Governing the Web:
Where all Roads Lead to Rome*

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Abstract
Governing on the Web is a critical aspect of any e-government project as it is the Web that provides the chief platform through which information is disseminated with websites operating as the main information delivery mechanisms. This study analyses policy information on the Web to understand how the hyperlinked organization of webpages, produced by web-enabled policy communities, influences the structure and content of the Web's information supply. It is argued that governing on the Web requires new governing instruments that are designed to manage in technologically-mediated environment which means that governments will no longer simply manage bulk data, but rather govern dense networks of information to manage the information flow. This paper explores the Canadian government's influence on the Web arguing that government capacity online is shaped by the state's nodality in online policy networks.

Introduction

The informationalizatin of government refers to a shift in the key functions of the state in the post-Internet era (Castell 2000). In response to changing political, economic and social demands, countries around the globe have designed and implemented e-government agendas that seek informational integration among government agencies, online delivery of services, and the improvement of democratic transparency, accountability and trust (Affisco and Soliman 2006; Evans and Yen 2006; Roy 2006). Governing on the Web is a critical aspect of any e-government project as it is the Web that provides the chief platform through which information is disseminated with websites operating as the main information delivery mechanisms (Marchildon and McNutt 2007). Western governments host massive websites publishing a huge amount of public information, hosting services, and communicating information. Unlike private sector websites that supply limited consumer information, government websites provide reports, advice, news, and notices for businesses, consumers, and citizens with the content of the site constituting part of the public record (Borins 2007). This does not suggest however, that the information governments published on the Web is latent as an "e-government Web site is neither neutral nor free of opinion. The way in which it is designed, the information presented and how that information is presented all affect the messages conveyed by the Web site and, as such, by the government" (Jaeger 2005, 703).

The information available on public sector websites is by no means the only source of information on government policy and programs. Indeed numerous organizations host sites dedicated to sharing policy research, advancing policy alternatives, or advocating certain political actions. The community of websites participating in this provisioning of information is extensive including different governments, international organizations, universities, think tanks, citizen groups, social movements, professional associations, media, the private sector, and non-profit organizations with the cross linking among and between these sites creating networks of information. Studying information on the Web requires analysts to consider these informational networks to understand how the relational structures among these websites are continually renegotiated through a dynamic set of interactions among participants. These informational networks are produced by policy actors that use the Web to supplement offline policy activities. As policy actors publish content and link to other webpages, observable patterns of relations among participants in the network emerge.

On the Web, government policy making capacity including the ability to disseminate information, undertake web-based education campaigns and market policy and new programs is shaped by the extent to which the state is nodal in these online information networks. Hood and Margetts (2007) explain nodality as "the property of being in the middle of an information or social network. Strictly, a 'node' is a junction of information channels. Governments are typically 'nodal' at least to some degree . . . Often, they sit in some central place in their domain – the Rome to which all roads lead" (3). A centralized position in the network confers power, as actors that are nodal have more access to resources, more opportunities for exchange and a greater influence on

how information flows through the network (Borgatti and Cross 2003; de Sola Pool and Kochen 1978). However, as Petricek et al.'s (2006) empirical work has demonstrated "if private sector organizations and non-governmental organizations are more successful at using the World Wide Web to increase their nodality, it may be that government will suffer a net loss of nodality in the virtual realm" (1-2). As certain websites will figure predominately in the networks the information, policy alternatives, and opinions of these actors will have a greater influence on policy outcomes. For example different policy actors and organizations will supply different policy options to policy problems with those groups that are able to disseminate their opinions most widely having a greater opportunity to garner support, shape popular discourse, and market their ideas.

The discussion presented here is meant to supplement the current scholarly focus on the functions of e-government (public sectors websites' transactive capacity, electronic services delivery) and the impact of such initiatives on legislative processes. Instead of examining the internal applications of e-government or the use of information technologies (ITs) in traditional democratic processes this paper explores the external face of e-government and the nature of government websites. Two new analytical concepts are introduced to help clarify the discussion and provide context to the topic explored. The first concept is the policy Web which is the aggregate collection of websites and webpages that are focused on public policy and policy information. The second concept is virtual policy networks, which exist on the policy web and refer to the domain specific organization of websites connected through cross linkages. The policy web is a passive entity as it supplies information and provides citizens, organizations and governments with the opportunity to learn of different policy alternatives and associated policy activity. Building on these two concepts this paper considers the external face of Canadian e-government and asks what websites are most influential.

To answer this question the organizational structure of six Canadian virtual policy networks are studied. The networks selected are currently very salient in the national policy and political environments and provide different examples drawn from social, economic, foreign policy and environmental domains. This project provides a new approach to evaluating the effects of e-government initiatives and informational technologies impact on policy and politics. It is hypothesized that public sector websites will be nodal in all six of the networks studied here; however, it is also predicted that other organizations will have varying degrees of influence depending on the levels of internationalization characterized by the specific domain. Understanding the nature of these networks is critical to government, politicians, citizens groups, and policy makers more generally.

Virtual policy networks are social networks and are thus analyzed using an approach that "facilitates the study of how information flows through direct and indirect network ties, how people acquire resources and how coalitions and cleavages operate" (Graton, Haythornthwaite, and Wellman 1997, 3). The structure of web-based networks of policy information provides insight into who has power and how political communications are organized. Extracting virtual networks from the Web is achieved using a web engine to trace the hyperlinks of webpages using hyperlink analysis to

analyze the organizational and communication patterns (Park 2003, Rogers 2006). Data collection in this project is achieved using the *Issue Crawler*; an innovative Web analysis package designed to map an issue space and provide raw data concerning connectivity. Using this approach this paper considers the Canadian government's nodality in the climate change, the Child Tax Benefit program, equalization, foreign policy, peacemaking, and rural health virtual policy networks.

Governing in a Virtual Environment

The Internet is a network of networks and is a physical communication infrastructure. The Web is a document delivery system that rides atop the Internet and is comprised of a single massive network with a typological structure determined by the arrangement in which the webpages are connected through hypertext. The Canadian policy Web is an informational space where networked patterns of exchange and communication are mediated by a dedicated technological infrastructure. The national policy Web hosts a massive repository of information pertaining to interest articulation, actors' relationships, institutional influences, governance approaches and policy discourses. This repository is supplied by a collection of individual contributions, with each latent human decision affecting the cumulative content of the informational supply. The national policy Web is a mesocosm of the offline policymaking universe with observable sequences of communication and exchange occurring in public forums with intent and purpose. In short it is a consequence of policy actors publishing hypertext to other websites focused on policy issues or more generally linking to other policy-based websites.

Drawing from policy and political scholarship it is assumed that the policy Web may be divided into various sectors or national domains, each of which will attract a larger discourse community that is attentive to policy activity as well as a core interest group with opportunities to shape decision-making (Coleman and Skogstad 1990; Montpetit 2005). Online these sectorally based virtual networks are created by Web-enabled policy communities whose political organizational forms have been transposed into the network structures of the Web (Rethemeyer 2007). Participants in such networks vary considerably but include government departments and agencies, interest groups, nonprofit and for profit organizations, political parties, professional associations, think tanks, and universities. While the policy Web produces indirect impacts on policy makers and decision-makers in terms of learning and information diffusion, it also provides various interests with the opportunity to share ideas and advance organizational agendas. As a result policy dynamics originating in the offline world will presumably shape information flows on the Web. Early indications suggest that participation in web-based information policy networks mimic the networked communication and organizational patterns of offline policy communities (McNutt 2006; van den Bos 2006).

Using the Internet as the key communication channel, public sectors websites expand pathways of communication among the state and its various clients; facilitate new governing strategies to manage informational resources, and support collaboration among autonomous units. Various policy actors provide information online using different types of Websites to communicate information (portals, gateways, self-service sites, content

sites, educational sites, blogs, and commercial sites). Thus while the expansion of informational pathways of communication between the state and citizens will facilitate new governing strategies in terms of information dissemination and enrich democratic relationships though increased transparency, the successful management of the nation's informational resources will be contingent on collaboration across sectors and between governments with services that are coordinated around the needs of informational consumers (Borins 2004; Theofanos and Mulligan 2004).

The use of ITs as external organizational instruments and the application of networked technologies in public sector administration has produced a flattening out of government where interagency information sharing and communication are common with multi-stakeholder collaboration considered the new administrative norm (Kernaghan and Gunraj 2005; Hood and Margetts 2007). On the service side of administration, ITs are used for transactional efficiency and interactive activity, while in the governing context ITs are employed to connect various policy participants and share information in Internet-mediated environments (Roy 2006).

Traditional bureaucracies' information systems were typically in-house and responsible for storing the department's internal data collection. The sharing of these information banks across agencies, among governments, and with the public has encouraged the formation of information infrastructures that support the transfer and communication of public information. Digital governance is often used to describe the state's contemporary role in managing the national information supply, ensuring the privacy, accessibility, and security of information, and communicating information to citizens and stakeholders (Borrins et al 2007). The digital state approach to managing information is largely focused on the processing of information (gathering, storing, and transmitting raw data). Managing networks of information is a vastly different task than managing Webberian hierarchies as "networked information creates relationships among activities and organization of government that were not anticipated in the classic public administration model" and are thus not amenable to command and control governance (Brown 2007, 60).

Governing on the Web requires new understandings of what is meant by governance with public managers often guiding partnerships as opposed to directly managing relationship. As Brown (2007) suggests "information is the essence of e-government" (60) and thus government will no longer simply manage bulk data, but rather govern dense networks of information to manage the information flow. Information is a critical policy resource as decision-makers must often "seek to convince other actors of the soundness of their positions concerning the problem and the consequences of one or more policy alternatives" (Jenkins-Smith and Sabatier 1993, 45). Similarly information exchange is a key activity in networked environments (Borgida and Cross 2003) with the structures of exchange influencing which websites have power as "the details of who is connected to whom will clearly affect what type of information is passed, how much, and how efficiently" (Cowan and Jonard 2004, 1558). How information flows, where information is produced, and what informational resources are

available all influence the types of information supplied, the attention the information receives and the narrative used to interrupt that information.

Research Design

On the Web policy actors' influence may be directly correlated with source credibility and an institution's reputation for providing reliable and credible information (Briggs et al. 2002; Wang and Emurian 2005). While there have been numerous accounts of the motivations behind linking behavior, to infer authority in a target page's content is the generally accepted reason why one individual hyperlinks to another webpage's information. Gibson, Kleinberg and Raghavan's (1998) early study of linking behavior found that the Web's link-structure was "considerably more orderly than [was] typically assumed" providing "a global understanding of the ways in which independent users build connections to one another in hypermedia that arises in a distributed fashion, and provides a basis for predicting the way in which on-line communities in less computer-oriented disciplines will develop" (225). Actors' reputations are built through a hyperlink popularity contest, using inbound links to endorse a particular source of information (Park 2003; Thelwall 2006). Identifying the most trusted sources of information in virtual policy networks provides insight into which webpages have the most influence in the community (Briggs et al. 2002; Vedder and Wachbroit 2003). In other words, linking behavior confers informational authority to a target website's content and thus, organizations with good reputations for providing trustworthy information receive numer-ous inbound links (Henzinger 2001). A links does not necessarily mean the source of the link agrees with the content provided on the target page but it does suggest that the source recognizes that information as reliable and relevant. To be acknowledged by the actors of a network as a trusted and reliable source of information implies influence (Cook and Cooper 2003; Hindmoor 1998; Wang and Emurian 2005).

Computer scientists often refer to the number of inlinks a website receives as an authority weight. In this analysis the more nodal the government is in the virtual network the greater the states levels of authoritativeness. As Petricek et al. (2006) suggest.

> The concept of 'nodality' in political science is analogous to authoritativeness (often indicated by number of links pointing to a site) and hubness (number of links pointing outside a site) with respect to computer science and the Web. Intuitively, we would expect government to become more nodal as the Internet and associated technologies become more embedded into all aspects of social and political life (1-2).

In virtual policy networks the sum of all inlinks is the network's full authority weight, with each website receiving a portion of the network's total authority weight. In instances where the federal government websites garner more than 50 percent it is assumed the Canadian government is nodal in that particular domain.

The state's ability to manage information flows and mould policy images is however impeded by the entry of non-domestic actors in the Canadian policy web space (McNutt 2008). The transnational overlap of public policy has grown precipitously in the last three decades, thus in addition to ITs shifting governance practices;

internationalization has also had a significant impact on government nodality (Coleman and Perl 1999).[1] Internationalization has introduced non-domestic actors into national policymaking arenas, produced supranational regulatory institutions, and in some policy domains diminished state capacity; however it has also been identified as stimulating policy learning (Howlett and Ramesh 2002; Oviatt and McDougall 2005).

The ability of ITs, especially those in the industrial sector, to diffuse the processes of internationalization rapidly and on a global scale has led to increasing informational dynamics, internationalized policy networks, and an active global civil society. Content originating from non-domestic sources may be classified as either geographically specific (American, European, and so forth) or global which refers to content provided by international policy institutes such as the United Nations, the World Banks, or the International Monetary Fund. The Canadian government is expected to be more nodal in policy sectors more national in scope and less nodal in internationalized domains where federal influence is restricted and conditioned by membership status in the global community, attenuating governments' role in problem definition, analysis, and implementation.

Methodology

As suggested earlier the web-based information networks studied here are called virtual policy networks. Virtual policy networks are produced by policy actors that use the Web to supplement offline policy activities with linking behavior among pages considered a form of political activity with a hyperlink deliberately chosen by an actor. Studying linking behavior in this way does not assume that the Web author agrees with the information being published, it merely suggests that the cited webpage is relevant to the topic and that the author views the content as related to the information they themselves are publishing. Hyperlinking is a strategic action with a hyperlink conferring informational authority (source credibility) on an alternative website's informational content (Smith, Newman, and Parks 1997). These communication behaviors are stamped on the subgraph of the Web[2] providing a networked portrait of information exchange in Web-mediated environments (Roger 2006).

Using a Web crawler to retrieve large quantities of data from the Internet, the structure of each virtual policy network is calculated through measures of link information. The study of link information allows for the identification of various online communication patterns, tracing incoming and outgoing links to determine connectivity and identify formal relationships. Web crawlers trace hypertexts on the web so as to retrieve certain information literally crawling "the Web by following its link-structure,

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[1] Internationalization refers to a process by which globalizing forces and technological advancements have altered the domestic configuration of policy planning and implementation.

[2] The Web's produces various properties associated with the connections between webpages and hypertext such as the path links follow, the content of pages, and how content is linked and ordered. In this project the subgraph of the web or the web graph refers to the structure of connectivity that is produced by studying a set of webpages sharing links.

collating, indexing and retrieving information as they go' (Evans and Walker 2004, 373). The more links a website receives, the more relevant the information hosted by that policy actor is considered to be by other members of the community. Thus websites with numerous inbound links or high in-degrees have good reputations for producing trustworthy information.

Hyperlink analysis is the study of thematic and structural features of hyperlinks and the behavior associated with the publication and retrieval of the Web's informational resources. Hyperlink analysis is structured around two principal activities: crawling (data collection) and connectivity-based ranking (data analysis). Crawling refers to the process of collecting webpages using a computer-based algorithm designed to visits pages and retrieve information, which is recorded in a large database. The course of the crawl is determined by tracing hypertext links that direct the engine from one webpage to another following the networked patterns of the Web's structure. For this project the web maps were all run using *Issue Crawler* an engine that maps web spaces using a focused subgraph of the Web (Richard, 2006). The method was first developed for search engine optimization analysis using cartography to map the networked ties among Internet-mediated communities publicizing their affiliations, partnerships, and belief-systems in a hyperlinked environment. The connectivity-based ranking provides a gauge of the relative influence of a specific site on the Web.

A centralized position provides nodal actors and organizations with greater influence over the flows of information. Using hyperlink analysis to study the nodality of the Canadian government in six policy domains this project considers two key measures to determine government nodality. The first measure is drawn from the connectivity-based ranking of websites participating in sector or issue specific virtual policy networks. This measure is used to rank the most reliable and trusted sources of informational content in the Canadian policy web. The second measure considers government authoritativeness in each virtual policy network providing insight into the degree to which the network is structured around federal government content.

The six virtual policy networks studied were selected because they are currently receiving attention in the national policy and political environments. Rural health became a popular policy issue following the reorganization of the Canadian health care system and the associated public versus private delivery system policy debates. Climate change is the most prominent policy issue on the minds of Canadians today and is in the media daily. Foreign policy is always on the public agenda as it is a domain that encompasses Canadian international relations, including security, defense and trade. Similarly peacemaking is also a popular topic as Canada debates its international obligations to collective security agreements. Equalization is a federal program that provides transfer payments to provinces to overcome fiscal disparities and ensure all provinces are able to provide residents with public services that are comparable to other provinces Equalization has been high on both federal and provincial policy and political agendas following change to the formula used to determine each province's fiscal capacity. Finally the Child Tax Benefit is a redistributing program that provides monthly tax free payments to

families with children under the age of 18 and is designed to help families in balancing work and family responsibilities.

Analysis

Climate Change
The Web crawler visited 32,134 webpages that contained content on Canadian climate change, recording 36,601 inbound links to 82 target websites. The Canadian Department of Justice received the highest indegree with 7,211 inlinks from the crawled population; with both the Canada Site and the Canadian Department of Environment also ranking in the three most linked to website (Table1). When all federal government websites were combined the total indegree was 20,915 which was 57 percent of total authoritativeness suggesting that in the climate change network the Canadian government is fairly nodal.

TABLE 1 Climate Change Top Ten Connectivity Based Ranking	
2006	
Canadian Department of Justice	7211
Environment Canada	6749
Government of Canada	5358
US Environmental Protection Agency	4269
US Department of Energy	2792
UN Framework Convention on Climate Change	1720
National Oceanic and Atmospheric Administration	1648
World Bank	1193
International Institute for Sustainable Development	916
Canadian Department of Natural Resources	591

Of all inlinks links received the provincial government garnered an authority weight of only 87. There were several private interests included however even when combined these websites obtained a meager 53 inbound links. There was a strong American presence in the network with 26.98 percent inlinks pointing to websites originating in the United States. The American government in particular received a significant level of authoritativeness with 9,175 inlinks. In addition, global policy institutes were also a significant factor in this network with 5061 inlinks. Again there was no media presence.

Child Tax Benefit
The Web crawler visited 25,801 webpages that contained content on the Canadian Child Tax Benefit recording 28,748 inbound links to 90 target websites. The Ontario government portal received the highest indegree with 4,920 inlinks from the crawled population; with both the Canada Site and the Government of Alberta ranking in the three most linked to websites (Table 2). The government of Ontario's nodality was however

moderate with 17 percent of the total authoritativeness. Government websites were clearly the most influential in the Child Tax Benefit network with the aggregate inlinks to federal government websites totaling 9,724 suggesting that the federal government attracted 33.86 percent of all inlinks, while the provincial governments received 81.1 percent or 23,315 of all inlinks with the highest levels of combined authoritativeness. Nonprofit organizations were also a significant aspect of the network receiving 4,904 inlinks.

TABLE 2 Child Tax Benefit Top Ten Connectivity Based Ranking	
Government of Ontario	4920
Government of Canada	4074
Government of Alberta	3439
Government of Quebec	1397
Health Canada	1319
Statistics Canada	1290
Government of Yukon	1041
Finance Canada	680
Childcare Resource and Research Unit	651
Justice Canada	616

The University of Toronto's Childcare Resource and Research Unit was the only academic institutes represented in the network receiving 651 inlinks from the crawl. There was also a number of Canadian think tanks included sharing a total of 1,274 inlinks. The geographical origins of the websites were predominately Canadian, with only one American website (idealist.org) that received a nominal inlinks count at 12. Global content was limited to intentional policy institutes including the United Nations, the Organisation for Economic Co-operation and Development and the Intentional Monetary Fund. The network is not considered internationalized as only 650 inlinks or 2.26 percent of the network was not Canadian.

Canadian Foreign Policy
The web engine crawled 45,927 webpages of Canadian Foreign Policy content recording 29,471 inbound links to 90 target websites. The Government of Canada received the highest indegree with 5,724 inlinks from the crawled population with both the United Nations and Foreign Affairs and International Trade Canada also ranking in the three most linked to websites (Table 3). Federal websites received 10,026 inlinks constituting 34 percent of network authoritativeness suggesting that in the virtual Canadian foreign policy network the Canadian government is not nodal. Unlike the five other sectors considered here there was a media presence in the foreign policy network with American broadcasters garnering 1,237 inlinks.

TABLE 3 Canadian Foreign Policy Top Ten Connectivity Based Ranking	
Government of Canada	5724
United Nations	5540
Foreign Affairs and International Trade Canada	2440
The Library of Congress	1932
Council on Foreign Relations	1445
United Nations Development Programme	1349
The Washington Post	601
The New York Time	507
Department of Finance Canada	488
Food and Agriculture Organization of the United Nations	441

American content did receive a fairly high indegree with 6,225 inlinks; however, global content largely originated from various United Nations agencies which received 12,898 inlinks from the crawled population. The only other two nations identified in the crawl were the United Kingdom (186) and Japan (55). Non-profit content was limited to think tanks, most of which were American policy institutes including the Cato Institute (205), the Carnegie Endowment for International Peace (180), the Center for Strategic and International Studies (178), and the Rand Corporation (54). Only two Canadian think tanks were identified in the crawl, the Canadian Institute of Strategic Studies (18) and the Canadian Institute of International Affairs (14).

Equalization

The equalization crawl identified 77 websites after visiting 29,545 webpages and recording 37,911 links to these targeted sites. The top three linked to sites were the Canada Site, Justice Canada and Industry Canada respectively (Table 4). The web engine also recorded inbound links to all the provincial and territorial governments in Canada; however, the sheer volume of links the Canada Site received (11,881) combined with the heavy presence of federal information in this network establishes the federal government as extremely nodal in the equalization policy network. In total federal governed inlinks totaled 30,172, which constitutes 79.59 percent of all inlinks. Provincial governments received 7,078 inlinks or 18.67 percent of authoritativeness.

TABLE 4 Equalization Top Ten Connectivity Based Ranking	
The Canada Site	11881
Justice Canada	9808
Industry Canada	3173
Government of Yukon	1668
Government of Alberta	1620

Government of Saskatchewan	1189
Privy Council Office Canada	1052
Government of Nova Scotia	607
Government of the Northwest Territories	560
Parliament of Canada	479

Think tanks collected 543 inlinks with the Institute for Research on Public Policy being the most influential. There were no inlinks to the media or commercial sites. The geographical origins of most targets sites were Canadian with American websites receiving 51 inlinks, one website from the United Kingdom receiving 10 inlinks and one from Australia receiving nine. Global policy institutes also received only a nominal level of authoritativeness with an aggregate count of 262 inlinks. Overall the level of internationalization in the Equalization network was nominal.

Peacemaking
The peacemaking crawl suggests that the Canada government is not recognized as a source of reliable and trustworthy web-based information on this issue. While the web engine identified 91 websites and recorded 15,765 inbound links, federal websites received only 3,325 inlinks which constitutes 21 percent of authoritativeness with international organizations also garnering a number of inbound links suggesting that internationally supplied information on peacemaking/ peace-building may be considered more reliable than current Canadian content. Indeed, it is the United Nations that receives the greatest number of inbound links (4,220) from the crawled population

TABLE 5 Peacemaking Top Ten Connectivity Based Ranking	
United Nations	4220
Foreign Affairs and International Trade Canada	1793
The Canada Site	1190
United Nations Development Programme	415
Human Rights Watch	303
United Nations Development Fund for Women	303
Canadian International Development Agency	287
UNICEF	278
World Bank	271
World Health Organization	266

Global websites received the highest aggregate indegree of 13,070 with content originating from Canada receiving 3,964 inlinks and inlinks for the United States totaling 530.

Rural Health

The Web crawler visited 20,562 webpages that contained content on Canadian rural health, recording 32,338 inbound links to 79 target websites. The Canada Site received the highest indegree with 8,571 inlinks from the crawled population with both the Department of Justice Canada and the Public Health Agency of Canada also ranking in the three most linked to website (Table 6). When all federal government websites were combined the total inbound links to federal sites was 24,957 with 77 percent of authoritativeness garnered by the Canadian state suggesting that in the rural health network the Canadian government is very nodal. Provincial governments received 3294 inlinks, while municipal governments were not represented.

TABLE 6 Rural Health Top Ten Connectivity Based Ranking	
The Canada Site	8571
Department of Justice Canada	8000
Public Health Agency of Canada	2766
Health Canada	2698
Government of Ontario	1928
National Institutes of Health	752
Treasury Board of Canada Secretariat	702
Canadian Health Network	516
Canadian Institutes of Health Research	432
Canadian Rural Partnership	357

American websites received 1,222 inlinks while international content was limited to the World Health Organization which received an indegree of 251. Nonprofit organizations identified in the crawl varied significantly, however health sciences and health policy research institutes did rank that highest. In addition, there were a number of professional associations representing physicians, nurses, and various other medical professionals.

Policymaking on the Web is clearly occurring, which was illustrated by the extensive government engagement in virtual policy networks and by the participation of numerous policy actors seeking to influence the flows of information. The Canadian government was nodal in three of the six networks considered here including climate change, equalization, and rural health. Of these three virtual policy networks climate change had the highest level of internationalized content, while the federal government had a lower level of authoritativeness. The federal government was extremely nodal in the equalization network, which contained very few hyperlinks to non-domestic sources of information. Similarly, in the rural health network government nodality was extremely high. In the child tax benefit network the provincial government of Ontario received the most inbound links, with provincial governments receiving the highest indegree. In both

the foreign policy and peacemaking networks global institutes were considered the most authoritative.

Conclusion

The Web is an information system created by human agents authoring and publishing data in shared virtual environments. It is a social system that accommodates both communication and exchange through networks formed by webpages and the hyperlinks that connect these sources of data. The transference of policymaking from the offline world to the virtual requires institutional shifts, modernized information management strategies, and a digital state platform that supports web-based policy activity. Policymaking on the Web is derivative of the offline process with dynamic responses to exogenous pressures, variable levels of information circulation, and differential access to privileged membership status. Just as there is a national policy domain, there is also a national policy Web space that includes the set of all policy information published by institutions and actors.

The analysis presented here suggests that the Canadian government's participation in virtual policy networks is significant, with the state operating as an important actor on the policy Web. The capacity of government to support Web-based policymaking and online governance activity will influence the supply of information and shape network structures. Governing on the Web thus necessitates new approaches to information management as citizens' trust in government must be negotiated in virtual environments of networked information.

Policy and political research using hyperlink analysis remains meager, nonetheless, the approach has a great deal of potential in expanding our understanding of the how the Web is impacting political environments and outcomes in offline policy communities. In addition studying virtual policy networks will also provide insight into how websites and online information is being used to shape policy discourse and challenge dominant policy image. Further research on policymaking in web-based environments would surely profit from studies that explore other national policy Webs and compare the organization of networks across different political and legislative systems.

The Canadian government's nodality in the six networks considered in this project varied widely across domains. The state enjoyed the highest level of nodality in the Equalization network where it is clearly a centralized actor. In the peacemaking network the state had limited authority and truncated opportunities to govern information as the United Nations appeared to be the most trusted source of information on the Canadian policy web. The capacity of Canadian e-government to support Web-based policymaking and online governance activity will influence the supply of information and shape network structures. Governing on the Web thus necessitates new approaches to information management as citizens' trust in government must be negotiated in virtual environments of networked information.

Traditional information dissemination and knowledge transfer activities have been radically expanded with the introduction of computer-mediated communication into the public sector, facilitating information-sharing environments and policy learning. Government nodality is an increasingly important consideration in managing information. This research highlights the potential of e-government initiatives to shape policy outcomes; however, the state's capacity to steer and enforce Web-based network behavior is conditional on developing appropriate policy instruments to govern information in Web-based environments. Government's influence on the Web is a significant aspect of evaluating the state's activities in information provisioning. Developing contemporary tools of public action will require government decision-makers to pay closer attention to virtual networks of policy information. Governments expend massive public resource to provide information (Borins et al 2007); however, the impact of information provisioning on citizens' behaviors, on the policy process, and on the public's understanding of a policy area remains poorly understood at the macro level.

WORKS CITED

Affisco, J. and K. Soliman. (2006). "E-government: A Strategic Operations Management Framework for Service Delivery." *Business Process Management Journal*. 12(1): 13-21.

Ahuja, M. and K. Carley. (1998). "Network Structure in Virtual Organizations." *Journal of Computer Mediated Communications.* 3(4).

Borgatti, S. and R. Cross. (2003). "A Relational View of Information Seeking and Learning in Social Networks." *Management Science.* 49(4): 432–445.

Borins, Sandford. (2004). "A Holistic View of Public Sector Information Technology." *Journal of E-Government* 1(2): 3-29.

Borins, Sandford, Kenneth Kernaghan, David Brown, Nick Bontis, Perri 6, and Fred Thompson. (2007). *Digital State at the Leading Edge.* Toronto: University of Toronto.

Briggs, P., B. Burford, A. De Angeli, and P. Lynch. (2002). "Trust in Online Advice." *Social Science Computer Review*. 20(3): 321-332.

Castells, Manuel. (2000). *The Rise of the Network Society*. 2nd ed. Massachusetts: Blackwell Publishers.

Coleman, William D. and Anthony Perl. (1999). Internationalized Policy Environments and Policy Network Analysis. *Political Studies*. 47(4): 691-710.

Coleman, William and Grace Skogstad, eds. (1990). *Policy Communities and Public Policies in Canada.* Toronto: Copp Clark.

Cook, K. and R. Cooper. (2003). "Experimental Studies of Cooperation, Trust, and Social Exchange." *Trust and Reciprocity.* Elinor Ostrom and James Walker eds. New York: Russell Sage Foundation. Pp.209-244.

Cowan, R. and N. Jonard. (2004). "Network Structure and the Diffusion of Knowledge." *Journal of Economic Dynamics and Control.* 28(8): 1557-1575.

de Sola Pool, I. and M. Kochen. (1978). "Contacts and Influence." *Social Networks*. 1(1): 5-51.

Dunleavy, Patrick, Helen Margetts, Simon Bastow and Jane Tinkler. (2006). "New Public Management Is Dead—Long Live Digital-Era Governance." *Journal of Public Administration Research and Theory.* 16(3): 467-494.

Evans, D. and D. Yen. (2006). "E-Government: Evolving Relationship of Citizens and

Government, Domestic, and International Development." *Government Information Quarterly.* 23(2): 207-235.

Evans, M. and A. Walker. (2004). "Using the Web Graph to Influence Application Behavior." *Internet Research.* 14(5): 372-378.

Gibson, D., J. Kleinberg, and P. Raghavan. (1998). "Inferring Web Communities from Link Topology." *HYPERTEXT''98.* Proceedings of the Ninth ACM Conference on Hypertext and Hypermedia: Links, Objects, Time and Space - Structure in Hypermedia Systems, June 20-24, Pittsburgh, PA, USA. ACM: 225-234.

Garton, L., C. Haythornthwaite and B. Wellman. (1997). "Studying Online Social Networks." *Journal of Computer Mediated Communication.* 3(1).

Henzinger, M. (2001). "Hyperlink Analysis for the Web." *IEEE Internet Computing.* 5(1): 45-50.

Hindmoor, A. (1998). "The Importance of Being Trusted: Transaction Costs and Policy Network Theory." *Public Administration.* 76(1): 25-43.

Hood, C. (1986). *The Tools of Government.* Chatham: Chatham House Publishers.

Hood, C and H. Margetts. (2007). *The Tools of Government in the Digital Age.* London: Palgrave.

Howlett, M. (2000). "Managing the 'Hollow State': Procedural Policy Instruments and Modern Governance." *Canadian Public Administration.* 43 (4): 412-431.

Howlett, Michael and M. Ramesh. (2002). "The Policy Effects of Internationalization: A Subsystem Adjustment Analysis of Policy Change." *Journal of Comparative Policy Analysis.* 4(1): 31-50.

Jaeger, P. T. (2005). "Deliberative Democracy and the Conceptual Foundations of Electronic Government." *Government Information Quarterly.* 22(4): 702-719.

Kernaghan, Kenneth and Justin Gunraj. (2005). "Integrating Information Technology into Public Administration: Conceptual and Practical Considerations." *Canadian Public Administration.* 47(4): 525-546.

Kleinberg, J. (1999). "Authoritative Sources in a Hyperlinked Environment." *Journal of the ACM.* 46(5): 604-632.

Marchildon G. and K. McNutt (2007). "Infostructure and the Revitalization of Public Health in Canada." *HealthcarePapers.* 7(3): 44-51.

McNutt, K. (2008) "Policy Actors on the Web: The Canadian Climate Change Virtual

Policy Network." *Canadian Political Science Review*. 1(3).

McNutt, K. (2006). "Do Virtual Policy Networks Matter? Research Note: Tracing Network Structure Online" *Canadian Journal of Political Science*. 39(2):391-405.

Montpetit, Éric. 2005. "Westminster Parliamentarianism, Policy Networks, and the Behaviours of Political Actors." *New Institutionalism: Theory and Analysis*. André Lecours, ed. Toronto: University of Toronto Press. Pp.225-244.

Oviatt, Benjamin M. and Patricia P. McDougall. (2005). "Defining International Entrepreneurship and Modeling the Speed of Internationalization." *Entrepreneurship: Theory & Practice*. 29(5): 537-553.

Park, H. W. (2003). "Hyperlink Network Analysis: A Method for the Study of Social Structure on the Web." *Connections*. 25(1): 49-61.

Petricek, V., T. Escher, I. Cox and H. Margetts. (2006). *The Web Structure of eGovernment - Developing a Methodology for Quantitative Evaluation*. E Applications Track at the World Wide Web Conference, Edinburgh 23rd - 26th May 2006.

Rethemeyer, K. (2007). "Policymaking in the Age of Internet: Is the Internet Tending to Make Policy Networks More or Less Inclusive?" *Journal of Public Administration Research and Theory* 17(2) 259-284.

Rogers, R. (2006). *Information Politics on the Web*. 2nd ed. Cambridge, MA.: The MIT Press.

Roy, Jeffrey. (2006). *E-Government in Canada: Transformation for the Digital Age*. Ottawa: University of Ottawa Press.

Sabatier, P. and H. Jenkins-Smith. (1993). *Policy Change and Learning: An Advocacy Coalition Approach*. Boulder: Westview Press.

Smith, P.A., A.I. Newman, and L.M. Parks. (1997). "Virtual Hierarchies and Virtual Networks: Some Lessons from Hypermedia Usability Research Applied to the World Wide Web." *International Journal of Human-Computer Studies*. 47(1): 65-95.

Thelwall, M. (2006). "Interpreting Social Science Link Analysis Research: A Theoretical Framework." *Journal of the American Society for Information Science and Technology*. 57(1): 60-68.

Theofanos, M. and C. Mulligan. (2004). "Empowering Patients through Access to Information: The United States Department Of Health And Human Services E-Health Enterprise," *Information, Communication and Society* 7(4): 466-490.

van den Bos, Matthijs. (2006). "Hyperlinked Dutch-Iranian Cyberspace." *International Sociology*. 21(1): 83-99.

Vedder, A. and R. Wachbroit. (2003). "Reliability of Information on the Internet: Some Distinctions." *Ethics and Information Technology*. 5(4): 211-215.

Wang, Y. and H. Emurian. (2005). "An Overview of Online Trust: Concepts, Elements, and Implications." *Computers in Human Behavior*. 21(1):105-125.