [16]. The logic of the comparative method in identifying outcomes and their causes, especially the ones that are qualitatively oriented, require the comparison across a set of similar cases, thus contrasting how a combination of conditions or causes fits together in one setting and how they may fits differently in comparable settings [16]. Selecting the three countries Mexico, United States, and Canada, fits into this prescription. These three countries share important similarities in government structures (three levels of government and a federal system), and subject to similar environmental impacts. Yet, their digital government programs provide important differences to compare.

As the methodological consideration of transnational research implies, a project of this nature requires the adoption of a collaborative approach integrating multiple disciplines, multiple methods, and multiple theoretical lenses and a team from several countries in order to fully understand the complex phenomena.

**Interdisciplinary Research Collaboration**

The advantages of research collaboration have been well recognized in many disciplines [2]. Managed effectively, multidisciplinary research collaboration has the potential to create a holistic and integrated view of complex phenomena [3]. Yet, very few researches embrace a true interdisciplinary approach, aside from the few that employing the loosely affiliated team as a vessel of efficient data collection [3].

A number of challenges existed for conducting interdisciplinary research. First, academic environment provides disincentives for participating in an interdisciplinary research project. Junior faculty faces the pressure of producing a number of quality publications within a short time frame and may avoid being involved in interdisciplinary projects that typically runs a long period of time before data can be presented in published form [17]. In addition, interdisciplinary research has relative fewer established outlets for publication, thus creating career uncertainty for junior faculty. The second challenge is related to the methodological difficulties of comparative interdisciplinary collaboration. Eglene and Dawes [18] reflect that the main challenges in conducting a multinational research project include nonequivalence of key management terms, cultural stereotypes, assumptions of universality, and difficulties in comparative analysis. A third challenge to collaborative research is the difficulties to manage a team of researchers in distributed setting, such as identifying individuals who shares the interests and have the ability to form a collaborative relationship and developing relational, intellectual, and research skills necessary to successfully completing the tasks and sustain the research network [4]. Finally, there is a lack of prescribed mechanisms for managing the processes used to conduct the research in an academic setting, such as composing, maintaining, and renewing team, providing continued motivation, integrating perspectives, handling diverse level of commitment, managing the work flow, etc. [3].

To mend these difficulties, studies on research collaboration often focus on the tasks and processes involved in developing and managing the content and relationships in collaborative research, and prescribes mechanism to handle the tasks in a more effective fashion [3]. In laying out a collaborative research approach for organization design, Cummings, Mohrman, Mohrman, & Ledford [19] address explicitly the relationship aspect of research and the importance of institutional support for collaborative research. They described the tasks for building and maintaining a transorganizational system (TS), an institutional response to the need for collaborative research by forming a group of organizations with
supportive linkages, at three stages—identifying the organizations for the TS, convening potential organizations, and organizing by establishing necessary structures and mechanisms for ongoing operations. Building upon Cummings et al.’s three stage model, Teagarden and colleagues [4] identified that four stages are involved in the development of a consortium for international human resources management research. These are forming consortium, generating research questions and constructing survey, conducting research, and making sense of the finding.

Key factors that contribute to collaboration are another element addressed by research collaboration literature. Physical proximity has a significant impact on the development of collaborative relationship and the execution of collaborative work [20]. It influences the collaboration through its impact on frequency, quality, and cost of communication. In addition to the existence of institutional research base, such as a well functioned research center, Cummings et al, also address the importance of research relationship at the content and relational level, researcher roles, and researcher skills [19]. In addition, Teagarden et al. [4] highlighted the importance of a project champion, team diversity, and face-to-face meetings. They proposed that a project champion is essential to establish a research team and motivate participants; team diversity in composition leads to reliable and valid data collection and research findings that can be generalized; and face-to-face meetings have a positive relationship to the measure of reliability, validity, and generalizability.

Knowledge Network
At a more detailed level, how to efficiently transfer knowledge among a group of individual members [21] would be a key to the success of interdisciplinary research group such as NADGWG. Social network analysis “analyze(s) the patterns of ties linking its members” [22] (p.157) and has an advantage in showing network structures and explaining connections among actors in general and concrete terms [23]. Using social network analysis, Rowley, Behrens, and Krackhardt [24] suggests that network structure which efficiently transfers knowledge is different, depending on the types of information which actors in a network look for. When actors look for new and unique information, sparse network has an advantage because actors can access diverse information in a sparse network in which actors are not connected with one another or actors with similar information. On the other hand, when actors look for specific information which provides deeper knowledge, a dense network has an advantage because dense network provides redundant information and limits the access to diverse information, which allows actors to evaluate information obtained by comparing them, and to gain deeper understanding in a specific area. Having high density network creates additional benefits for online collaboration. It is also found that benefits of information technology were greatest in collaborations when pairs were close together [25]. It expedites the transfer of knowledge and information, and shortens the time needed to transmit message from one member to the other.

In addition, Wasko & Faraj [26] emphasize on the importance of influential actors in collaborative network. Influential actors act as the core of the network will sustain and maintain ties by mediating and corresponding with the rest of the network members. In addition, the central and core actors have signaling benefits, making central actors more attractive to others.

In summary, previous research on transnational research, research collaboration and knowledge networks, has advanced substantially our understanding of the important factors and crucial processes involved, as well as mechanisms used dealing with challenges encountered in employing interdisciplinary research team. However, the need for more and diverse methodological reflection and guidance remains. As O’Connor suggested, their approach can not fit into all multidisciplinary research team, as their focus is on leveraging the team’s diversity in achieving common understanding [3]. Our study provides additional insights about conducting transnational work and developing sustainable international and interdisciplinary research network.

The NADGWG closely reassemble a TS [19] that attempts to build long-lasting research network that supports the development of a research agenda as well as a host of research projects. We use a variation of the TS processes as the adaptation fits into the situation of NADGW better. We categorized the processes involved in building the research group into four stage—initiation, formulation of agreements, advancement on research, and group sustainment. At the same time, we identify the challenges at each stage, and examine mechanisms as well as factors for handling the difficulties.

4. Research design and methods
The data that this study is based on is collected through two means. First is the systematic observation and reflection of the experience made by the team members. The second source is based on self-administered social matrix questionnaires distributed among the member of NADGW in two time points—the first face-to-face meeting in May 2007 and the fourth meeting in Dec. 2009. There are 25 to 29 researchers joining this
working group within these two time periods. The questions of the surveys ask the participants to describe their disciplines and methods, their experience with collaborative tools, their expectation in terms of sharing and creating knowledge, and their previous personal and professional relationships with other members. Social network analysis was used to analyze the social matrix data and the results are presented in section 5 to illustrate the initiation and development of the research collaboration.

5. Network development: evidence from a social network analysis
The analysis is conducted based on the deterministic approach of social network analysis using Ucinet 6.232. It is found that the density of the network increases overtime by 109%, from 0.1884 in pre-collaboration to 0.3953 in mid-collaboration. In addition, the average distance in which a researcher connects to others is decreasing by 22% from 2.027 to 1.585 (table 1). This indicates that the collaborative network became more cohesive and compact, even though five new actors joined this collaborative network. In addition, it is found that centralization of the network increases. The network centralization is a measurement of the degree to which the entire network is focused around a few central actors. Network degree of centralization increases by approximately 7%, from 47.83% to 54.76% in mid collaboration (table 1). Increase in the network centralization provides suggestive evidence on the influence of a few researchers in leading and sustaining the development of this network.

Additional analysis on the centrality of actors is conducted to measure and identify the influence and power of these influential actors. High network centralities indicate higher reputation and influence over the entire network. Two measures of centrality are selected, namely: degree and closeness centrality. Degree centrality measures the overall network activity of individual actors. On average, the degree centrality increases overtime from 4.917 to 11.724 (table 1), yet the minimum value of centrality is 0 in both waves of collaboration. This indicates that a few actors with high centrality are actively seeking and receiving more and more ties for collaboration. However, the number of influential actors is increasing overtime (figure 1).

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Table 1. Network Measurement

<table>
<thead>
<tr>
<th></th>
<th>Pre Collaboration</th>
<th>Mid Collaboration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Network size</td>
<td>24</td>
<td>29</td>
</tr>
<tr>
<td>Density</td>
<td>0.1884</td>
<td>0.3953</td>
</tr>
<tr>
<td>Average distance</td>
<td>2.027</td>
<td>1.585</td>
</tr>
<tr>
<td>Degree – avg.</td>
<td>4.917</td>
<td>11.724</td>
</tr>
<tr>
<td>Min</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Max</td>
<td>15</td>
<td>26</td>
</tr>
<tr>
<td>Centralization</td>
<td>47.83%</td>
<td>54.76%</td>
</tr>
<tr>
<td>Closeness – avg.</td>
<td>45.384</td>
<td>66.174</td>
</tr>
<tr>
<td>Centralization</td>
<td>41.36%</td>
<td>63.96%</td>
</tr>
<tr>
<td>Number of triplets</td>
<td>12,144</td>
<td>21,924</td>
</tr>
</tbody>
</table>

Figure 1: Network Visualization

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1 In this analysis, members are considered to have ties when they either write paper together or write grant proposal together.
2 Density is defined as “the ratio of actual relations or ties among a set of actors in a network and the maximum possible number of ties (Emirbayer and Goodwin 1994, p.1448).
3 Distance is defined as a function of the number of ties separating two actors (Emirbayer and Goodwin 1994, p.1448).
4 There are 5 actors which have degree of centrality more than 8, of actor to all other reachable actors. Thus, closeness centrality can be used as a proxy to measure relative access to network resources and information. The analysis result indicates that closeness centrality which means that they have ties connection with minimum 8 other actors (The result of individual centrality is not included due to page restriction. Please contact the author for detail result of individual actor centrality).
increase by almost 46%, from 45.38 in pre-collaboration to 66.17 in mid collaboration (table 1). This increase in closeness centrality further accentuates the importance and influence of a few influential actors that is found earlier in accessing information and emitting information to the rest of the group.

Closeness centrality is closely related to the clustering coefficient. Clustering coefficient indicates the closeness of immediate neighbor in the network. The result suggests the evidence of high clustering in this network, 56% of actors in pre-collaboration have clustering coefficient more than 0.5 and it increases to 87% in mid-collaboration5. The scatterplots result of closeness centrality and clustering coefficient indicates that most of the distribution is in the upper part of the graph, thus represent the ‘small world’ network structure (figure 2). Small world network structure means that the research collaboration network is characterized with small group with dense ties and small path distance bridges the connection among subgroup6. Small world network structure is preferable in research collaboration since it enables fast diffusion of knowledge and foster knowledge generation.

Moreover, this research network also demonstrates the apparent of low order structure of network. This is the collaboration is characterized by a triplets’ structure; a collaboration that consists of three collaborators (figure 1). The number of any kinds of triplets increases by 80% in mid-collaboration (table 1). Higher order structure, a group with more than 3 researchers, might induce higher collaboration costs such as the cost of coordination and increased risk of distortion.

Conclusively, the general pattern of network structure indicates that this network is typified with short path distance and clustered network. The network becomes denser and more cohesive overtime. A dense and close relation has an advantage in decreasing search time and cost by shortening the access channels of communication. Furthermore, this network is initiated and sustained by a few influential actors that are actively seeking, building, and maintaining ties with other members of the network. These influential actors draw and create close sub-groups that are exemplified from the high closeness centrality and supported with small path distance between each sub-group. This structure mimics the small world network structure which is preferable in research collaboration. Finally, this network also exhibits a low order structure; many of the sub-groups consist of 3 collaborators. Low order structure is many times associated with lower costs of coordination and collaboration.

6. Process description

The network analysis shows clear signs of growing collaborations among working group members. It will be more useful to unpack what occurred during this period, and how the group organized itself to achieve the progress in collaboration using qualitative account based on observation and reflection. In this section, we describe the actions and activities taken place during the each stage, from initiation, reaching agreement, advancing research, to sustaining group efforts respective stage. Then important success factors are identified along with challenges.

Stage one: Initiating

The first meeting of the North American Digital Government Working Group took place on February 26, 2007 though a Conference Call in which 13 members participated. The Conference Call was hold to virtually introduce team members to each others. Four group members formed the initial Management Team, and worked in planning the first meeting and in developing a set of collaboration principles related to group organization and potential growth through email and weekly conference calls. The first face-to-face meeting took place in Philadelphia in May of 2007, and was attended by fifteen participants of the working group from Canada, Mexico, and the United States.

During this early stage, substantial challenges are presented due to the ambiguity nature of the task. Different from a conventional grant that has a well-defined methodology and projected products, this group is formed under the umbrella of creating a sustainable international digital government research community, with additional goals of developing a research agenda. This task, however, has different meaning to different participants, based on their different level of involvement in grant proposal development, their roles as practitioners vs. academia, or their previous experience with similar initiatives.

5 For the Ucinet result contact the authors
6 Watts, D.J. (1999)
Participants generally do not have a strong sense of what to expect and what are expected of them. In addition, some members only met one person of the whole group. An important step, thus, is to make sense of the purpose of the working group and develop certain level of trust among the group.

The agenda of the first face-to-face meeting is especially designed to address collective sense-making through brainstorming sessions. These exercise led to numerous ideas and themes for research from border and immigration issues to economic and trade issues to e-government leadership to create digital cities and smart regions in border areas. Through this exercise, it is also apparent that the group is not satisfied in drafting a research agenda without conducting in-depth research into some of the important areas. However, not everyone is interested in one subject area. The practitioners are especially vocal about what are needed from research to deal with real problems on the ground. Agreement about objectives and deliverables for projects was not an easy task. However, with these exercise, group members started dealing with some ambiguity, and understanding that the project and goals were developing over time through continuous conversations. More importantly, through ranking, two research themes emerged as most important and two initial subgroups were formed to tackle each, with one to explore Border Region Information Sharing, and another to explore Full Information Product Pricing Strategies to promote international commerce and regional development.

In addition to the clarification of the goals, an important strategy deployed to develop initial trust is to anticipate and address challenges in a direct way. The co-chairs led an exercise through which some important challenges are explicated identified and ranked in this first meeting. The foremost challenge was to find new sources of funding since the initial grant that the group received could pay for travel expenses only for members from US institutions. The second challenge was related to finding a good set of strategies to maintain the group connected through virtual meetings and collaboration tools. The third challenge was on the way to create a synergy between group members even if the group has members that have never worked together before.

The first face-to-face meeting laid the foundation of the group collaboration because it created an important opportunity for fast dialogue and rich conversation. But this meeting would not have achieved the desirable results without several conditions. First, some group members knew each other from previous collaborations and that helped to create the group and start fruitful conversations with the broader team. The second essential element is the introduction of two subgroups. Not only the group benefited from less complexity in coordinating a smaller and less diverse group, individuals could also see them more clearly the roles that they can play in this collaboration. In this way, the members of the group have rapidly developed a sense of belonging to the group. Third, the existence of a management team developing agenda and facilitation plan and coordinating activities of the whole group, kept the group alive initially. Two more group members joined the management team. This team kept meeting once every two weeks through a conference call to plan the whole group activities. Each subgroup also started meeting through teleconferences to plan activities inside each of them.

**Stage two: Formulating agreement**

For a second meeting, members came together at the Universidad de las Americas (Mexico) for three days in November 2007 to continue the working group activities. The opening day of the working group meeting involved a set of discussions organized around group formation activities, as well as in the subgroups formed during the first meeting. The design of the second day provided an opportunity to spend a full-day with government officials from a variety of ministries of the Mexican federal government and other organizations involved in the digital government efforts in Mexico.

An important success factor for the working group has been the team composition with knowledge representation about all three countries of North America. The design of the second meeting allowed participants from the three countries to have a better and common appreciation of the situation in one of the countries, Mexico. Having practitioners participated in the meeting provided additional incentives for the working group members as it became a forum to share most updated knowledge and to build connections with practitioners. This meeting also served as a template for the coordination of the other two major meetings.

Members also continued working on their respective sub-groups. Even though the initial themes were identified in the first face-to-face meeting, work at the subgroups was loaded with sense-making and solidifying activity, in which members of each subgroup continuously negotiated the meaning and objectives of each project, as well as relevant views of projects to their organizations and countries. As mentioned before, the division of the group into two sub-groups had the objective to create more synergy between researchers that share common interests. An important mechanism to reach agreement is through the subgroup’s ability in identifying initial products, creating initial momentum in the collaboration. As it
Stage three: Advancing research
The North American Digital Government Working Group held its fourth meeting at Université Laval in Québec City, Quebec, Canada in November of 2008. Fourteen members of the working group met together in the facilities of the Institute of Information Technology and Society, Université Laval. The three day meeting focused on refining the Working Group’s overall Research Agenda, moving forward the research activities of the two sub-groups, and exploring key issues of interest with invited practitioners. Following the design of the previous meeting in Mexico, the second day of the Working Group featured presentations from government officials and practitioners in Canada, followed by a round table discussion with the guests exploring areas of common interest and to identify opportunities for collaboration.

Stage four: Sustaining research group
The fifth face-to-face meeting was hosted in Washington DC in December 2009. NADGWG participants continued their work on the development of a comparative transnational research agenda, as well as participated in a one day workshop hosted by the Digital Government Society of North America and the United States Office of General Services Administration focused on Social Media and Government, Sharing Cutting-Edge Practice and Research. Again, similar to the previous meeting with public officials from Mexico and Canada, this meeting was extremely valuable to the continued development of the common research agenda for North America.
The exchange of ideas and engagement between academics and practitioners prove again to be very valuable and probably a critical element for the working group efforts.

Developing a common research agenda for Canada, Mexico, and the US has been a challenge for the group, not only because of the differences between the three countries in terms of economic and social development, but also, because each country has different interests and priorities in terms of digital government. The development of the agenda has required a great level of coordination through several face-to-face meetings and many teleconferences, most of them only including the management team. Given that members not in the management team only hear these conversations during the face-to-face meetings, taking advantage of everyone’s input in the agenda development remain to be a challenge. On the other hand, there are pending issues inside the group. For instance, promoting collaboration from all members has been a challenge and some members have had only limited activity in the whole group activities due to various reasons. Finding the funding opportunities where subjects in all three country can benefit requires active searching as well as creative framing on the side of the working group, and institutional support on a larger scale.

In order to solidify what has achieved, the working group has been considering forming more institutionalized entity, such as university consortium, to truly create a sustainable international research community.

7. Conclusion
In this study, we examined development of a transnational interdisciplinary research group. Using socialmatrix and qualitative data, we unpacked the process of initiation, reaching agreement, advancing research, and sustaining research group, identified challenges the collaboration need to encounter, and addressed key enabling factors. We made important contribution to the literature of research collaboration by building a case in a rather non-conventional but increasing important context—conducting transnational research and developing sustainable international and interdisciplinary research network.

As the networking analysis demonstrates, the formation and development of NADGWG have been successful. To highlight what we learned, we here summarize some of the key factors that were important across several stages in transnational interdisciplinary research collaboration. First, having a core group that have been collaborated before in several ways, sharing some experiences in facilitating groups was a key element in group formation. Second, leadership is important. The two co-chairs provided vision, guidance and services to the group. The leadership roles are provided not only by the co-chairs. Individuals in subgroup emerged took on essential responsibilities to formulate research framework, identify intellectual products, and plan and push for progress in producing deliverables in a continuous way. The third essential element is trust development. Identity and trust among members have developed from previous collaboration and the face-to-face meetings, and promoted by having these meetings in the three countries. Senior faculty can be especially instrumental in encouraging junior faculty or graduate students to take more eminent roles. Fourth, managing the complexity and diversity of the group by dividing it into two subgroups effectively lowered the cost of coordination and improved the chance of incentive alignment, while keeping the interdisciplinary and transnational composition of the team. Moreover, continuous contacts through skype combined with face-to-face meetings have been instrumental in producing results and reaching agreements. For this specific effort, online collaboration tools such as SharePoint or wikis, have not had an important impact in facilitating collaboration, and email and Skype have become the most useful media to keep the group in connection. Finally, organizing through a management team has provided a management structure facilitating coordination, leadership and energy to sustain the effort.

We should note that there are limitations to this study. Case study is limited in its generalizability to other settings. The uniqueness of this working group and its context require that readers apply caution in extending the findings to all other interdisciplinary research collaboration. Moreover, the generalizability of case studies depends on the growth of the collection of cases developed in various settings. Accordingly, future research on this topic in different settings may reveal further insights and develop new understanding into the processes and success of building and sustaining interdisciplinary research collaborations.

8. References


