Building the Academic Community of E-Government Research on Cross-Boundary Information Integration and Sharing

Djoko Sigit Sayogo, Jaehee Jong, Taewoo Nam, & Mohammed Gharawi
University at Albany, State University of New York
{dsayogo, jjong, tnam, mg438982}@albany.edu

Abstract
This paper presents the result of a network analysis on cumulative studies addressing issues of data integration, information sharing, knowledge network, and technical interoperability, which we consider as key themes of cross-boundary information integration and sharing for e-government. The network analysis explores the academic community of e-government research pertinent to those four topics. We profiled conference papers and journal articles included in the e-government research database that the Digital Government Society of North America released in March, 2011. This study found the lack of connections among scholars in the research community in terms of publication outlets and research themes. The paper also discusses potential reasons of the disconnected pattern in collaborative research.

1. Motivation of research

A rich body of e-government research has addressed a variety of topics on the basis of diverse disciplinary backgrounds for almost two decades. E-government research ranges over various disciplines and theories so that it is indeed a multi-, inter-, and cross-disciplinary area. Now the academic status of e-government research takes a single separate domain with the recently rapid expansion of the research community [19]. Given an increasingly large number of e-government studies, literature review-based meta-analyses of the existing e-government research mostly have suggested challenges and gaps in developing e-government and new agendas of e-government research [2,9,13,15,20,23]. From those studies, we might easily recognize what the mainstreams and major foci of e-government research are, but little has been known about the e-government research community itself.

Since the position of e-government as a research field is of growing importance, Scholl’s [19] study that profiled the e-government research community is not only intriguing but impressive to e-government researchers over the globe. He identified what popular outlets of e-government research (conferences and journals) are, who active scholars in those outlets are, and what types of research have been conducted so far. The pioneering study illustrated the current snapshot of the e-government research community. His analysis on the e-government research community has motivated our genuine research that can present newer, deeper and richer implications about connections among the community members. In this paper, we aim to explore connections among individual members of the e-government research community.

To that end, we conducted a reconnaissance study on a selected topic amongst diverse e-government research fields. We did not try scanning all specific fields of the e-government research, but instead we identified cross-boundary (organizational, inter-organizational, inter-governmental, and trans-governmental) information integration and sharing (CBIIS) collaboration as an important, rising area of e-government research. We seek to untangle the nature of research collaboration in the e-government research community in terms of co-authorship. Considering the delivery of richer implications behind connections among authors, we selected CBIIS as a relevant research field instead of the whole field of e-government research.

CBIIS is fundamental and essential to e-government. Information and communication technologies (ICTs) facilitate government information sharing and integration in a networked environment [8]. The ability to share information across organizational boundaries is a prerequisite for efficient processing of citizen services and for effective decision-making by multiple collaborative environments. Much research to date has highlighted the need to share government information and interoperate between diverse information systems.

Given the growing importance of the CBIIS field in the whole area of e-government research, why do we take a close look at the CBIIS e-government research community itself instead of discussing key arguments in that community? While several studies have suggested the thorough review of CBIIS research [8,10,11,20], little is known about how the between-researcher collaborations shape the CBIIS research community. CBIIS emerges as a research field that
requires research collaboration from various disciplinary backgrounds and perspectives. E-government scholars need to know the pattern of research, how research collaboration is formed, and how the various dimensions of CBIIS are connected among researchers in the domain.

In this study, we illustrated a preliminary mapping of connections among individual members (authors of conference papers and journal articles) of the e-government research community by employing the social network analysis method. One of that method’s merits is to map a network of complex relationships in authorships. The method enables us to answer various research questions: 1) How are individual authors connected?; 2) How are they connected with respect to research outlets?; and 3) How are they connected with respect to research themes?

We restricted our primary focus to CBIIS and its capacities, which comprise data integration, information sharing, knowledge network, and interoperability. We used the e-government research database that the Digital Government Society of North America (DGSNA) released in March, 2011. To search for relevant research related to CBIIS, we accessed conference papers and journal papers included in the database. We categorized the works into four themes: data integration, information sharing, knowledge network, and interoperability. Through this process, we constructed a dataset of the academic community of e-government research on CBIIS. Then we run a network analysis. This paper presents the analysis results made by the research process.

The paper is structured into six sections, including the foregoing section. Section 2 will address why we selected CBIIS amongst a variety of e-government research topics and expound theoretical details of the topic. Section 3 will describe the process of building the dataset and the properties of the method (network analysis) in detail. Section 4 will visually present the results of the analysis with network diagrams. Section 5 will discuss further implications for the e-government research on CBIIS.

2. Conceptualizing cross-boundary information integration and sharing

This section offers the rationale of selecting the area of CBIIS for a network analysis on the e-government research community and the way we conceptualize CBIIS for the purpose of this research. CBIIS has been recognized as one of crucial areas within the domain of e-government. This can be attributed in part to the massive amount of benefits that public organizations can obtain when sharing information or integrating data with others. Dawes [7] classified these benefits into three main categories: technical, organizational, and political. For instance, organizations can benefit from the reduction in data processing costs, sharing technical resources, and development of better standards. Public organizations can also improve their decision-making capabilities, broaden professional networks, and increase the quality of services by prompting CBIIS initiatives. Additionally, CBIIS can contribute to better appreciation for government-wide policy goals, more public accountability, and more comprehensive public information and service delivery [1].

Pardo and Tayi [17] characterized CBIIS as a lynch pin in a substantial range of ICT use in critical public policy domains such as public safety, crisis management, and health care. The importance of CBIIS in those domains has attracted the attention of researchers from various areas and domains. Today, CBIIS, like most other areas in the domain of e-government, is “seen as sitting at the cross-roads between a number of other research domains, particularly computer science, information systems, public administration, and political science” [13].

Given the interdisciplinary nature of CBIIS, this study argues for the necessity of bringing a variety of views together and explores how they relate to one another. One possible way for doing this is by investigating the patterns by which researchers connect between the different views or themes of CBIIS.

In order to identify the ways in which CBIIS has been conceptualized, we relied on the work conducted by Gil-García et al. [10] who attempted to create a common and solid definition for CBIIS. In this work, the authors discussed many working definitions for CBIIS that exist in the literature. They pointed out that while many definitions put emphasis on either technical aspects [6] or social ones [14], few definitions include both. According to Gil-García et al. [10], a wide array of existing studies have presented four ways to understand CBIIS. The four ways reflect the views or themes in which researchers have approached CBIIS phenomena. The four themes are:

- **Interoperable technical infrastructure**: systems that communicate with each other at the hardware or operating system level.
- **Integrated data**: integration of data at the level of data standards.
- **Shared information**: the sharing of tacit and explicit knowledge.
- **Trusted social networks**: networks of social actors who know and trust each other.

The four themes above are main building blocks of CBIIS, and thus recognizing and addressing the
interdependent nature of those components are central
to understanding the complex phenomenon of CBIIS.
In light of the main research themes of CBIIS, the
remaining sections of this study will discuss the
interdependency of CBIIS research on each theme—
i.e., how researchers are connected around these four
themes and who are making these connections.

3. Empirical strategy

3.1. Constructing the dataset

The data for this study was derived from the e-
government literature database of the DGSNA
released in March, 2011. This database consists of the
comprehensive list of publications (conference papers
published on proceedings, and peer-reviewed journal
articles) pertinent to the broad areas of e-government
research. The publications listed in this database dated
back from 1981 to January 2011 comprising 4,284
references in total. This study focuses on written
works addressing the four key themes of CBIIS
(network, sharing, integration, and interoperability).
The four areas in the CBIIS e-government
research were used as the keywords for the purpose of
classifying and reducing the references. We searched
the abstract of each publication in the original
database using the keywords of the combination of the
four key themes of CBIIS. Subsequently, we skimmed
the body of the literature to ascertain compliance with
the specific keywords. Based on this process, we
generated a list of 216 publications (published until
the end of 2010) with distribution presented in Table 1.

Table 1. CBIIS publications

<table>
<thead>
<tr>
<th>Category</th>
<th>Number</th>
<th>Proportion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2000 – 2005</td>
<td>63</td>
<td>29%</td>
</tr>
<tr>
<td>2006 – 2008</td>
<td>85</td>
<td>39%</td>
</tr>
<tr>
<td>2009 – 2010</td>
<td>68</td>
<td>32%</td>
</tr>
<tr>
<td>Research themes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Network</td>
<td>43</td>
<td>17%</td>
</tr>
<tr>
<td>Information Sharing</td>
<td>87</td>
<td>35%</td>
</tr>
<tr>
<td>Data Integration</td>
<td>71</td>
<td>29%</td>
</tr>
<tr>
<td>Interoperability</td>
<td>45</td>
<td>18%</td>
</tr>
</tbody>
</table>

Note. No research before 2000 has been found.

3.2. Preparing the network data

We generated the network data by constructing a
two-mode network data. Two-mode network data is a
matrix when the rows and columns index different
sets of entities [4]. In this study the rows correspond
to the authors of publications found while the columns
 correspond to the publication outlets and research
themes. The two-mode network will assess the
relationship based on the belonging to particular
group. If an individual author $i$ belongs to a group $j$,
then we assign value of 1 to the intersection of $i$ and $j$
($x_{ij}$=1 if the person $i$ belongs to the group $j$). For this
study, we built the network using until the fifth authors.

In addition to the two-mode network data of
publication outlets and research themes, this study also
constructs a one-mode network data based on the
affiliation data. The one-mode network data is
generated by transposing the two-mode network data.
While the two-mode network represents person-by-
event relationship, the one-mode network represents
person-by-person relationship. If a person $i$ is in at
least one group with a person $j$, then we assign value
of 1 ($a_{ij}$ = 1 if the person $i$ is in at least one group with
the person $j$).

3.3. Analysis technique

We employed two different techniques for an
analysis: a descriptive statistic and trend analysis and a
social network analysis. We used the former technique
to take a look at research development over time in the
four key areas of CBIIS e-government research. A
primary objective of this analysis is to portray the
trends of research, assessing the consistency and
popularity of particular research themes from 2000 to
2010. However, this paper presents the result of the
analysis in tables and diagrams with respect to some
particular years when meaningful and clear patterns
appeared.¹

The social network analysis uncovers the patterns
of authorship relationships in the CBIIS themes
through three sets of analysis techniques: namely,
network visualization, centrality, and cohesiveness
measure. We conduct the analysis on both the two-
mode network data and one-mode network data. The
analysis allows us to discuss the following three issues:
1) Social relations among the authors/researchers
within the academic community; 2) How publication
outlets (including conference proceedings and journals)
are intertwined; and 3) How the structure of this
connectivity might affect knowledge development and
dissemination in CBIIS.

4. Analysis result

Table 2 presents the trend of the four research
themes with respect to year. We collapsed the year
2000 through 2003 into a single period due to a tiny
number of publications pertaining to CBIIS. The
proportion of research topics varies with years. Only

¹ Upon request, we will provide larger diagrams of visualization and
the patterns in years not included in the figures by email.
information sharing and interoperability are consistently researched in that period. While the topic of data integration receives much attention during 2000 to 2005 and 2009 to 2010, the period from 2006 to 2008 shows the lack of studies addressing data integration. Network shows quite a reverse trend. Only a small number of publications integrate two or more research themes.

Table 2. Trend of research themes with respect to year

<table>
<thead>
<tr>
<th>Research Themes</th>
<th>~2003</th>
<th>2004</th>
<th>2005</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
</tr>
</thead>
<tbody>
<tr>
<td>Network (N)</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>13</td>
<td>34</td>
<td>36</td>
<td>11</td>
<td>3</td>
</tr>
<tr>
<td>Information Sharing (IS)</td>
<td>29</td>
<td>39</td>
<td>32</td>
<td>31</td>
<td>26</td>
<td>17</td>
<td>25</td>
<td>23</td>
</tr>
<tr>
<td>Data Integration (DI)</td>
<td>38</td>
<td>23</td>
<td>32</td>
<td>0</td>
<td>3</td>
<td>0</td>
<td>29</td>
<td>20</td>
</tr>
<tr>
<td>Interoperability (IO)</td>
<td>29</td>
<td>29</td>
<td>37</td>
<td>31</td>
<td>26</td>
<td>38</td>
<td>25</td>
<td>40</td>
</tr>
<tr>
<td>N + IS</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>6</td>
<td>0</td>
<td>5</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>IS + IO</td>
<td>0</td>
<td>0</td>
<td>19</td>
<td>11</td>
<td>2</td>
<td>0</td>
<td>9</td>
<td></td>
</tr>
<tr>
<td>DI + IO</td>
<td>5</td>
<td>6</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>N + DI</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>0</td>
</tr>
<tr>
<td>IS + DI</td>
<td>0</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>6</td>
</tr>
<tr>
<td>N + IS + IO</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>IS + DI + IO + DI</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>0</td>
</tr>
</tbody>
</table>

Note. Percentage in each year

These different patterns with respect to research themes across the years may reveal the preliminary indication of the pattern of knowledge development and dissemination in the area of CBIIS. Untangling the patterns requires further investigation on the connectivity of different research themes, the relationships of authorship, and the role of publication outlets and academic gatherings as a platform to build collaborative relationships.

4.1. Analysis by outlets

This section describes the network pattern of connections among authors in terms of publication outlets. Figure 1 visualizes the two-mode network of outlets only in 2004, 2008, 2009, and 2010 when the between-author connections show noticeable patterns, though we analyzed the recent ten years from 2000 to 2010. The visualization of the two-mode network omits the diagrams capturing the remaining years when the connections appeared less clearly. We suggest two findings from Figure 1. During the last decade, CBIIS research has been limited to a small number of outlets such as dg.o, HICSS, EG0V, and ICEGOV. In addition, networks of CBIIS research have been disconnected in large (especially in 2008 and 2010). There have been only few connections between different outlets, which a tiny number of researchers created. Table 3 lists the authors who bridged extensively between different clusters.

Figure 1. The two-mode network of publication outlets
The network diagram in 2004 of comprising all conferences and journals suggests a distinctive result. It seems to be a single huge cluster, which differs from the pattern of disconnection among outlets in other years. When conferences and journals in 2004 are separately analyzed, each of them shows disconnection among outlets. That implies the existence of connections between journals and conferences.

Network in 2009 also shows a loosely connected pattern. When we analyzed separately conferences and journals in 2009, we observed connection to some degree within each publication outlet. Hence the property of somewhat a connected network pattern in 2009 does not seem to arise from connection between conferences and journals. Rather the network was created within conferences or journals.

### Table 3. Broker measurement of publication outlets

<table>
<thead>
<tr>
<th>Outlets 2004</th>
<th>Outlets 2009</th>
</tr>
</thead>
<tbody>
<tr>
<td>E. Tambouris</td>
<td>M. Janssen</td>
</tr>
<tr>
<td>A. Busson</td>
<td>A. Krause</td>
</tr>
<tr>
<td>D. Tiscornia</td>
<td>B. Niehaves</td>
</tr>
<tr>
<td>E. Nardelli</td>
<td>J. Becker</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Outlets 2008</th>
<th>Outlets 2010</th>
</tr>
</thead>
<tbody>
<tr>
<td>D. Askounis</td>
<td>M. Kamal</td>
</tr>
<tr>
<td>Y. Charalabidis</td>
<td>308</td>
</tr>
<tr>
<td>T. Pardo</td>
<td></td>
</tr>
</tbody>
</table>

Note. Broker values = the number of pairs not directly connected.

Figure 2 shows visualization of the one-mode affiliation network of relationships between authors corresponding to publication outlets. The network diagrams represent a similar pattern to the two-mode network. Most patterns reveal disconnection except for 2004 and 2009. Those diagrams form several clusters, some of which are connected by only a few authors.

The property of the network of publication outlets also can be revealed by two network indices: density and centrality. The density value indicates the degree of existing connections within a group of publication outlets. Table 4 shows the rise in density from 2008 to 2010, which points out the growing collaborations among authors. The mean of centrality represents the average number of relationships per author. The network in 2008 indicates the highest value of centrality; authors typically maintain 14 relationships.

Centralization values do not seem consistent by year. The centralization in 2008 and 2009 had lower values relatively to that in other years. This difference indicates little reliance on the network’s central author.
Table 4. Network measurement of publication outlets

<table>
<thead>
<tr>
<th>Indicator</th>
<th>2004</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
</tr>
</thead>
<tbody>
<tr>
<td>Density</td>
<td>0.382</td>
<td>0.125</td>
<td>0.312</td>
<td>0.400</td>
</tr>
<tr>
<td>SD density</td>
<td>0.516</td>
<td>0.331</td>
<td>0.479</td>
<td>0.490</td>
</tr>
<tr>
<td>Centrality</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td>17.57</td>
<td>14.09</td>
<td>12.48</td>
<td>13.60</td>
</tr>
<tr>
<td>SD centrality</td>
<td>10.32</td>
<td>7.12</td>
<td>5.77</td>
<td>8.08</td>
</tr>
<tr>
<td>Min-Max</td>
<td>3-38</td>
<td>0-38</td>
<td>5-17</td>
<td>1-22</td>
</tr>
<tr>
<td>Centralization</td>
<td>23.2%</td>
<td>10.8%</td>
<td>5.9%</td>
<td>26.2%</td>
</tr>
</tbody>
</table>

The measure for the degree of centrality also informs the most central actors. Table 5 lists actors who have the highest degree of centrality by year. The list of those individual authors varies from year to year. In addition, Table 6 lists the most central publications in the network. The prominent publications are chiefly limited to several outlets such as HICSS, AMCIS, EGOV, and ICEGOV. These authors and outlets listed are central to their own networks, which represent isolated clusters of some authors within publication outlets they are involving in or familiar with rather than a large network encompassing the entire academic community.

Table 5. The degree of centrality of authors in terms of outlets

<table>
<thead>
<tr>
<th>Authors</th>
<th>2004</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
</tr>
</thead>
<tbody>
<tr>
<td>E. Tambouris</td>
<td>38</td>
<td>37</td>
<td>37</td>
<td>37</td>
</tr>
<tr>
<td>A. Xenakis</td>
<td>31</td>
<td>31</td>
<td>31</td>
<td>31</td>
</tr>
<tr>
<td>A. Keravel</td>
<td>31</td>
<td>31</td>
<td>31</td>
<td>31</td>
</tr>
<tr>
<td>A. Macintosh</td>
<td>31</td>
<td>31</td>
<td>31</td>
<td>31</td>
</tr>
<tr>
<td>Y. Charalabidis</td>
<td>38</td>
<td>38</td>
<td>38</td>
<td>38</td>
</tr>
<tr>
<td>D. Askounis</td>
<td>38</td>
<td>38</td>
<td>38</td>
<td>38</td>
</tr>
<tr>
<td>T. Pardo</td>
<td>29</td>
<td>29</td>
<td>29</td>
<td>29</td>
</tr>
<tr>
<td>F. DeAngelis</td>
<td>23</td>
<td>23</td>
<td>23</td>
<td>23</td>
</tr>
</tbody>
</table>

Table 6. The degree of centrality of outlets

<table>
<thead>
<tr>
<th>Outlets</th>
<th>2004</th>
<th>2008</th>
<th>2009</th>
</tr>
</thead>
<tbody>
<tr>
<td>EGOV</td>
<td>14</td>
<td>15</td>
<td>14</td>
</tr>
<tr>
<td>JoEG</td>
<td>6</td>
<td>5</td>
<td>4</td>
</tr>
<tr>
<td>EJEG</td>
<td>5</td>
<td>5</td>
<td>4</td>
</tr>
<tr>
<td>RIDE</td>
<td>4</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>Outlets</td>
<td>2007</td>
<td>2008</td>
<td>2009</td>
</tr>
<tr>
<td>HICSS</td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>EGOV</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>ICEGOV</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

4.2. Analysis by research themes

The preceding section showed the lack of connections among publication outlets and signified the prominent role of certain authors in bridging the connections between publication outlets in CBIIS research. This section outlines the pattern of relationships based on the similarity in research topics pertaining to the four key research themes.

Figure 3 illustrates the two-mode network of research themes only for the years from 2007 to 2010 when the specific patterns in each year appeared distinguishable. There was a limited connection between different research themes. It is only several authors who bridge one research theme to another through connecting between authors who study on different research themes. Arguably, given a small number of authors who act as a connector between different themes, the structure of the research network is likely to become fragile and segregated.

The network in Figure 3 depicts the increase in its density. Information sharing and interoperability consistently emerge as a key topic across the years. However, the prominent role of information sharing diminishes in 2010. While the network theme gains more attention in 2007 and 2008, data integration becomes more prominent in 2009 and 2010.

Table 7. Network measurement of research themes

<table>
<thead>
<tr>
<th>Indicator</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
</tr>
</thead>
<tbody>
<tr>
<td>Density</td>
<td>0.311</td>
<td>0.321</td>
<td>0.404</td>
<td>0.498</td>
</tr>
<tr>
<td>SD density</td>
<td>0.484</td>
<td>0.476</td>
<td>0.555</td>
<td>0.534</td>
</tr>
<tr>
<td>Centrality</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td>21.49</td>
<td>35.96</td>
<td>32.73</td>
<td>29.4</td>
</tr>
<tr>
<td>SD centrality</td>
<td>12.64</td>
<td>19.50</td>
<td>18.06</td>
<td>13.94</td>
</tr>
<tr>
<td>Min-Max</td>
<td>0-47</td>
<td>0-104</td>
<td>0-98</td>
<td>2-53</td>
</tr>
<tr>
<td>Centralization</td>
<td>18.8%</td>
<td>20.4%</td>
<td>20.4%</td>
<td>20.3%</td>
</tr>
</tbody>
</table>

Figure 4 visualizes the one-mode affiliation network of author-to-author relationships based on authors’ similarity in research topics. The presented pattern is similar to that in the two-mode network. The network of authors becomes denser from 2007 to 2010. Two indicators in Table 7 report the increasing density of the network, which means that authors become more connected to one another within their own research domain. Meanwhile, the centralization by research themes has showed little difference in the value in recent three years.

Several prominent actors listed in Table 8 have contributed to connecting among authors within their own clusters or networks. This is evidence for the disconnection across research themes. As portrayed in Figure 3, there are only few prominent actors who enable other authors to connect each other to support the convergence of research foci in the domain of CBIIS.

Table 8. The degree of centrality for authors in terms of research themes

<table>
<thead>
<tr>
<th>Authors</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
</tr>
</thead>
<tbody>
<tr>
<td>J. Gogan</td>
<td>47</td>
<td>47</td>
<td>47</td>
<td>47</td>
</tr>
<tr>
<td>J. Fedorowicz</td>
<td>47</td>
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<td>47</td>
<td>47</td>
</tr>
<tr>
<td>C. Williams</td>
<td>47</td>
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</tr>
<tr>
<td>S. Goudos</td>
<td>47</td>
<td>47</td>
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<td>47</td>
</tr>
<tr>
<td>S. Dawes</td>
<td>104</td>
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</tr>
<tr>
<td>K. Phusavat</td>
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</tr>
<tr>
<td>E. dos Santos</td>
<td>66</td>
<td>66</td>
<td>66</td>
<td>66</td>
</tr>
<tr>
<td>R. Gil-Garcia</td>
<td>66</td>
<td>66</td>
<td>66</td>
<td>66</td>
</tr>
</tbody>
</table>

2264
Figure 3. The two-mode network of research themes

2007

2008

2009

2010

Note. Blue square represents publication outlets and red circle represents authors.

Figure 4. The one-mode network of relationship based on similarity

2007

2008

2009

2010
5. Discussions and concluding remarks

5.1. Facilitating conditions for building the community of e-government research network

The findings of this study reveal the disconnection of authors among different publication outlets or research foci, although sharing similarities within the grand theme of CBIIS to some degree. The network pattern of publication outlets shows disconnection among conferences. Only few authors have bridged the connection between multiple conferences. Within the focus of CBIIS research, different authors in different years make bridges between conference outlets. These findings are intriguing when we consider that the premise of academic conferences has provided access to the highest caliber scholarship and newest research in the digital government domain. Attendance on academic conferences serves to expand knowledge, network, and references. Academic conferences also offer an opportunity to learn from other scholars, challenges, pitfalls, and lessons in the digital government practices. The opportunity contributes to further advancing digital government and fostering research collaborations.

The inter-conference connection sustained by only few authors seems to undermine the grand purpose of academic conferences. Yet, it is too naïve to conclude the failure in achieving the grand purpose. Instead, we offer several plausible explanations of the disconnected network patterns.

First, joining and presenting in academic conferences are not so cheap in term of time, effort, and money. Azjen [3] pointed out that facilitating conditions, such as time and money, influence the behavioral intention and action of individuals. The entire process of conference activity begins with generating ideas, collecting data and materials, writing a paper, submitting, and revising the paper by reflecting reviewers’ feedback, and attending a conference. Each activity in this whole process requires time, commitment, effort, and money for an individual researcher. In particular, travel expenses might limit the ability of a researcher to attend several conferences within one year.

Second, a conference theme varies with years. Conferences or annual meetings of an academic society have an umbrella theme that changes every year. Many scholars align their research interests with given conference themes. They submit their research paper only to conferences fitting well their own interests. Scholars with a particular research focus based on their own expertise might not be interested in joining multiple conferences not perfectly pertaining to their focus. Lastly, different topics or issues for research may gain attention every year. Table 2 indicated that some research themes received much of attention in particular years and lost attention in other years. Scholars tend to adjust their research efforts in accordance to the popularity of particular research topics. These three plausible explanations of the disconnection in the two-mode network of CBIIS publication open up new venues for future research. Implications from this study need to be examined by analyzing and identifying what influences the popularity of research themes over time.

In addition to the disconnection in terms of publication outlets, this study found the disintegration of research network within the CBIIS field in terms of research themes. Gil-García et al. [10] argued and called for the integrative approach to the four elements of network, information sharing, data integration, and interoperable structure. Arguably, the disintegration in research foci could affect knowledge development in the CBIIS research field.

Two reasons may explain the disintegration. First, a majority of scholars are focusing their research efforts on a particular topic within the domain of CBIIS. The lack of resources (time and money) for collaboration blocks the expansion of the research network. Second, most researchers that share similar research topics tend to collaborate on their paper within a small group. The lack of rich connections among researchers under a grand theme limits knowledge development in the CBIIS area. There are some reasonable accounts for that. Research collaboration across different backgrounds (disciplines, expertise, interests, and so on) imposes psychological costs for individual scholars. To reduce such costs, venturing on collaboration with others requires well thought-out and carefully planned approach. Sayogo, Zhang, and Pardo [18] found that selecting good research partners is pivotal to collaboration in digital government research. Closeness and trust are the major considerations in research partner selection, but the conditions are not easily gained in a short term.

5.2. “Small world” network of e-government research community

This study found suggestive evidence that given the variation in conference themes and the difference in popular topics over years, scholars align their research interest to the specific conference themes or popular topics. These conditions contribute to the agglomeration of research themes and impede the bridging and expansion of research across different
themes. A majority of researchers that share similar topics tend to create a dense sub-group.

In some way, a dense network facilitates the creation of knowledge. Closer pairs could interact more than otherwise [5,12], and thus facilitate collaborative idea development. The benefit of a dense network is that the transfer of knowledge and information becomes faster by decreasing the time needed to transmit messages from one member to another [21]. On the other hand, a dense network limits the diffusion of knowledge across different sub-groups unless some actors act as a boundary spanner and bridge the boundaries. Scientific collaboration generates knowledge and simultaneously diffuses knowledge across expertise and geographical boundaries. Hence a network structure typified with dense sub-groups and a boundary spanner bridging the groups are favorable for knowledge generation and expansion. This network is called as “small-world” network structure [22].

The visualization of network based on research themes in the preceding section suggests quite compelling evidence of a small-world network structure. Small-world types of network assist in fostering knowledge generation through shared researchers’ specialization [16]. A highly-clustered and short path-length network in scientific collaboration increases timeliness to transmit messages from one member to another, while sparse networks weaken communication and coordination [21].

These findings account for the network structure found in Scholl’s [19] research and the clustering of digital government research in North America and Europe. In the exploratory survey in 2009, he found that the structure of digital government research community consists of small core and core-extended members (280 authors) and occasional members (3,281 authors) [19]. Core member created clustered a sub-network that is closely connected to other sub-networks initiated by other core members. The sub-network created by core members consists of other core and occasional members. Empirical findings of this research ascertain that the network structure described in Scholl’s [19] study indeed represents a small-world network structure.

5.3. Research limitations

Up to this point, this study provided a preliminary analysis on the pattern of connections among authors who share similar interests in CBIIS, and discussed possible reasons of disconnections in a research network. We need to address three limitations inherent in this study. First, the snapshot that this study suggested is based only on whether scholars connect to each other by authorship. The qualitative nature of connections between studies within the research community has not been discussed. Second, publications on conference proceedings and journals do not cover all possible research collaboration. We could explore other possible ways to collaboration, such as, book chapters and others. However, academic journals and conferences as major outlets of e-government research capture connections between researchers better than other outlets. Another weakness is our intentional restriction of a research focus to the four themes of CBIIS. The scope of CBIIS research may extend to a larger theme of e-government research beyond the four themes.

5.4. Implications for further research

This preliminary study found disconnection in the two-mode network of CBIIS publication and only few bridge connections in terms of publication in academic conferences and research themes. If academic conferences aim to offer opportunities for scholars to interact and collaborate with each other, then the findings of this study might suggest the failure to achieve the objective. There are two main issues for further research, derived from the findings: 1) What motivates some researchers to bridge the connection while others don’t, and through what mechanism they are able to make the connection; and 2) How open conferences are to actually sustain collaboration.

Taking the time and resource constraints aside, we need to learn from some successful “bridgers” or boundary spanners who have already contributed to building the connection in the community based on publication outlets and research themes in their own ways. We also need to understand why others do not engage in the same behavior. By understanding the motivations and the challenges that they faced, we could then identify the barriers and strategies to make an academic conference a flourishing place to garner collaborations.

Another interesting issue is how open conferences are to actually sustain collaborations. This issue relates to the adequacy of conferences to foster collaboration. We point at two issues that warrant further research: 1) The need to follow up whether attendance is actually benefitting from the conference; and 2) To what extent information gathered on the conference adequately warrants collaboration.

In term of research themes, how the limited connection between the research themes restricts researcher’s ability toward turning their work into practical guides and tools.
6. Acknowledgment

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7. References


