Evaluating the Hidden e-Government through Document-Flow Networks

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Abstract

e-Government is often considered to be an approach to achieve more citizen-centric and effective public administration. To assess the extension to which this declarative goal has been achieved, researchers have established a number of indicators and benchmarks for evaluating e-government efforts. However, most of these indicators focus on the implementation of G2C (government-to-citizen) and G2B (government-to-business) front-office services. They neglect the importance of the back-office and its G2G (government-to-government) services as the real and most important engine of e-government. In this paper, we focus on evaluating G2G aspect of e-government and propose a novel evaluation approach based of networks of document flows between public administration bodies, public administration services, citizens, and businesses. We explore how G2G development efforts influence the evolution of the document-flow networks and show that the network topology and properties are closely related to the G2G maturity level. The paper illustrates the utility of the proposed approach on two case studies of providing integrated public services in the domain of urbanism in Macedonia.

1. Introduction

Aspiration of every government, from the past to present, is to be more effective. Currently, many governments relate increased effectiveness to the objective of customer orientation, which identifies effective and efficient supply of quality services as a crucial element of public administration. Achieving that objective requires different kind of measures and actions in the public administration area. One of them, that opens new pages in those efforts, includes the implementation and use of information and communication technologies (ICT), and is referred to as e-government.

In order to assess the success of the process of e-government implementation, researchers have established a number of indicators as well as various benchmarks that integrate different sets of indicators. However, since the focus of early e-government efforts was mainly on rapid achievement of visible results, the evaluation also concentrated on the supply (most visible) side of e-government. Most of the indicators and benchmarks had a narrow focus on measuring e-government output, i.e., front-office implementations of G2C and G2B services. This narrow focus of evaluation has led to a significant slowdown of development in many countries. For this reason, many researchers point out the importance of back-office processes improvement (hidden G2G e-government aspects) for the further development of e-government. Therefore, there is a need to establish new indicators that, instead of focusing on the G2C and G2B results, will capture the development of behind-the-scene G2G information systems supporting the management and administrative functions of public institutions. These involve support for data and information management, electronic records maintenance, and cross-departmental flow of information.

Assessing the development of G2G aspect of e-government is the main challenge to be addressed in the paper. A possible approach, to be presented here, is to analyze the role of networks in the organizational structure of public administration. One aspect of these networks, closely related to e-government, is the document flow between citizen, businesses, and different public administration bodies. Being able to quantify (measure and observe) these document-flow networks would be an important step towards quantifying the effects of e-government and other public administration reforms on e-government and its G2G aspect in particular. Namely, establishing these networks would allow us to use standard methods for social network analysis and apply them for assessing the development of e-government, which will be a very relevant contribution to the field and the process of formal e-government evaluation. More specifically, we will explore the possibilities to use the properties of the document-flow networks in public administration, as measured using social network analysis, as indicators of G2G aspects of e-government development.

The rest of this paper is organized as follows. Section 2 provides brief introduction to the topics of e-government evaluation and inter-organizational networks. Section 3 introduces the document-flow networks and illustrates the process of their establishment on an example concerning four services in the domain of urban planning in Macedonia. It also explores the relation between network properties and back-office development. Finally, Section 4 summarizes the paper and outlines directions for further research.

2. Related Work

In this section, we are going to introduce two areas of work, related to the research presented in this paper. First, we are going to survey the methods, benchmarks and indicators for evaluating e-government efforts and emphasize the main problem of lack of indicators for evaluating back-office aspects of e-government. Second, we are going to define inter-organizational networks and their relation to the domain of public administration and e-government.

2.1. Evaluating e-Government

The roots of e-government evaluation in Europe lie in the eEurope 2005 Action Plan which proposes a target for Europe to become '*the most competitive and dynamic knowledge-based economy in the world in 2010*' (Instituto Nacional De Estatistica. 2004). e-Government evaluation studies focus on various aspects and can be divided into few groups, such as e-readiness, back-office, front-office (supply & demand), e-government effects and impacts (Kunstelj and Vintar, 2004); or supply-oriented, demand-oriented, information society and e-government indicator studies (Janssen et al., 2004).

The early period of e-government evaluation was characterized by focusing on evaluation of e-readiness and front-office, mainly the supply-side of assessment of e-government, and measuring the outputs (Accenture, 2007). The analyses have been web-based and have taken into account public services that are supplied via the Internet with identifying a number of indicators for citizens (G2C) and businesses (G2B). The researches related to the back-office were very rare. Kunstelj and Vintar (2004) identify only six studies in this domain: two with main focus on back-office and four with supplementary focus on back-office. This points that G2G part of e-government was not so much in the focus, even more, some of the researches have explicitly excluded the G2G part because 'it required a separate empirical approach and no adequate indicators could be found in other sources' (SIBIS, 2003) what talks about absence of measuring

the back office transformation progress or service integration. So, it is obvious that "*the work on back-office measurement so far was limited*" (UN, 2009).

A few years later, new indicators were used for e-government benchmarking (UN, 2008; OECD, 2002; Accenture, 2007) which measured the G2G aspect: concentrating on transforming government, back-office changing, connectivity and infrastructure, connectivity and network preparedness. Necessity of new indicators for G2G measurement is due to different reasons: the main criticism of their lack was linked with the availability of 'an online service which does not say much about internal re-organization and/or the users' perspective'; conclusion in some of the researches reports reported about 'lack of cross agency co-operation' (Accenture, 2007); it becomes clear that 'the real benefit of e-government lies not in the use of technology per se, but in its application to processes of transformation' (UN, 2008).

Governments around the world were realizing that continued expansion in e-services is not possible without some kind of integration of back-office systems. According to Joia (2007), 'one of the most challenging e-government sectors, to fulfill the e-government services, is the digitally enabled collaboration and cooperation perspective among different government agencies'. Critiques of e-government benchmarking turned up also in academic literature (Codagnone and Undheim, 2008; Kunstelj and Vintar, 2004). But independently who was the author of the critiques, more than ever, was pointed that 'e-services require another way of organizing processes, different than the traditional pubic administration' or like Vintar et al (2003) notes '*… to achieve fully implementation of e-government it is necessary to be made: changes in organizational design, changes in ways of communication and working …*' what leads to a new reality of public administration. An important aspect of this new reality is the establishment of inter-organizational networks.

2.2. Inter-Organizational Networks in Public Administration

Networks are graphs containing a number of points associated or related with a number of connections, where points are actors in the network, while the connections represent relationships among the actors. Network actors can represent people, groups, organizations, cities, computers or other resources (Krebs, 1996); or with other words actors can be any kind of meaningful social unit, including individuals, collective entities, firms and organizations (Contractor et al., 2006). The relations may be any kind of linkage between actors, including formal role relations, affective expressions (e.g., friendship or respect), social interactions, workflows, transfers of material resources (e.g., money or other goods) publishing and retrieval of knowledge, flows of nonmaterial resources (e.g., information, documents, or advice) and business alliances, to name several types of them (Contractor et al, 2006).

Networks where actors represent organizations are often referred to as inter-organizational networks (IONs). IONs can be defined like '*clusters of organizations that make decisions jointly and integrate their efforts to produce a product or service*' (Alter & Hage, 1993). The actors in IONs can be individuals (persons as actors), groups and organizational units (groups as actors), or organizations (Brass et al., 2004; Provan & Sydow, 2007). The relationships in IONs can represent collaboration, coordination, or any kind of joint activity. So, from this point of view IONs can be observed as '*any collection of actors*' (Podolny & Page, 1998) – separate legal organizations, which work together and cooperate, in order to achieve not only their individual goals, but also common goals of the network as a whole (Danowski et al, 2008).

In literature we can find different motivations for organizational networking: economic, technological, and political. Intention to penetrate on the global markets and adjusting on the new conditions; need to carry with rapid technological changes and needs of producing new products or services in shorter period of time; complexity of tasks and need for funds (informational, resources and expertise) and still stay efficient – press the organizations in more creative solutions in the process what is the major stimulant to network development. Political influence and leadership also can be a motive for networking. The major driving force in developing of IONs in the early phases is willingness to cooperate. Later, the trust (obligations and expectations, Agranoff, 2007) is '*the glue and the grease that ensures networks operate at their peak*' (Krebs, 1996).

A wide variety of IONs forms can be found in the reviewed literature, depends of: the form (trade associations, cartels, cooperatives, joint ventures, franchising, consortia, commercial agreements, sub-contracting, interlocking directorates, and strategic alliance) (Alter & Hage, 1993; Grandori & Soda, 1995); the strength of ties (promotional or obligation); the expertise (chartered and non-chartered) (O'Toole, 1997); the purpose of cooperation divided networks depends of the way of cooperation (competitive versus symbiotic cooperation, the number of organizations involved in collaboration, and the level of cooperation) (Alter and Hage, 1993). The most general typology of IONs may be is division by the nature of organizations on: public, private and "partnerships" between two. Our interest in this paper is focused exactly on the networks in the public sector.

IONs in public administration (PA) can be seen like networks which actors are formal governmental (and other PA) institutions and the relations are formal role relations, workflows, document flow, and flows of nonmaterial resources (information, advice). The relationships are based of horizontal and/or vertical agreements between different levels of government, regulated by law. Agranoff (2007) refer to these networks as 'public management networks' (PMNs). PMNs includes all kinds of public administration institutions involved in a public policy making and/or administrative structure through which public goods and services may be planned, designed, produced, and delivered. The motives of inter-agency and inter-sector arrangements in government can be found in public purposes: solving policy problems or matching services, since very often the services are complex and require realization and/or compilation of different individual services delivered by different PA institutions.

3. Document-Flow Networks

The awareness that each e-government service is to be delivered by different PA institutions connects together the both areas above. To evaluate e-government, especially its hidden (back-office) aspect, one has to look into organizational aspects of public administration and especially how different PA institutions work together to deliver a complex e-government service. This is exactly where we start our study – by analyzing the inter-organizational networks established through delivery of public administration services, we want to find novel indicators of e-government maturity.

On one hand, low level of e-government development is related to frequent activities of the citizen in the process of realization of the complex service. Following the traditional way, where PA institutions are organized following the function-oriented 'silo effect' scheme, the citizen has to go from one organization to another in order to establish a proper document-flow between PA institutions that lead to service realization. In contrast, mature public administration and e-government services, supported with appropriate back-office systems, have focus on public service delivery from the

perspective of the citizen, so called citizen-centric e-government, where citizen usually gets all the needed services in a 'one-stop-shop' front-office. Thus, the PA institutions take active role in the document-flow network and ease the burden of citizen in the processes of service delivery and realization.

In order to be able to quantify the reorganization due to e-government efforts, we observe in this paper the networks of document flows that appear in the process of service delivery. The document-flow networks, established in this paper, include actors of four different types:

(1) *Citizen* that initiate the process of service delivery by submitting the application document and necessary attachments;
(2) *Public administration (PA) institutions* that are involved in the process of delivering the service initiated by the citizen;
(3) *Other institutions* (businesses and others) that the citizen (or PA institutions) need to obtain all the documents related to the service of interest;
(4) *Services* that are performed at PA and other institutions above.

The relations in the document-flow networks correspond to the flow of documents that appear between them. For example, if citizen has to obtain a building permit for a new house, he/she has to send an application to "Approving Building Permit" service; in the document-flow network this is indicated by a link between the node "citizen" and the appropriate service node. Similarly, the link between the "Approving Building Permit" service and "Municipality" node denotes that the document and corresponding service is being handled by the municipality (which is clearly a PA institution). In the following section, we illustrate the process of network establishment on a simple example of the service "Obtaining Re-Adaptation Approval".
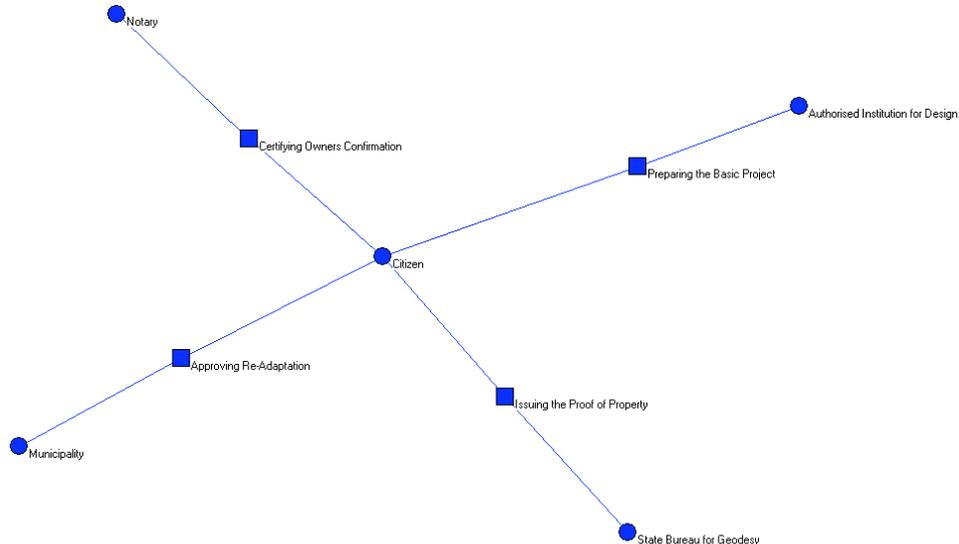

Figure 1: Document-flow network for the service "Obtaining Re-Adaptation Approval".

3.1. Establishing a Network for a Single Service

In the processes of urban planning in Macedonia (like in many other countries), built objects and facilities come with a permission for its use, that is issued upon successful construction. In order to adapt the use of the facility for purposes not specified in the original permission (e.g., to convert an apartment to office space or vice versa) one has to obtain an approval for re-adaptation of an existing facility. In order to do so, a citizen in Macedonia has to obtain three documents (in no particular order), prior to applying

for the approval at the municipality. First, it has to obtain a basic project for re-adaptation (conversion) issued by an authorized institution for design (architectural office). Second, she/he has to obtain proof of ownership for the facility. And finally, the citizen has to obtain notary authorized consent of the majority of the co-owners of the building, if the facility is part of the larger estate.

Figure 1 depicts the document-flow network for the service "Obtaining Re-Adaptation Approval". Box-shaped nodes in the network correspond to services, while round-shaped nodes correspond to the individuals and organizations: citizen in the center of the network, a single PA institution (municipality node at the right-hand side), and two other institutions (notary and authorized design institution). Note that we used Pajek software tool (Pajek, 2010) to prepare the networks visualizations throughout this paper.

The network shows that the citizen is in the center of the document-flow network related to the process of service delivery. This is due to the fact, that there is a complete absence of back-office or front-office services in the domain of urbanism, provided at municipalities in Macedonia. Before starting to measure network properties, let us illustrate the process of integrating several networks for multiple services into a single document-flow network of service delivery in the area of urbanism.

3.2. Integrating Networks for Multiple Services

Following the procedure for transforming services (or better, the processes of delivery of services) into document-flow networks, we prepared three other networks for three related services in the domain of urbanism in Macedonia: "Issuing a Building Permit", "Approving Authorization of Use", and "Deciding a Location Conditions". Note that the services are inter-related, to start the construction a new facility, one needs building permit, upon finalization of construction, she/he needs authorization of use. And in order to obtain project for building, one needs decision on conditions for building at a given location of interest.
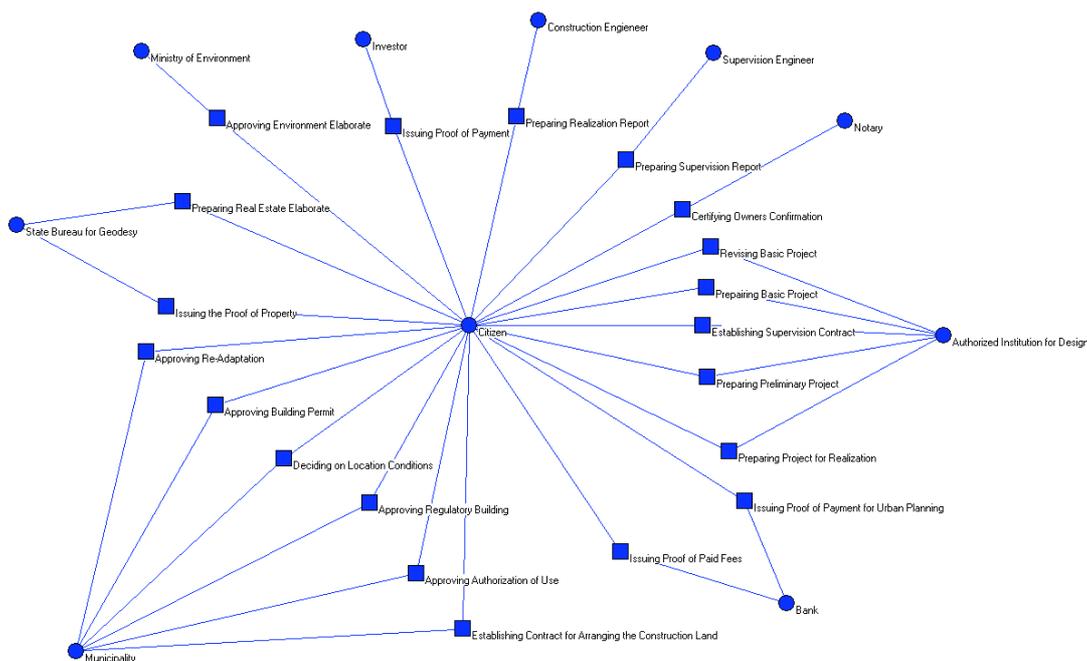

Figure 2: Integrated document-flow network corresponding to four different services in the domain of urbanism.

To avoid verbosity, we do not include the graphs of individual document-flow networks corresponding to simple services. Instead, we aggregated them together in a single document-flow network depicted in Figure 2. It integrates data about document flow in all four urbanism-related services in Macedonia.
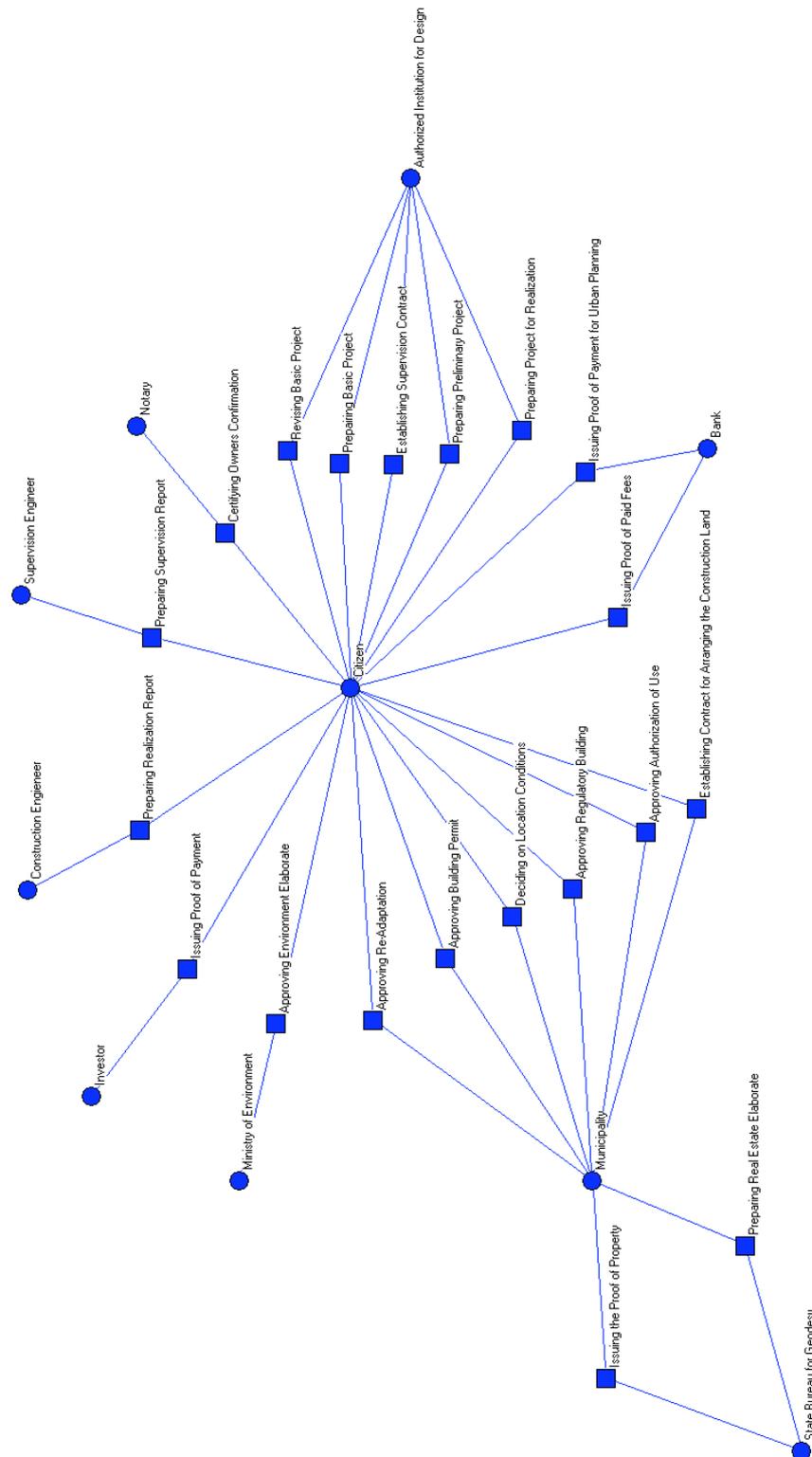

Figure 3: Integrated document-flow network corresponding to four different services in the domain of urbanism after implementing a shared service between municipalities and the State Bureau for Geodesy.

For studying the change of the network due to the improvement of back-office integration, we introduce here with a very simple hypothetical scenario. Let us assume that municipalities and the State Bureau for Geodesy in Macedonia establish a common (shared) back-office services that establish an opportunity for direct document exchange and flow for the purpose of service delivery. In that case, the network would change in a way depicted in Figure 3. Comparison of the graphs in Figure 2 and Figure 3 shows how this change is reflected in the network. The services of "Issuing Proof of Property" and "Preparing Real Estate Elaborate", performed by State Bureau for Geodesy, are not to be triggered by the citizen as in the case before back-office improvement. Instead, all the necessary documents for performing those services (which are still necessary) are transferred from the municipality to the Stat Bureau without any citizen intervention; a clear improvement in the direction of citizen-centric service delivery.

The important question we would like to answer now is whether and how this change influences the properties of the network, or more specifically how and to what extent the properties of the network from Figure 2 differ from the ones for Figure 3. Before answering this question, we have to define network properties of interest.

3.3. Network Properties

The concepts of centrality and centralization are among the most commonly used ways to analyze the patterns which appear in networks. Centrality refers to positions of individual nodes (actors) in the networks, whereas the centralization characterizes the entire network. According to Nooy et al (2005), the notions of centrality and centralization are strongly related to the simple idea of distance. In this sense, a central node in the network is the one which is closer (connected through fewer links) to every other node in the same network. According to this assumption, degree (number of links for a node) and accessibility of a node indicate its level of centrality. On the other hand, when studying the centralization of a network, we can say that a network is highly centralized if there exists a clear boundary between its central and peripheral parts.

In network analysis, we can differentiate between three centrality measures: degree, closeness, and betweenness. Degree is the simplest centrality measure and represents the number of links incident with the observed node. To assure the comparability with other centrality measures, we use the normalized degree centrality – that is we divide the number with the total number of links in the network. Closeness reveals those central nodes which are "close enough" to other nodes in the network. This measure considers direct and indirect choices (that is directly and indirectly connected nodes), which is why it is slightly better measure than degree. The closeness of a given node is calculated as a ratio of the number of nodes (directly and indirectly) connected with the given one and the sum of all distances between the given node and all the connected ones. Betweenness centrality leans on the assumption that the distance between nodes is not the only relevant measure of centrality. It also considers which (important or unimportant) nodes lie on the shortest paths between the pairs of nodes in the network. According to this, a node is central, if it is situated on a great number of shortest paths among other pairs of nodes. In other words, the betweenness centrality of a node is the proportion of all geodesics between pairs of other vertices which include this node (Nooy et al, 2005).

Regarding the presented centrality measures, the network analysis offers three centralization measures, i.e. degree centralization, closeness centralization, and betweenness centralization. Centralization measures depend on the centrality measures

which vary in the network. A network with one central node is more centralized as compared to a network with various equalized centrality measures (Nooy et al, 2005).

3.4. The Effect of Back-Office Development on Network Properties

Table 1 compares the centrality measures for the two document-flow networks corresponding to the situations before (left-hand side) and after (right-hand side) the implementation of a shared service between municipalities and the State Bureau for Geodesy. We used the three measures, specified above (degree – DEG, closeness – CLOS, and betweenness – BETWN), and calculated them for each node in the network first. Again, we used Pajek software tool to calculate the centrality measures.

We do not however, report centrality measures for individual nodes, but rather the averages thereof for the different groups of nodes in the network: citizen, PA institutions, other institutions, and services (first four rows in Table 1). Furthermore, we calculate the average for all the nodes in the network (fifth row in Table 1). Finally, the sixth row in the table reports the centralization measures for the whole networks.

Table 1: Comparison of the centrality properties of the document-flow networks in Figure 2 (before implementing the back-office service) and Figure 3 (after implementing the shared back-office service).

	Urbanism-Before			Urbanism-After		
	DEG	CLOS	BETWN	DEG	CLOS	BETWN
Citizen	**0.72**	**0.76**	**0.92**	**0.66**	**0.66**	**0.86**
PA institutions	0.11	0.33	**0.0066**	0.14	0.30	**0.071**
Other institutions	0.063	0.32	0.0023	0.063	0.30	0.0023
Services	0.072	0.45	0.030	0.072	0.41	0.037
All	0.097	**0.42**	0.052	0.097	**0.39**	0.061
Entire Network	/*	**0.71**	0.90	/*	**0.57**	0.83

* Degree centralization cannot be computed since the network contains multiple links.

All centrality measures show change of centrality of the "citizen" node – this was to be expected and goes in line with the term "citizen-centric" service delivery. Note however, that this improvement of the service citizen-centrality correspond to the *lower centrality* of the "citizen" document-flow network. This is due to the fact that in mature service-deliver environments, the citizen has a peripheral role in the process of service delivery and most of the document flow is independent from the citizen intervention. In contrary, underdeveloped service delivery environment (which is currently in place in the domain of urbanism in Macedonia) is characterized with high centrality of the citizen node in the document-flow network. In the specific case, the changes of the particular centrality measures are similar, with the closeness measure showing the highest change.

The change of centrality for the nodes corresponding to PA institutions shows that back-office development move PA institutions from the periphery of the document-flow network towards the center. Their overall degree centrality slightly increases, while betweenness show dramatic change. The possible explanation is that in mature service-delivery environment with strong back-office support many PA institutions play a role of a proxy or intermediate that delivers a small part of the service, or only establish a connection between other institutions.

The other two types of nodes do not show any significant change of centrality. For the other institutions this is what we expected, since the change of back-office only affected the PA institutions and their inter-relations. The services centrality show some negligible change, which might get emphasized, if larger changes are implemented.

Finally, we can also see that the centralization of the whole network decreases; this is mostly due to the reduced centrality of the citizen node.

4. Discussion and Further Work

The paper presents a straight-forward methodology for establishing document-flow networks for the process of service delivery in public administration (PA). It illustrates the use of methodology on a real-world example of building a document-flow network for four commonly used PA services in the domain of urbanism in Macedonia. The paper also shows that the properties of the document-flow network show tangible change under the change in the back-office environment for service delivery. The analysis of the change on a simple case of establishing a shared service between two PA institutions, shows that the centrality of the "citizen" node in the document-flow network decreases (i.e., his/her involvement in the process decreases), while the centrality of the PA institutions increases.

Based on these initial and preliminary results, we can postulate a hypothesis that document-flow networks can be a useful tool for analysis of the service delivery process. More specifically, we hypothesize that the properties of the document-flow networks can be used as indicators for evaluating e-government, especially the G2G and back-office (hidden) aspects of it. However, in order to prove the usefulness of the document-flow networks and properties thereof, further experiments are necessary to confirm these initial findings. We currently analyze a real-world case of the reorganization of the service-delivery process for establishing an enterprise in Macedonia. We should also extend our study with further cases from other sectors in public administration as well as other countries with more mature service-delivery environments.

Since G2G aspects of e-government have been neglected in many previous studies on e-government evaluation and benchmarks, we can see the work presented here as a first milestone towards extending the existing benchmarks with simple but powerful indicators of back-office maturity. However, two steps are necessary here. First, we have to establish a formal definition of the methodology for building the document-flow networks, which would allow unambiguous establishment and replication of the service-delivery networks. Second, we have to investigate the relation of the existing indicators for G2G e-government evaluation to the indicators based on the centrality properties of the document-flow networks.

In this study, we focused our attention to centrality properties. Other properties, used for social network analysis, can be considered as well. Further work should also address the question of the proper set of network properties to be observed.

As a final remark, note that other authors have been using the methodology of social network analysis in various e-government studies, see e.g., analysis of partnership networks for implementing an e-government project (Cotterill and King, 2007), implementing local e-government policy (Medaglia, 2006), or coordination of soft-target organizations (Uddin and Hossain, 2009). All these studies combine social network analysis with other qualitative and quantitative methods, such as interviews and surveys. In our study, we do not need these, since we collect the empirical data systematically from documents about service delivery process. The closest related study is the work presented in (Alter and Hage, 1993) on analysis of health-care networks, induced from the path that the patient makes through different hospital departments, which compares the properties of these networks to the efficiency thereof.

Acknowledgements

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