Collaborative Network Analysis of two eGovernment Conferences: Are we Building a Community?

Nuša Erman and Ljupčo Todorovski
University of Ljubljana, Slovenia
nusa.erman@fu.uni-lj.si
ljupco.todorovski@fu.uni-lj.si

Abstract: In the last two decades, eGovernment research maturated into an active scientific field with a number of publication venues, many of them taking form of regular annual conferences. In this paper, we address the central question of whether the active researchers of these different venues converge towards a joint eGovernment research community. To answer this question, we perform a comparative analysis of the collaborative networks of co-authorship relationships between scholars that published papers at the two major conferences in the field: the European Conference on eGovernment, and the International Conference on eGovernment. Surprisingly, the obtained results show that each conference has built its own relatively stable community, and there are only weak ties that do not really indicate an emergence of a joint eGovernment scientific community.

Keywords: co-authorship network, scientific community, social network analysis

1. Introduction

eGovernment research (EGR) focuses on studying the use of information and communication technology in public administration and government activities. In the last two decades, the interest in EGR has dramatically grown, resulting in its evolution into an active scientific field. EGR scholars established a number of formal and informal communication channels to disseminate knowledge and research results. Among them, academic conferences comprise the exchange of information and reinstatement of discussion among the participants through the formal and informal patterns, which represent a useful feedback for the improvement of scholars' work (Lisée et al. 2008).In the relatively young and dynamic area of eGovernment, a number of conferences have emerged. Three of them get most of the attention from the EGR scholars: International Conference on eGovernment (EGOV), European Conference on eGovernment (ECEG), and International Conference on Digital Government Research. Two other more general conferences hold regular sections on eGovernment: Hawaii International Conference on System Sciences and the European Conference on Information Systems.

Due to the evident and intensive short-term growth, many authors have analysed the process of development and the state-of-the-art of the EGR field and its community. To perform their studies, authors have focused on the abovementioned conferences and other EGR publication venues as primary data sources. Authors have considered maturity (Grönlund 2004, Grönlund and Andersson 2006) and the development (Heeks and Bailur 2007) of EGR field, as well as the analysis of the nature of contributions and the evolution of research interests(Bannister and Connolly 2010). These studies vary both in terms of the central focus of the EGR analysis and its aims as well as analytical methodology used.

In his first study, Grönlund (2004) proposes a model for measuring the maturity of eGovernment research and following that model he analyses papers published in the proceedings of three conferences, i.e., EGOV, HICSS, and ECEG. The study categorizes each paper based on the research rigor and relevance into several categories defined by the model. The results of the categorization analysis show that the studied papers lack in theory generation and theory testing, as well as that the content of the papers frequently involve case stories and product descriptions. Thus, Grönlund finds the field immature and repeats the study in 2006 for papers published at the EGOV conference (Grönlund and Andersson 2006). The results, obtained following the same model, show increased research collaboration between various institutions as well as an increase in the publication standards in terms of number of referenced papers and research rigor. However, there is only a slight progress recognized in terms of theory forming and testing. These findings are confirmed also through the results of the analysis undertaken by Heeks and Bailur (2007), in which they study a sample of eighty-four papers published in the Information Polity and Government Information Quarterly journals, as well as the papers published in the ECEG conference proceedings. They recognize a lack of clarity, rigor, and generalization that would lead to a common eGovernment theoretical framework and identify these to be common features of most of eGovernment related papers included in the analysis.

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Finally, Bannister and Connolly's analysis (2010) which follows a similar methodology to Grönlund's and uses it for the study of papers published in the ECEG proceedings, also confirms some of the above conclusions; the majority of conference contributions are descriptive and/or conceptual in nature. However, they also show that the trends regarding the topics addressed and research approaches used in the studied papersindicate a more analytical and investigative research.

The main analytical approach used in the above exemplary studies is content analysis (Busch et. al 2005) of articles used to identify article types, methodologies, and data used or topics and issues addressed. Although content analysis is widely used approach in the study of scientific communication, it is often limited with the number of papers we can include in the study and therefore it is also often limited to a single publication venue or a limited sample of papers from different venues. Scaling up those studies to a large number of papers and venues can be a serious challenge and mostly prohibitive.

In our previous studies (Erman and Todorovski 2009, 2010), we proposed an alternative approach based on social network analysis (Nooy et. al 2005). We focus on qualitative analysis of networks of various types of scientific communication (collaboration and citation) among researchers in the EGR field. One of the limitations of our previous studies is that they focused on the papers published at a single publication venue, the EGOV conference. In this paper, we overcome this limitation by extending our study of the EGOV collaboration networks to the ECEG conference. More specifically, we observe the networks of relations between authors publishing at the two conferences, where the relations represent co-authorships of joint papers. We build these networks using the electronic manuscripts of the papers published in the respective proceedings in the five-year period from 2005 to 2009. The main aim of this paper is then to compare the networks emerging from ECEG and EGOV to the joint network of co-authorships between all the authors from both conferences. By this comparison, we can check the validity of our central hypothesis that through the time, the scholars publishing at these two conferences converge towards a joint community of eGovernment researchers. We also use the collaborative network analysis to identify the most prolific authors in the community and identify emerging sub-communities dealing with specific eGovernment topics.

The rest of the paper is organized as follows. Section 2introduces the notion of scientific community and collaborative co-authorship network as formalism for representing and analysing communities. In continuation, it presents the data used in this study and the resulting collaborative networks for the ECEG, EGOV and the joint community. Section 3 presents the results of the comparative analysis of the networks. Section 4 discusses and compares the results, putting them in the context of related work. Finally, Section 5 draws conclusions and outlines the directions for further research.

2. Scientific community as collaboration

Scientific community, defined as a totality of working and interacting scientists, is usually quantified through the analysis of scientific publications (Mali 1994). The most important aspect of scientific community is the communication between scientists, also known as scholarly communication. On one hand, scholarly communicationhas several manifestations, one of them beingcollaboration between scientists. Following the Bordons and Gómez's definition (2001), scientific collaboration identifies the cooperation of two or more scientists on a joint research project, where they share different resources. On the other hand, scholarly communication mainly involves the dissemination of information and knowledge among scientists through formal and informal communication channels (Borgman 1990).

Collaboration is most frequently reflected through the joint authorship and publication of different types of scientific documents and therefore measured through the analysis of co-authorship collaboration in publications.The most commonly used methods to perform such an analysis are methods of scientometrics and bibliometrics. The use of bibliometric and scientometric analysis has several advantages compared to other methodological approaches in the study of collaboration. It enables the analysis of large amount of data leading to a higher significance of the obtained results. The results can also be verified by repeated analysis and are therefore very reliable. (Bordons and Gómez 2001, Borgman 1990).

We should note however, that there exist limitations related to the study of scientific collaboration through publications and to the bibliometric studies in general. The first is related to the practice of making colleagues or superiors "honorary co-authors" for purely social reasons. The second is that

scientific collaboration does not necessarily lead to co-authored papers. However, a co-authorship network analysis is still widely used as a proxy for the study of collaboration (Bordons and Gómez 2001).

Published scientific articles and papers represent the most frequently used data source for bibliometric and scientometric studies. These studies usually analyse the papers published in scientific journals, whereas conference proceedings are often neglected. But as Glänzel and his colleagues (2006) argue, scientific conferences represent the very important communication channel, since they comprise the exchange of information and encourage the discussion among the participants. In this sense, such scientific meetings capture the informal part of scholarly communication, as well as the formal part represented by conference proceedings.

Following the dispositions presented above, in this paper, we are interested in the analysis of eGovernment conference community by studying the co-authorship collaboration of researchers in the field. More precisely, we concentrate on a community formed through publishing papers in the proceeding of two major eGovernment conferences, ECEG and EGOV in the period from 2005 to 2009. The most obvious way to represent the notion of co-authorship is the use of network, where the nodes represent individual scientists, and links among them represent co-authorship relations. Therefore, we applysocial network analysis approach to study the network of co-authorships in the selected papers, which is proven to be a very useful method of bibliometric and scientometric research. In the continuation of this section, we introduce the data and corresponding co-authorship networks.

2.1 Data description

We build the data set for this study as extension of the data collected in Erman and Todorovski (2010).Hence, the bibliographic data about papers from EGOV conference is upgraded with data about papers published in the ECEG proceedings. For both conferences, we included papers published from 2005 to 2009. The extended data set includes 475 papers; 314 new papers from the ECEG proceedings and 161 papers from the EGOV proceedings. These 475 papers were co-authored by 765 different researchers.

The graphs of Figure 1 depict the dynamics of the number of papers and the number of authors through years for each conference. At a first glance, we can see that EGOV conference proceedings publish lower number of papers than ECEG conference proceedings. The same observation is true also for the number of collaborating authors. The described difference should be ascribed to the fact that the acceptance criteria for publication in EGOV conference proceedingsare very strict since the review process has been improved in 2005. Papers that are not accepted for publication in the main EGOV conference proceedings are considered for publication in the second-tier (communication) proceedings, which are not included in our study.

On the other hand, the number of papers published at EGOV conference is relatively stable and ranges from 30 to 40 papers per year. In contrast, the number of papers published at the ECEG conference fluctuates between 50 and 83 papers per year. The similar pattern is observed when the number of authors is considered; the number of authors at the EGOV conference varies between 70 and 100, whereas at ECEG it varies from 100 to 180 authors per year.

2.2 From data to co-authorship network

The bibliographic data can be transformed to a co-authorship network following a simple procedure. For each paper, we collect the list of paper authors *A*. For each author in *A*, we add a corresponding node to the network, if one has not been there yet. If the list consists of a single author we proceed with the next paper, since it does not introduces any co-authorship links in the network. Otherwise, for each pair of authors from *A*, we add an undirected link (edge) connecting the corresponding network nodes. If the link has been present already, we increase its weight by one; if the link is new, we set its weight to 1. Thus, the weight assigned to an edge connecting two nodes in the network denotes the number of papers that the corresponding two researchers co-authored.

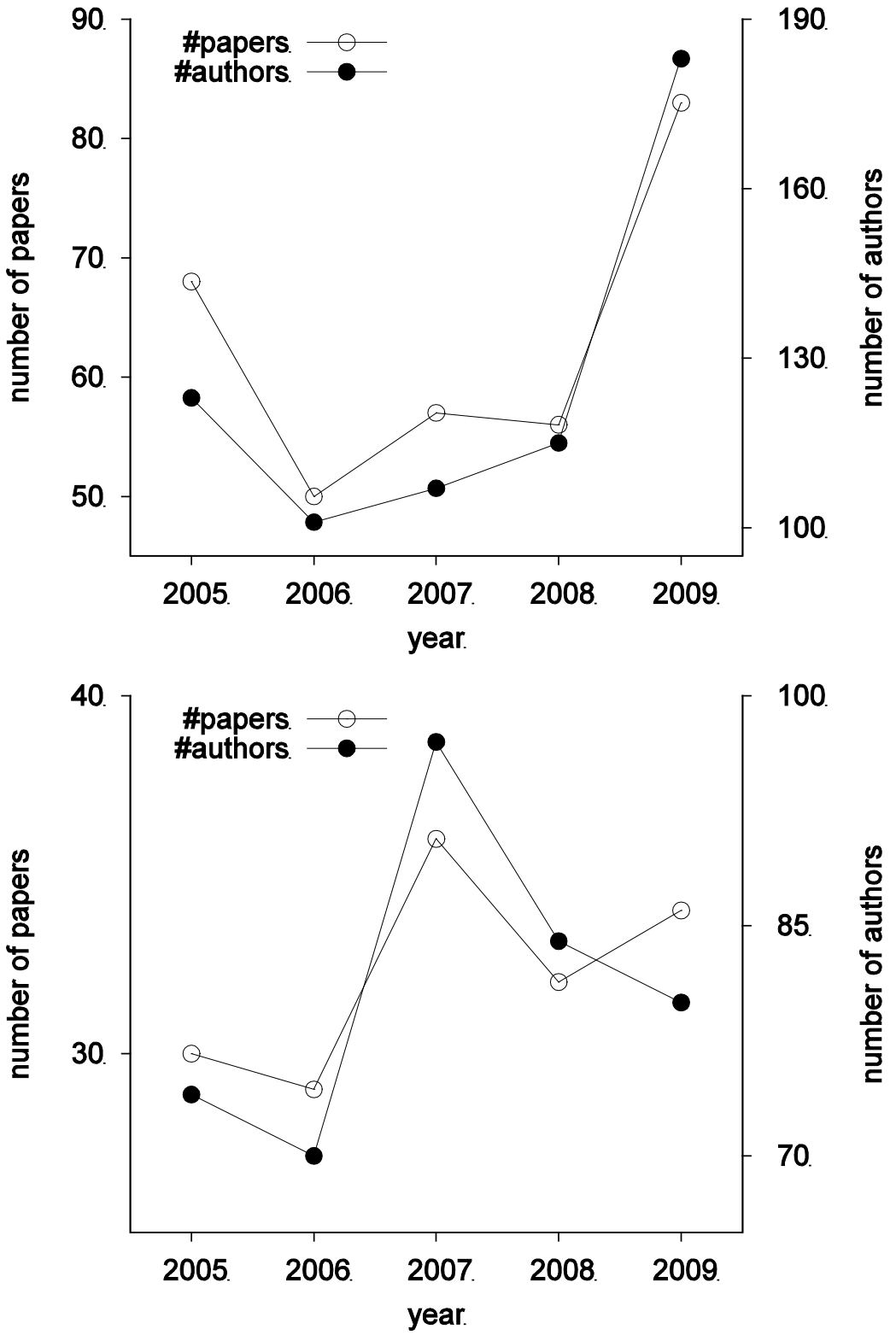

Figure 1: Number of papers published in the proceedings of the ECEG (left-hand side) and EGOV (right-hand side) conferences and number of authors thereof in the period from 2005 to 2009.

Following the outlined procedure, we generated five weighted undirected co-authorship networks for the yearly proceedings of ECEG and EGOV as well as a joint network of both proceedings for each year from 2005 to 2009. Using the single-year networks, we also constructed five "cumulative" co-authorship networks; the first network contains data from 2005 and each successive network is built by joining the next year network to the current one.

Table 1 summarizes the basic properties of the five cumulative networks for the three analyzed communities, i.e., EGOV, ECEG and the joint community. The number of nodes corresponds to the number of authors, while the number of edges corresponds to the number of co-authorships between pairs of researchers. The percentage of edges with weight larger than one represents the portion of research pairs that co-authored more than one paper, and the density represents the portion of all possible edges that are present in the observed network.

As expected, all three communities induce steadily growing networks both in terms of the number of nodes and edges. This increase in size is being strictly followed by density decrease. The ECEG community network is very sparse and has three times lower density than EGOV network in 2005. Densities of both networks, as new authors enter both communities, decline, and the more rapid decline is observed in the EGOV network. The low density of ECEG community network is reflected in the sparseness of the joint community network, where in 2009only 0.33% of all possible edges are present. The very low density of the joint network might also indicate the lack of communication between the ECEG and EGOV community.

Table 1: Basic properties of the "cumulative" co-authorship networks for the ECEG, EGOV, and joint ECEG+EGOV community

Community	Network Property	2005	2005-2006	2005-2007	2005-2008	2005-2009
ECEG	#nodes	123	192	266	353	491
	#edges	92	164	234	326	500
	%edges(w>1)	2.2	9.8	12.0	12.3	11.4
	Density	0.0123	0.0089	0.0065	0.0052	0.0041
EGOV	#nodes	74	136	208	262	307
	#edges	91	170	295	395	467
	%edges(w>1)	0.0	1.2	7.5	7.8	9.4
	Density	0.0337	0.0185	0.0137	0.0116	0.0100
ECEG+EGOV	#nodes	194	318	456	588	765
	#edges	183	328	516	706	950
	%edges(w>1)	1.1	7.0	11.1	10.9	11.2
	Density	0.0098	0.0065	0.0050	0.0041	0.0033

On the other hand, the portion of edges with weight larger than one is higher in case of ECEG community networks stabilizing at the level of 12% in the last three years, indicating the establishment of long-term collaboration between community members. The higher collaboration level in ECEG community influences the increase of collaboration activity in the joint community. The higher percentage of long-term collaboration edges might be also due to the fact that ECEG conference proceedings include more papers per year.

To further explore these initial conjectures based on the basic network properties, we will continue with deeper analysis of the structural properties and dynamics of the observed networks.

3. Structure and dynamics of the EGR community

To perform the analysis of the built cumulative co-authorship networks, we use Pajek software tool (Nooy et. al 2005). The results are presented in three subsections: in the first one, we quantify and analyze the dynamic change of the EGOV, ECEG and joint networks from 2005 to 2009; second section identifies the most active and most collaborative authors in the joint community; and in the third subsection we analyze the joint community structure in terms of subgroups of co-authoring researchers, their geographical distribution, and the thematic topics of their research. In each section, we also compare the results with the extract from our previous research (Erman and Todorovski 2010) emphasizing the aspects of interaction between the two observed conferences.

3.1 Comparative community dynamics

Table 2 summarizes the results of the analysis of the dynamics of the three observed communities. We first observe the percentage of "stable" community members, that is, "returning" scholars that published their papers in more than one proceeding. At the beginning of the observation period, in 2005, all authors are considered to be new to the community. The portion of returning authors in both communities is very high: more than half of the authors publish their papers repeatedly at the same

conference. The percentage steadily increased to more than 75% in all three communities. A notable exception is the drop to 72% in 2005-2009 ECEG community, which is due to the fact that a large number of 180 authors contributed 83 papers to the 2009 ECEG proceedings. This is in contrast with the tightly constrained EGOV publishing policy, where small number of accepted papers stabilized the community with up to 85% of returning authors. The latter situation can be considered as a sign of a stabilizing community.

The joint community shows similar stabilizing trend with 77% returning authors. However, note that the joint community is merely a "joined" community network. A surprisingly low percentage of authors (1.6) published papers at both ECEG and EGOV in 2005. The percentage steadily increases through the years, and hardly hit 4% in 2007, but still remains below 5%. This indicates that we still have to wait for the co-existence of different eGovernment scientific venues to evolve into a synergy of real joint eGovernment scientific community.

Table 2: Dynamics of the ECEG, EGOV and the joint community from 2005 to 2009 in terms of number of authors, percentage of returning authors, percentage of authors publishing at both conferences, number of papers, and percentage of papers with more than one author

Community		2005	2005-2006	2005-2007	2005-2008	2005-2009
ECEG	#authors	123	192	266	353	491
	%returning	0.0	64.1	72.2	75.4	71.9
	#papers	68	118	175	231	314
	%co-authored	54.4	57.6	60.6	64.1	66.2
EGOV	#authors	74	136	208	262	307
	%returning	0.0	54.4	65.4	79.4	85.3
	#papers	30	59	95	127	161
	%co-authored	66.7	69	75.8	78.0	80.7
ECEG+EGOV	#authors	194	318	456	588	765
	%returning	0.0	61.0	69.7	77.5	76.9
	%joint	1.6	3.1	4.0	4.6	4.3
	#papers	98	177	270	358	475
	%co-authored	58.2	61.6	65.9	69.0	71.2

The extent of collaboration between community members can also be measured through the percentage of co-authored papers. All three communities show stable increase in the percentage of co-authored papers, reaching the maximal value of 81% (EGOV), 66% (ECEG), and 71% (joint). In sum, there is a clear trend of growing collaboration among community members in both ECEG and EGOV. In both communities (and especially EGOV), this trend is accompanied by the process of community convergence and stabilization with researchers that regularly publish in the proceedings. On the other hand, results indicate that the ECEG and EGOV induced two separate communities, where only a very modest number of authors publish papers at both conferences.

3.2 Productivity and collaboration among community members

We measure the productivity of a community member by the number of his/her published papers and the number of her/his appearances in the yearly proceedings. Table 3 presents the list of the ten most productive authors in the joint community in the period from 2005 to 2009. Five or 50% of them have published their papers at only one conference, and five of them at both conferences.

The list is, however, biased towards ECEG authors, since the number of papers published at ECEG is much higher. Thus, at the top of the list, Janssen M. has published nine papers, seven of them in the ECEG conference proceedings. Further down the list, we include authors that published at least six papers at any of the conferences. The list of most prolific authors in Table 3 includes a high percentage (33%) of authors that are active in both communities relative to the percentage of joint authors in the joint community (5%). This might be an early indicator of a trend of convergence towards joint community in the future.

Table 3: The ten most productive authors in the ECEG and EGOV conference community in the period between 2005 and 2009 measured in terms of number of published papers and number of years in which authors published their papers,the names of the authors that published at both conferences are emphasized (bold)

Author	#papers	#ECEG-papers	#years
Janssen M.	9	7	5
Fairchild A.	7	7	5
Askounis D.	7	3	4
deVuyst B., Neumann L.	6	6	4
Polzonetti A., Corradini F.	6	4	4
Grönlund Å.	6	0	4
Lubbe S.	6	6	3
Becker J.	6	0	3

Activity of individual members is not as important to the process of community building as the degree of collaboration of an author with others. We can observe the collaboration through the degree of connectedness among nodes within a co-authorship network. In social network analysis, the degree of connectedness is expressed through measures of centrality of individual network nodes, i.e. degree, closeness, and betweenness centralities, which differ in the way the position of individual authors within the co-authorship network is referred (Nooy et al 2005). In co-authorship network, degree centrality equals the number of collaborators an author has, closeness centrality indicates the accessibility of the observed author to the others, and betweenness centrality indicates the number of shortest paths that pass through the observed node. Table 4 lists the most central authors with respect to each of these three measures.

Table 4: The most central authors in joint conference community in the period between 2005 and 2009 according to the degree, closeness, and betweenness centrality, emphasized (italic) names correspond to the most central authors according to three (two) centrality measures

	Degree centrality		Closeness centrality		Betweenness centrality	
	Author	%	Author	%	Authors	%
1	Askounis D.	1.57	Askounis D.	1.72	*van Dijk J.*	0.02
2	Corradini F.	1.44	Corradini F.	1.57	Henriksen H.Z.	0.02
3	Polzonetti A.	1.44	Polzonetti A.	1.57	van der Geest T.	0.02
4	Janssen M.	1.31	*Charalabidis Y.*	1.53	Tan Y.H.	0.02
5	*Charalabidis Y.*	1.31	Janssen M.	1.44	Askounis D.	0.01
6	*Hahamis P.*	1.18	*Sourouni A.M.*	1.44	Corradini F.	0.01
7	van der Geest T.	1.18	van der Geest T.	1.43	Polzonetti A.	0.01
8	*Sourouni A.M.*	1.18	*Lampathaki F.*	1.37	Janssen M.	0.01
9	*Lampathaki F.*	1.05	*van Dijk J.*	1.36	*Vintar M.*	0.01
10	*Vintar M.*	1.05	*Hahamis P.*	1.32	Wimmer M.A.	0.01

The lists presented in Table 4 contain 14 authors, most of them not being among the most prolific ones in Table 3. Five of them are among top 10 according to all three centrality measures: Askounis D., Corradini F., Polzonetti A., Janssen M. and van der Geest T. Further six authors are central according to two of the observed centrality measures. Most of these eleven authors come from the ECEG community, which is due the fact that ECEG authors and collaborations prevail the joint network in both number of nodes and edges (see Table 1). EGOV authors correspond mostly to the network nodes with high betweenness centrality.

3.3 Community structure

In this final part of the analysis, we shift our focus from the quantitative network properties to the network structure. We search for clusters of highly inter-connected nodes that might correspond to emerging eGovernment sub-communities. To this end, we apply methods for identifying components and cores in social networks. The search for components in co-authorship network enables to identify possible sub-groups of authors which collaborate frequently and, presumably, share common research topic(s). On the other hand, the search for cores makes possible to identify such sub-groups

of authors in which the authors are mutually linked. Hence, such core-sub-groups actually represent sets of paper(s) in which all core members collaborated (Nooy et al. 2005).

Our co-authorship joint network for the 2005-2009 period has 263 components. Out of these, 80 components contain only one author; 80 authors are isolated since they never in the observed period co-authored a paper with others. On the other hand, we identified the largest component consisting of 16 tightly interconnected authors. Note however, that here we can perceive the impact of papers with significantly higher number of authors compared to other papers: namely, in such a situation a single paper co-authored by many authors would induce a (non-)representative component. To overcome this problem, we augment each component with the list of corresponding papers and consider only those components that are induced by at least four joint publications. In addition, we also filter out all the components with less than five researchers.

Table 5 presents the results of the component analysis by enlisting all eleven components that satisfy the four-joint-papers criterion explained above. Each community subgroup is described with the leading researcher that is a co-author of majority of the papers in the component, the geographical distribution of authors' affiliations, and the list of thematic topics of the papers in the component.

Table 5: The analysis of eleven largest components of the joint co-authorship network,we only considered components that correspond to at least four papers

#authors/ #papers		Representative	Geographical distribution	Thematic topics	Conferences
16	9	Van Dijk J.	Netherlands	citizen-centric e-services; user profiling; delivery channels; e-services adoption and usage	EGOV (9)
15	9	Andersen K.N. Tan Y.H.	Denmark, Norway, Netherlands	project evaluation; benefits of IT usage; e-customs; super-national e-services	EGOV (9)
14	8	Charalabidis Y.	Greece	interoperability; meta-data and (semantic) annotation of e-services	EGOV (5) ECEG(3)
12	10	Janssen M.	Netherlands	service-delivery, eGovernment stage models	EGOV (3) ECEG (7)
12	8	Vintar M.	Slovenia, Greece	indicators of eGovernment development; e-services adoption and usage; life events and integration of e-services	EGOV (7) ECEG (1)
12	7	Corradini F. Sabucedo L.A.	Italy, Spain	semantic-driven integration of e-services	EGOV (3) ECEG(4)
11	8	Grönlund Å.	Sweden, Norway	eGovernment research analysis; misc	EGOV (7) ECEG (1)
11	6	Ayo C.	Nigeria	e-voting, eGovernment progress, eGovernment and public administration reforms	ECEG (6)
9	7	Becker J.	Germany	Misc	EGOV (7)
8	6	Ferro E.	Italy, USA	digital divide and IT literacy	EGOV (6)
5	4	Mentzas G.	Greece	evaluating quality of e-services	EGOV (4)

The results show that most of the components representatives (all but the representatives of the eighth and last components) were already identified as most productive or most central ones. Furthermore, most of the identified sub-groups have narrow geographical distribution: ten out of eleven components are entirely from Europe, six are even tighter, including single region or country, or, in some cases, a single institution. International or trans-Atlantic collaboration is relatively rare. Finally, there is a great variety of thematic topics addressed by the researchers in different groups. Note also, that the identified sub-communities are orthogonal in the topics they deal with; each of them develops its own (relatively narrow) expertise area that is different from the others. Most of these groups are mainly affiliated with EGOV conference. This is in line with our previous results that show the greater cohesiveness of the EGOV community. In this part of the analysis, this fact is reflected in a greater ability to stir groups of researchers with a common research interests.

When identifying the cores of the network, we applied the same four-joint-papers criterion. Figure 2 depicts the six cores of the joint co-authorship network that follow this criterion. They confirm the findings of the component analysis: each of the six cores corresponds to one of the identified components from Table 5. Another fact can be derived from the result depicted in Figure 2: only these 15 authors (out of 765; 2%) have been involved in more than three joint collaboration ventures. This is

another piece of evidence that the long-term collaboration within the joint conference community is relatively rare.

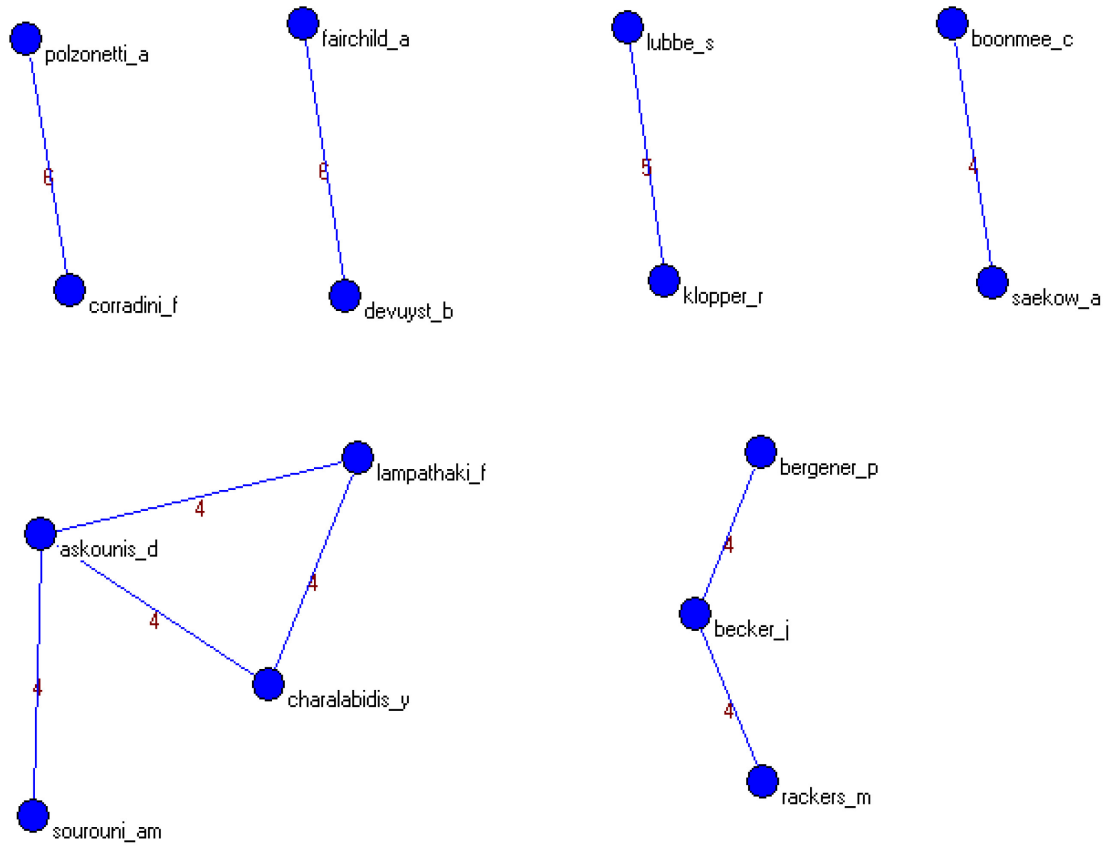

Figure 2: Six cores of the joint (ECEG+EGOV) community co-authorship network

In sum, the structural analysis shows that a number of sub-communities have emerged, each of them dealing with topics that are orthogonal to the thematic topics of the other. Virtually almost all the sub-communities have a representative researcher that is ranked among top active or collaborative community members. Most of the sub-communities have narrow geographical distribution including a single region, country or even institution. The community members are mostly affiliated at institutions in European countries, and large-scale international collaborations are very rare. The findings virtually resemble the ones for the EGOV conference.

4. Discussion

The results of our study provide several insights into the activity and collaborative cooperation of authors in eGovernment field. First, when comparing the number of authors publishing in the EGOV and the ECEG conference proceedings, we find that in both communities the portion of returning authors is very high; more than a half of authors publish their papers repeatedly at the same conference, and the portion increases from year to year (exception is a notable drop in 2005-2009 ECEG community). However, the EGOV community tends to be slightly more stabilized as compared to the ECEG community, since more than 85% of authors repeatedly publish their papers in conference proceedings. Second, three out of ten most productive authors are active in both communities and a portion of authors publishing their work in both proceedings increased from 1.6% to a good 4% in 2005 to 2009 period. Although the numbers are very low, this can be an early indicator of a trend towards the establishment of a joint community in the future. Third, note that the findings of community structure analysis indicate greater cohesiveness of the EGOV community, which is reflected in a greater ability to stir groups of researchers with a common research interest (despite the bias towards ECEG papers and authors, since the number of papers published in ECEG proceedings is much higher).

There are number of studies that analyze the state-of-the-art and the dynamics of the development of the eGovernment research (EGR) field mentioned in the introduction. There are four studies by Grönlund (2004), Grönlund and Andersson (2006), Heeks and Bailur (2007), and Bannister and

Connolly (2010) that our paper strongly relates to. All the above mentioned studies use content analysis as a main methodological framework. Grönlund (2004, 2006) proposes a model for measuring the maturity of the field focusing on the phases through which the research fields typically pass in the process of becoming mature. He observes an increase in the authors' efforts to comply with the research publication standards, increase in the number of references, which indicates better involvement with previous research, and increase in the collaboration of authors from various institutions. Heeks and Bailur (2007) study a sample of eighty-four journal and conference papers dealing with eGovernment *per se*. They characterize papers according to methodological issues related to and conclude that the change over time seems limited. Therefore, they also propose some recommendations for further research in eGovernment field. Last but not least, Bannister and Connolly (2010) use a methodological framework similar to Grönlund's, where they investigate the nature of contributions and the evolution of research interests in papers published in one conference publication venue. They show a large diversity in topics addressed in the studied papers, while the research approach evolves from conceptual to investigative in nature. Authors also note the absence of novel theoretical contributions and propose that the authors in the future direct their work in this direction.

There are several important properties in which our study differs from the related ones. First, the mentioned studies mainly use content analysis, whereas our paper relies on a standard scientometric method widely used to analyze other research fields. The advantage of the latter is particularly that it is not limited with the number of papers or publications we want to analyze. The use of such common analytical framework also enables to further develop the study scope and simply compare the results of these studies. In this sense, the present paper continues our previous studies (Erman and Todorovski 2009, 2010), where we have dealt with the analysis of citation and co-authorship networks induced from the papers published in the EGOV conference proceedings. Here, we extend the scope of those studies to the ECEG conference. Second, we collect the empirical data *systematically* from all the papers published in the proceedings of the ECEG and EGOV conference in the five years period between 2005 and 2009. Most other studies perform analysis of a sample of data about articles and papers from various publication venues. Although this decision makes the definition and the scope of the scientific community clear, which can be often subjected to various, not very strict definitions in other studies of the eGovernment research community (Scholl 2009). Finally, as opposed to the focus on methodological approaches in the other studies, we identify here the most productive and collaborative authors as well as the geographical distribution of authors and thematic topics addressed by the core clusters of co-authors.

5. Conclusion

Scientific community is a conglomerate of scientists who spread and diffuse their knowledge mainly through the publication of their theories and studies. The core of every analysis of such communities is the study of communication patterns among scientists on the basis of citation, co-citation, or co-authorship network analysis. In the present paper, we focused on the study of two eGovernment conference publications, i.e. ECEG and EGOV conference proceedings, where we addressed a very important question: Do the active researchers of these two different publication venues converge towards a joint eGovernment research community? The answer to this research question is clearly: *No*. The two publication venues considered in this study do not converge towards a joint eGovernment scientific community. Only few authors (less than 5%) publish papers at both conferences. However, both communities do show maturity, in terms of large number of members publishing regularly, increasing collaboration between community members, and emergence of clearly profiled sub-communities. In this sense, EGOV community seems to be ahead of ECEG; the profiling and stability of the community being more evident. The high share of authors publishing at both conferences among the most prolific authors in the communities might be an early indicator of the emergence of the eGovernment community.

The (non-) existence of eGovernment research community has to be further tested with extending the scope of this study. We cannot disregard the fact that the data used to perform the analysis is far from being exhaustive. We have to include eGovernment papers from other publication venues, both conference proceedings (such as International Conference on Digital Government Research, Hawaii International Conference on System Sciences, European Conference on Information Systems) and journals (such as Government Information Quarterly, Information Polity, European Journal on eGovernment) in our data set. There also exist other possible data sources to be included in our future work. We can use different reference libraries as well as online journal databases, or data

gathered by means of Google Scholar tool. The analysis of listed data expansions will enable us to significantly widen the current scope of our study.

Note also that in the present paper we focused on the co-authorship network, whereas a study of the citation network of ECEG papers can be another line of further work. Other types of networks that capture informal communication among researchers in the field can be considered as well, e.g., a network of joint conference participation, which can be derived from the lists of participants of every year conferences. Finally, one can also look into other types of networks analysis of the citation networks that has publication venues where the referenced papers come from in the nodes. Such analysis would reveal the most influential "neighbouring" scientific fields and publication venues with highest impact on the development and shape of the eGovernment research field. Ultimately, there is a challengeable issue of integrating the results of analysing different networks of relations among scientists and/or publication venues into a unified map of the EGR field.

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