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Social Policy on the web: The Online Institutional Structure of Social Policy Domains in the UK

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Abstract: Our traditional image of government is often of the Parliament or of bricks and mortar government service delivery offices, such as NHS hospitals or Benefits Agency sites. However, in an online world, government is increasingly seen and experienced through the internet. Moreover, in the online world, government websites can be readily connected into hyperlink networks. What do the online 'footprints' of social policy domains look like? And how do these online social policy networks relate to equivalent offline networks? This paper examines these questions in relation to three policy domains in the United Kingdom, namely: foreign affairs, health and education. It draws on large-scale web crawls and sophisticated web-metrics and Social Network Analysis techniques to map and compare the shapes of these different policy domains. It explores the shape, nature and make-up of these various online networks and the participants in them, including the relevant contribution of non-government and commercial websites. It considers whether or not online networks may reflect or contribute to social policy networks, or government ambitions of 'joined-up' service delivery, and whether jurisdictional boundaries are evident in the online world. In examining these topics, this paper seeks to provide an empirical and conceptual contribution to understanding 21st government and service delivery.

Keywords: social network analysis, social policy, e-Government, hyperlink networks, web social science, UK government

1. Introduction

Our visual images of government are often populated by figurehead individuals (such as Presidents and Prime Ministers) or iconic structures (such as The White House, Parliament House, MI6's SIS Building) or key institutions (such as Treasury, Department of Work and Pensions, Royal Mail). We are well versed in how these items are interconnected, institutionally, constitutionally and organizationally. Given our internet-infused contemporary lives, where does the internet appear in our images of government? It is likely that particular government websites do not have anywhere near the same recognition value as iconic government images. Moreover, we have very little understanding of the online interconnections or map of online government that parallels our institutional, constitutional and organizational map of government.

This paper presents findings from a program of research that maps and analyses government on the web. It is argued that given the centrality of the internet today, it is no longer bricks and mortar that define our engagement with government, but the online world. Given this reality, we need to be more attuned to what that world is like, how it is shaped and structured, and how it in turn may shape us and the institutions of government. Key questions need to be considered. For example, what role do commercial websites play in online government? Does government online reflect on the ground connections and fissures (such as national and jurisdictional boundaries)? Do the online policy networks reflect organizational or political policy networks?

While digital information technologies have long been a part of government operations, the advent of the internet in the 1990s stimulated a major program of 'e-Government' research that examines the role of both the internet and other digital ICTs in the conduct of government (Henman, 2013). In terms of understanding government on the web, a major contribution of e-Government scholars has been to differentiate different forms or functionalities of websites, which are listed as progressive stages, which Lee (2010) summarises as: presenting; assimilating; reforming; morphing; and e-Governance. The idea of stages of e-Government has been used to assess and rank countries' e-Government performance (EU 2012; UN 2012; Ostermann & Staudinger, 2007) and stimulated a raft of research assessing the facilitators and barriers to such 'advancement' of government websites both in terms of government factors (West 2004) and citizen factors

(Shareef et al, 2011). The relationships between government agencies and websites have also evolved alongside website functionality. Though under-researched, agencies typically had a one-to-one relationship, then website proliferated within each agency for different strategic purposes, and then a shift occurred for whole of government web portals and joined-up e-service delivery (Lucke, 2007; Margetts & Partington, 2010). Despite this large and growing body of work little is known of the ecology of government websites in terms of their online relationships with other websites.

This paper examines the situation of three policy domains in the UK: foreign affairs; health; and education. Our approach is not to examine the government online as isolated websites, but websites within a network, a network constructed by the hyperlinks between government and other websites. Accordingly, we analyse government websites within the online networks using both webmetrics and social network analysis techniques. *Webmetrics* is the term used to refer to statistics about the structural characteristics of a website. For example, Escher *et al* (2006) utilized numbers such as the numbers of inlinks and outlinks to a website, and path lengths between webpages within a single website to assess the visibility, extroversion and navigability of a website (see also Thelwall, 2009). *Social network analysis* techniques, in contrast, focus on analysis of a network and items within a network. For example, techniques can include numerical measures of the importance of an individual website in a network (in terms of authority or as a hub [Kleinberg, 1999]), or numerical measure of the shape of a network (in terms of spoke), or can involve more complex considerations such as how a network might be partitioned.

Our approach to analyzing government on the web thereby draws upon and extends previous work including (Margetts and Escher, 2006; Whalen, 2011). However, we extend this work which is based on analysis of national-level government, by adding regional/State level government (in this case, Scotland and England) to the analysis.

In this paper we set out to examine two key topics. First, we seek to understand the significance of government sites within a wider network. How important are they in that network and what roles do they play. For example, it has been observed by Hood (1983; Hood and Margetts, 2006) that *nodality*, that is the extent to which government is at the centre of social and informational networks, is a key attribute and tool of government. How central is government in the online world, and is its nodality challenged by it? Do government websites act as informational authority to which others consult?

Secondly, different policies areas – such as foreign affairs, environment and sanitation – have very different institutional, service, legal and stakeholder settings, dissimilar people who are affected by and influence the policy and services in each domain, and are likely to have varied policy associations. Thus we secondly seek to understand the online networks arising from separate policy domains, and how they may vary and what the variations are reflective of (such as legal-constitutional settings, institutional arrangement and policy families). Indeed, e-Government has been argued to break down the traditional institutional silos of government, by enabling ‘joined up’ government. Are these ambitions evident in the online networks?

In examining these questions we selected three different policy domains: foreign affairs; health; and education. These domains were selected as they reflect different constitutional, institutional and service delivery settings to enable similarities and differences between the policy and online networks to be considered, contrasted and interpreted. For each policy domain, a small number of government websites were selected as important and key sites in each domain. Such sites were selected to represent their centrality to either policy or service delivery in that domain, and also at each relevant jurisdictional level. In this paper we investigate the national and the regional level (represented by Scotland, as many English sites are subsumed under the national/British level). *Foreign Affairs* included one seed site, www.fco.gov.uk, which provides corporate and policy information relating to topics such as foreign affairs, climate change, international aid and development, European Union, and national security. *Health* contained three seed sites: (1) www.dh.gov.uk, which provides corporate and policy information from the Department of Health, relating to public health, social care, the NHS and public safety and emergencies; (2) <http://nhs.uk>, which provides information from the National Health Service on conditions, treatments, local services and healthy living. It is the online ‘front door’ to the NHS; and (3) www.show.scot.nhs.uk, the official website of NHS Scotland. Finally, two seed sites were included for *Education*: (1) www.education.gov.uk, which brings together into one location all corporate and policy information from the Department of Education, including school

performance, curriculum and supporting children and young people; and (2) www.educationscotland.gov.uk, the website of the national body supporting quality and improvement in Scottish education.

Foreign affairs is clearly the domain of the national British government, and its links are likely to be international, rather than intra-national. The role of private companies in service delivery vis-à-vis foreign affairs would be expected to be limited. The key website is that of The Foreign and Commonwealth Office (www.fco.gov.uk). British health policy, on the other hand, is centrally organised through the National Health System (NHS), but is differentially structured in England, Wales, Scotland and Northern Ireland (Smith, 2009; Greer, 2004; Alcock, 2008; Crinson, 2009). The expansion of market-based reform to health policy has resulted in an increased role of the private sector, particularly in England (Baldock et al, 2012; Alcock, 2008; Talbot-Smith and Pollock, 2007). The national and Scottish NHS websites were included in this study alongside the key national health policy site (www.dh.gov.uk). British education policy and service delivery is arguably more de-centralised than health. While it is coordinated and financed at a federal level, local authorities are responsible for the operation and management of schools (Baldock et al, 2012). However the role of local authorities has somewhat decreased due to increasing private marketization of school provision (Alcock, 2008; Chitty, 2002; Chitty, 2009; Baldock et al, 2012). The national and Scottish education websites were included in this study.

2. Method – generating the data

Using the five websites listed previously, three separate networks were created in September 2012, one for each policy domain. These policy networks were derived by identifying both all hyperlinks out of each seed website and all hyperlinks coming into each seed site. The hyperlink relationships between these external websites were also collected.

Practically, hyperlink network data were collected and assembled via an iterative process that broadly occurred in three stages. Stage One involved undertaking a web crawl for each of three policy domains using the VOSON software (Virtual Observatory for the Study of Online Networks). VOSON is a “web crawler that crawls ‘seed sites’ nominated by the user, extracting hyperlinks to other sites.” (Ackland 2011, p. 185). This web crawl collected both ‘outbound’ links (web pages that the seed sites *link out to*) and ‘inbound’ links (web pages that *link in to* the seed sites). Inbound links were collected via the Blekko API. Further, the internal links for each of the seed sites were collected (to a maximum of 1500 pages). This enabled intra-website analysis to examine the internal linking structure within each seed site. Figure 1 provides a graphical visualisation of the web crawling process.

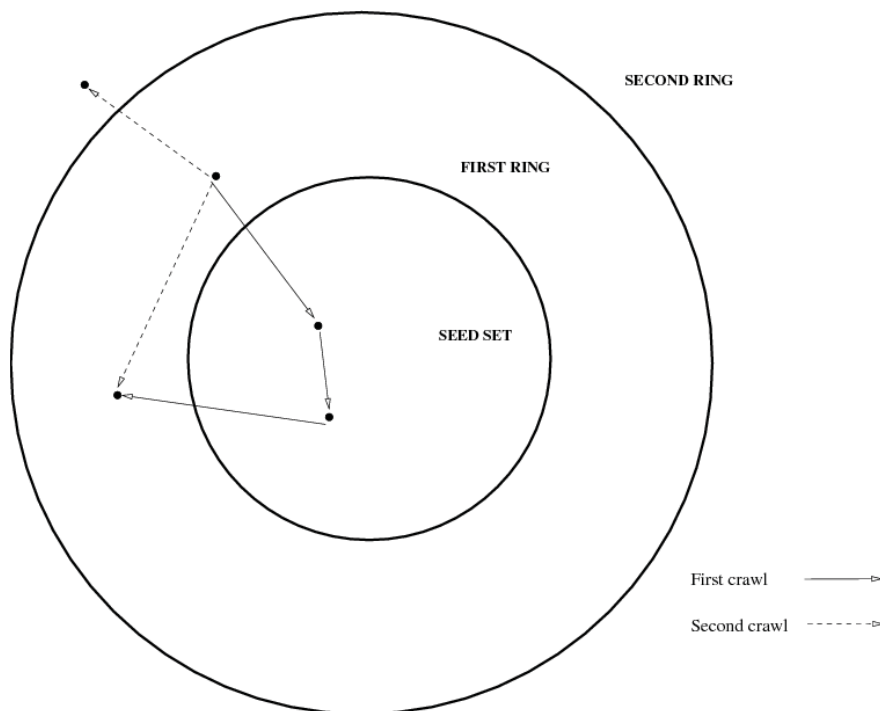


Figure 1: VOSON web crawling methodology

Stage Two involved finding the outbound links for pages that were discovered during Stage One (these pages are known as the ‘first ring’). Hyperlinks between pages in the first ring were mapped during this process, resulting in a network of nodes (i.e. web pages). Next, ‘pagegroups’ were created from pages in the first ring, to enable network analysis between websites (i.e. domain names) rather than only between individual pages. Thus, each node in the network is a collection or grouping of pages (generally a single domain name), rather than just individual webpages. Only websites with more than one connection to the rest of the network were included in the subsequent analysis. This resulted in three policy networks where each node represents a separate website/domain name.

Stage Three involved classifying, or ‘coding’, each website according to the policy domain it belongs to (e.g. health, education, community services) and which tier of government (e.g. national, regional, local). Although only three policy domains are examined in this paper, websites were coded among a list of 48 possible policy domains or uncoded. This process was performed manually by visiting each website and coding according to whether it related to a specific policy domain or pertained to a particular tier of government. However, as Escher *et al* (2006) identify, it can be challenging to determine which government websites are encompassed within a particular policy domain. Therefore, a coding schema was developed to describe the rationale for coding websites. This promoted a more consistent approach to data interpretation and recording of the coding methodology. Given the qualitative nature of this work, cross-checking of data between researchers was employed to address issues relating to rigour. These coding data were imported back into the VOSON pagegroup database for analysis.

Data analysis was conducted first by analyzing the seed sites level analysis and then the three policy networks.

3. Analysis of seed sites and their connections

Table 1 presents key webmetrics for the six government seed sites. ‘Size’ indicates how many webpages are contained in the pagegroup for each seed site (i.e. number of internal pages within the website). ‘Out’ refers to the amount of outlinks, which is the number of websites that receive links from the seed site. ‘In’ refers to amount of inlinks, which is the number of websites that link to the seed site. ‘Ratio’ is calculated as inlinks divided by outlinks; namely the number of pages of the website, the number of incoming hyperlinks and the number of outgoing hyperlinks, and the ratio of in-to-out hyperlinks. As with previous research (e.g. Whalen, 2011), consideration is also given to ‘normalising’ the in and out going hyperlink statistics to adjust them to reflect the overall size of the website. ‘Adjusted’ hyperlink statistics derived by dividing by the website size are listed in brackets.

Table 1: Seed site statistics

Policy Domain	Seed site	Total web pages	Outlinks (adjusted)	Inlinks (adjusted)	Ratio
FA	http://www.fco.gov.uk	2555	114 (0.045)	1256 (0.492)	11.0
Ed	http://www.education.gov.uk/	1917	44 (0.023)	872 (0.455)	19.8
	http://www.educationscotland.gov.uk/	302	13 (0.043)	137 (0.454)	10.5
He	http://www.dh.gov.uk/	2438	129 (0.053)	1052 (0.432)	8.2
	http://nhs.uk/	45598	1728 (0.038)	1404 (0.031)	0.8
	http://www.show.scot.nhs.uk/	16	0 (0.00)	374 (23.38)	#DIV/0!

One might reflect on what the size of a website may reflect, for example, size or complexity of the associated organization (assuming that the website corresponds to a particular agency), the size or complexity of legislation, services or relevant service populations, or the importance of the agency. The government seed sites vary from 16 webpages (Scottish NHS) to over 45 thousand (national NHS). Unfortunately, technical problems in webcrawling meant that the Scottish NHS webmetrics are not valid (for example, no outlinks were recorded). Despite this, there does appear to be a pattern of Scottish government websites having fewer webpages than their national equivalent.

The number of outgoing links reflects the 'extroversion' of a website. One might consider that this also reflects the 'extroversion' of the associated government entity, and reflective of such things as service delivery partners, related policy and service areas, key stakeholders, or important external information sources related to the content of this website-Government entity. Apart from the problematic Scottish NHS site, the number of outgoing links ranges from 13 (Scottish education) to 1728 (British NHS). Looking at policy domains, health websites tend to have more outgoing links than foreign affairs, and education has fewer still. This may be reflective of the importance of health and the wide variety of health related websites, but one might also expect this of education as well. Given that a smaller website might be expected to have small outlinks, the adjusted outlinks data (i.e. outlinks/webpage) shows that for every seed site there are on average less than one outgoing hyperlink for every ten pages. Government websites appear to be constructed with few external hyperlinks. This could be interpreted as government sites being authoritative in nature and not very interactive as well (i.e. Web 1.0 more than Web 2.0).

The number of incoming hyperlinks reflects the visibility of a website to the external online world. Incoming links range from 1404 for the national NHS website to 137 for the Scottish education website. Again, there appears to be a larger 'visibility' among national government websites than the regional-Scottish websites. Normalising inlinks takes account of the size of a website, shows a much greater homogeneity between the seed sites with four of the six sites having between four to five inlinks per ten pages and one site about three per ten. The Scottish NHS with 23 inlinks per webpage is not trustworthy. While adjusting for website size may make sense, it could also be argued that the size of the website is not especially important for determining inlinks, but the website as reflective of the importance of the associated government entity/domain.

The logic underpinning the ratio measure provides an indication of how introverted a website is in terms of its linking practices (see for example: Escher et al, 2006). That is, a higher ratio suggests that the website is less likely to reciprocate links with websites in the broader policy network. With most seed sites have approximately 10 to 20 inlinks for every outlink, the general trend is that most seed sites tend towards introversion. The exception being the British NHS site which has very similar number of inlinks and outlinks, primarily due to its unusually high number of outlinks.

The websites that a government website links outwards to makes a statement about the importance of websites (and their associated agencies) to that government entity. It would be expected that variations in the nature of the government seed site (eg. policy domain, tier of government) is likely to shape these linked sites. Whilst a detailed analysis of these outlinking sites is beyond this paper, a few key observations follow.

Firstly, the government seed sites link to other British websites more than any other country, and non-country specific sites (e.g. .com, .net and .org) are the second most linked sites. Perhaps unsurprisingly, the foreign affairs website has more international linkages than the other policy domains.

Secondly, the government sites have a high level of outgoing connection to commercial (.com/.co), government (.gov/.go) and organizational (.org) sites. The foreign affairs and education domains link more to other government sites than any other category, whereas the health seed sites link most to organizational sites.

Thirdly, the seed sites tend to link to other websites in the same policy area and with websites that are central to government. There is also a high linkage to websites with no clear policy area and to social media (such as Facebook and Twitter).

4. Network analysis of policy network

While the focus to date has been on the seed sites and their linking quantity and quality, the second concern of this paper is to understand the shape and nature of online policy networks, as generated from the seed sites. Recall that these networks include all the sites (or neighbours) that are connected at least twice to a seed site by either an ingoing or an outgoing hyperlink and the hyperlinks between these neighbours. This is what is also called a 1.5 degree ego net (Ackland, 2013). Hence, the networks contain only websites that link directly to the seed sites.

The three policy web networks are of various sizes, ranging from 1022 to 3754 websites (see Table 2). The density of a network is defined as the ratio of existing edges to potential edges. Density provides an index of the degree of dyadic connection in the network, in this case websites forming pairs of connections.

Table 2: Policy network statistics

Subnetwork	Nodes	Edges	Density
Foreign affairs	1331	11088	0.006
Health	3754	35549	0.003
Education	1022	9171	0.009

Visualisations of the three policy networks are provided in Figure 2 to 4. The colour schemes represent ‘modularity classes’ (i.e. there is some kind of community structure occurring between nodes of the same colour) and the size of nodes is relative to their ‘in-degree’ (i.e. larger nodes have more inlinks). As community detection in the subnetworks is beyond the scope of this paper (see instead Henman et al, 2014), modularity class has been utilised here for convenient visualization of the graphs. Unsurprisingly, the large nodes in the network are primarily seed sites.

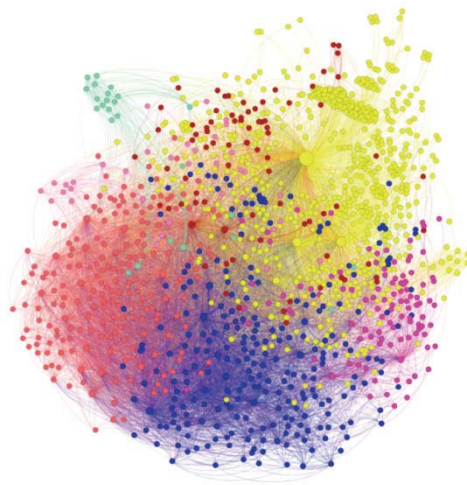


Figure 2: Foreign affairs policy network visualisation



Figure 3: Health policy network visualisation

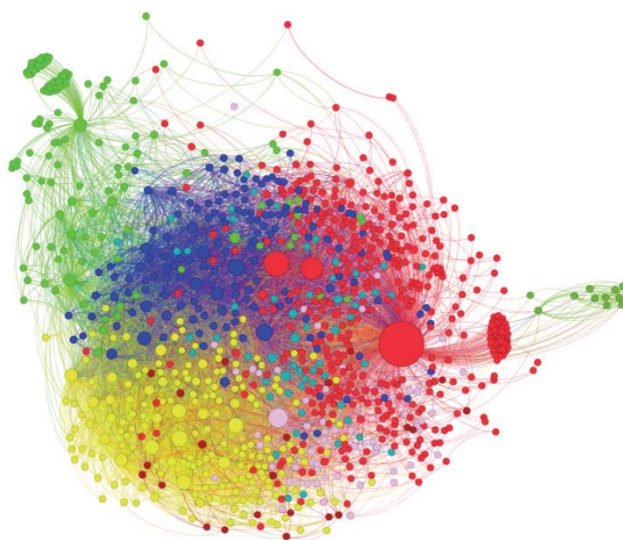


Figure 4: Education policy network visualisation

In the last few years a wide range of analysis techniques have been developed to analyse networks. A key issue in analyzing networks is to identify the important nodes in a network. What is meant by ‘important’ is defined differently and in relation to directionality. Google’s PageRank algorithm defines importance as follows: “a webpage is important if it is pointed to by other important pages” (Langville & Meyer, 2006, p. 28). In this paper we have utilized Kleinberg’s HITS algorithms (Kleinberg, 1999) which produce two inter-related scores: Authority; and Hub. *Authority* estimates the value of the content of the page. *Hub* estimates the values of the page’s links to other pages. In short, a high authority site is one in which lots of sites tend to point, a high hub site is one which points to a lot of sites. Authority and hub are co-defined in a mutual recursion – i.e. ‘authority’ is calculated as the sum of scaled hub values; ‘hub’ is calculated as the sum of scaled authority values. The algorithm calculates and updates these values through a series of iterations.

Table 3: Authority scores for policy networks

Authority			
<i>Policy network</i>	<i>Rank</i>	<i>Website</i>	<i>Score</i>
Foreign affairs	1	http://www.fco.gov.uk/	1.0
	2	http://twitter.com/	0.588692736
	3	http://facebook.com/	0.572631442
	4	http://www.direct.gov.uk/	0.364710581
	5	http://youtube.com/	0.360650499
Health	1	http://nhs.uk/	1.0
	2	http://www.dh.gov.uk/	0.897797078
	3	http://twitter.com/	0.859443032
	4	http://facebook.com/	0.780747991
	5	http://www.direct.gov.uk/	0.697962488
Education	1	http://www.education.gov.uk/	1.0
	2	http://twitter.com/	0.666689703
	3	http://facebook.com/	0.598395981
	4	http://www.direct.gov.uk/	0.53429954
	5	http://www.dwp.gov.uk/	0.432496618

Table 3 provides the top five Authority sites for the three policy networks. It is notable that the top authority score in each network is one of the seed sites. This is an artefact of the way in which the networks were generated, so caution is required in interpreting the results as the numbers may overstate their importance. It is worth noting that the Scottish health and education sites do not appear in the top five authority sites (being

24 and 51 respectively). The other top authority sites are social media sites – specifically Twitter and FaceBook – and the British government web portal, www.direct.gov.uk. Interestingly, the education network also includes the British Department of Work and Pensions (www.dwp.gov.uk) as the number 5 authority site. Interpreting these results is that the two social media sites reflect authority sites in that most organization websites now have a Twitter and Facebook account and have links to them from their homepages. Thus, organisations have a high linkage to these social media sites. At the same time, the government portal would naturally be expected to be a site to which other sites link. The appearance of the Department of Work and Pensions site in the education list is interesting. Although a large and important government policy agency, it is not the actual delivery agency, which is the Benefits Agency, nor is it directly responsible for education. Its importance is likely to reflect its central importance in social policy more generally.

Table 4 Hub scores for policy networks

Hub	Rank	Website	Score
Foreign affairs	1	http://wordpress.com/	1.0
	2	http://wikipedia.org/	0.977038438
	3	http://wired-gov.net/	0.92503357
	4	http://www.fco.gov.uk/	0.915480617
	5	http://nhs.uk/	0.915407201
Health	1	http://nhs.uk/	1.0
	2	http://wired-gov.net/	0.591554617
	3	http://wordpress.com/	0.54286114
	4	http://bbc.co.uk/	0.537609162
	5	http://guardian.co.uk/	0.508917735
Education	1	http://wordpress.com/	1.0
	2	http://nhs.uk/	0.985175263
	3	http://guardian.co.uk/	0.946759062
	4	http://wired-gov.net/	0.945866592
	5	http://bbc.co.uk/	0.943071504

The hub scores are for sites which are highly connected outwards, like an octopus. Table 4 illustrates a different picture than the authority scores from Table 3. Only two government websites (both seeds) appear in the list of top five hub sites. The foreign affairs seed site (www.fco.gov.uk) appears in the foreign affairs top hub sites. More surprisingly, the British NHS site is a top hub site in *all* policy domains, potentially reflecting its links to key authority sites. The top hub sites in the three policy networks, apart from these two seed sites, are largely publishing sites. Wordpress.com is a free and open source blogging tool and content-management system. Wired-gov.uk is a specialised news alerting service, with a focus on government and public sector news. Wikipedia is an online open encyclopaedia, whereas, the BBC and The Guardian websites are for news organisations. In each of these five sites, it makes sense that they would contain content with a high linkage to government or policy-related sites.

5. Conclusion

This paper undertook to examine the role of key British government websites in different policy domains (foreign affairs, health and education) and in national and regional (i.e. Scottish) jurisdictions. The paper undertook two levels of examination: examining the sites as a node in a network; an examining the network derived from those sites as a network. Looking first at the websites themselves, there appears to be a pattern of websites from smaller jurisdictions (i.e. Scotland) being smaller in size and having less visibility in the web in terms of number of incoming hyperlinks than larger jurisdictions (i.e. UK). However, the variation in visibility disappears when accounting for the size of each website. This does suggest that jurisdictional significance is to some extent reflected in the online world. Moreover, on the whole government sites have approximately 10 to 20 times more inlinks to outlinks regardless of the size of the website. This suggests that government sites, at least in these policy domains, are of significance for external websites, thus they remain ‘authoritative’ and important in the online world, which arguably reflects their importance (or nodality) in the everyday institutional and political world as well (cf. Hood & Margetts, 2007). Secondly, this paper examined the various online communities derived from a collection of key British government policy/service delivery websites. Key government sites are of high importance in the resulting network (as measured by the HITS Authority

algorithm), although this finding is arguably artefactual given they are seed sites. However, the high authority score of the British government portal www.direct.gov.uk is not artefactual. This finding is perhaps not surprising and is reassuring to government web strategy. Furthermore, this portal site competes with social media sites Twitter and Facebook for authority in the policy networks. Analysis by the HITS hub algorithm found that media sites are key in each policy network, providing a high level of links to important authority sites. This finding points to the continued importance of government web strategy to ensure the ongoing online visibility of their sites to other organisations through their websites. While these findings provides some confirmation that government website are partially shaped by their jurisdictional, organizational and policy location, further analysis of the different policy networks is needed to identify the nature and dimensions of these relationships. We are currently examining these relationships, then extending the analysis to other policy domains and to comparisons between Australia and the UK government on the web. How the role of government on the web is evolving as websites and in networks remains an important task for future research.

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