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Information governance in digitized public administration

Abstract: As the public sector increasingly transforms itself and its processes through digital technologies, information—the prime resource—the governance of information, and the need for advanced information skills, have moved to centre stage. Information governance processes form a critical bridge between the legacy systems of the past and the agile and mobile platforms of the future. Describing the forces at play, which include new information formats, modes of transmission and uses but also new skills and governance requirements, this article proposes an information governance-centred research agenda. Considering information governance through a holistic lens is essential to ensure that the new possibilities available through technology can be leveraged to transform government, while government information itself is preserved as the essential tool for current and future government decision-making, as a critical service to the public, as public memory, and as the foundation for public sector accountability and transparency.

Sommaire : Alors que le secteur public et ses processus se transforment de plus en plus par le biais des technologies numériques, l'information – la première ressource – la gouvernance de l'information, et la nécessité d'avoir des compétences numériques de pointe sont parvenues au premier plan. Les processus d'information de la gouvernance constituent une passerelle cruciale entre les anciens systèmes et les plateformes agiles et mobiles de l'avenir. Cet article décrit les forces en jeu, qui comprennent des formats d'information, des modes de transmission et d'utilisation nouveaux, ainsi que de nouvelles compétences et exigences en matière de gouvernance; il propose un programme de recherche axé sur la gouvernance de l'information. Il est crucial d'aborder la gouvernance de l'information par une approche holistique afin d'assurer que les nouvelles possibilités offertes par la technologie puissent être mises à profit pour transformer le gouvernement, tandis que l'information gouvernementale est elle-même préservée en tant qu'outil essentiel de prises de décision actuelles et futures, service fondamental au public, mémoire collective, et fondement pour l'imputabilité et la transparence du secteur public.

> What information needs to be created and acquired; for what purposes; who will have access to it; will information be shared, combined, and integrated to solve increasingly interconnected problems; will it be used to promote political and public debate and genuine stakeholder participation; who will own and control the information; how will its security, integrity and value be protected; and who will be responsible for making decisions about these issues? (Lipchak 2002: 3)

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Information is, along with money and people, a core resource of public administration. It informs decision-making about public policy and public management, supports the provision of services to the public and constitutes a service in itself; it provides a record of government activity for current and future use, and by extension is the basis for accountability within the public sector and to Parliament and the public. Information ("nodality") is one of the four essential tools of government (Hood 1983). A considerable part of government activity is founded on the collection, production, processing, analysis, use and reuse, dissemination, protection, disposal and long-term retention of information. This information life-cycle underpins all areas of public administration[1] and is particularly important in those touching on the relationship between government and society, including service to the public, public communications, access to information and protection of personal information (privacy) and of sensitive information held by the State (security).

An essential characteristic of information is that it can be held in many forms and transmitted through many media. These technological variables have shaped the nature and reach of government. Public administration in 1867, which depended on paper and the postal service, was by 1917 transformed by the typewriter and telephone; by 1967 it was absorbing electronic data processing and photocopiers; and in 2017 it is operating in the digital environment of mobile networks and big data. Earlier forms persist, and each new wave of technology has added to government capacity but also to the complexity of managing its information.

Information governance is an emerging concept that captures the more purposeful approach to government information that is required in the digital era, where information assumes an even more central role (Hood and Margetts 2007). It is both relatively new and still being defined. An umbrella concept, information governance incorporates consideration of policies, procedures and technologies that are essential to managing information and data through their life cycle (Kooper, Maes and Roos Lindreen 2011).

It also seeks to encourage behaviours in people and institutions that foster an information-centred organizational culture. The focus is on the body of information available to an institution, complementing information management's more traditional focus on individual records and items of information. As stated by a private sector-supported think tank, information governance concerns "the activities and technologies that organizations employ to maximize the value of their information while minimizing associated risks and costs" (Information Governance Initiative 2013–2016).

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Information governance in digitized public administration, then, is about the capacity to make effective use of all information resources (records, published, electronically-held data) that lie at the heart of governance and public administration. The nature of a government's information holdings – of what it knows – is as complex as government itself, providing its memory, on the one hand, and raw material for its current and future activities on the other. Government information is also of critical importance to the economy and society as a whole; much of it is sensitive, to the individuals and corporations from whom it is collected and to the national interest, and requires special handling in order to maintain its integrity and continued availability. Notwithstanding the centrality of information to what government does, however, the management of information as a public resource has received uneven attention from both public administration practitioners and academic researchers. This continues to be the case in the administrative environment shaped by digital technologies.

This article establishes the requirement for research on how information governance can provide a foundation, in a digital world, for government information to meet current needs while ensuring it remains a core resource over time. To provide context, the article begins by highlighting the tensions and pressure points in our increasingly digital environment. It then surveys the insights that the available literature provides into information governance; the field draws on a wide range of academic disciplines but in many ways is still in its infancy and has only to a limited extent focused on the specific environment and concerns of public administration. The final section sets out a research agenda to frame and examine the challenges faced by information governance and management in digital public administration.

Riding the tiger: information governance in an open-ended technological environment

Public sector information governance, building on a deeply-rooted institutional environment and culture, carries with it an enduring set of issues and themes. These relate to how government manages its stock of information as an end in itself, but they also underpin government's relationship with citizens, its role in the economy and society, and the processes of public governance rooted in the rule of law and principles of transparency and accountability. The digital environment adds new urgency to many of these themes, introduces others and in any case adds an unprecedented degree of complexity and velocity. To take one example, what is described as big data is in many ways not a new phenomenon, but with rapidly expanding capabilities of extraordinarily powerful search engines and analytic tools it

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has introduced new dimensions to information management while disrupting well-established assumptions that are not, however, about to disappear in the near future – notably with respect to the legacy legal and administrative framework for records-based information management that was put in place after passage of the *Access to Information* and *Privacy (ATIP) Acts*.

A defining characteristic is that the new dynamics are open-ended and rapidly moving, even accelerating. An abiding challenge, therefore, is to reconcile the legacy and the new, addressing them as separate spheres but increasingly also treating them as parts of an integrated whole (Council of Canadian Academies 2015). This situation creates opportunities for fresh and better uses of information (Hood and Margetts 2007), but the inherent instability and uncertainty also carries significant risks. The article begins by examining these issues.

The permanence of uncertainty

The open-ended nature of technological development – which is largely driven in and by the private sector – creates ongoing tensions between new possibilities, actual (but evolving) requirements, and a substantial legacy environment that will not entirely disappear. As it must be assumed that a significant portion of government information resources held at any given time will continue to be held for time periods that will outlast current technological platforms, the inherently unstable nature of the digital environment poses major challenges in terms of investments, management and governance of information, entailing a never-ending process of change management. These dynamics do not lend themselves easily to a uniform approach, as different components of the public sector information environment will be moving at different paces at different times.

The changing nature of information

A pervasive requirement is understanding what is encompassed by government information. External publications and internal records are clearly included. But what about new forms in which information is held and transmitted in the digital era? The universe of government information is a moving target. The Government of Canada currently defines an information resource as: "Any documentary material produced in published and unpublished form regardless of communications source, information format, production mode or recording medium." (Canada. Treasury Board Secretariat 2015) The categories that illustrate this list are wide-ranging: textual records, electronic records, new communication media, publications, films, sound recordings, photographs, documentary art, graphics, maps, and artefacts.

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Historically the vast majority of information has been held in the form of paper records and publications; these are still important, as part of the institutional memory and on an ongoing basis. Governments have held information in electronic data bases since the 1950s (Canada. Royal Commission on Government Organization. Glassco 1962), and digital formats came into their own with the widespread adoption, beginning in the 1990s, of personal computers, electronic networking and Web-based service delivery, both within government and in society at large (Rowland 2006). In the past decade, mobile technologies and social media have compounded the diversity and numbers of formats in which information is held (Moss 2015). Looking ahead these trends will continue and accelerate, bringing into the mainstream rounds of technologies and related forms of information that are currently unknown or on the periphery. These changes in information media and format result in a greater capacity to convey and share information both within and outside government, and contribute to a state of information abundance that characterizes the emerging environment (Roy 2016; Lips 2016). Paradoxically, there is also a risk of information scarcity as material that is posted – and in that sense published – on government Websites risks being hidden or even disappearing as Websites are restructured and updated, with incomplete archiving and often opaque navigation.

While electronically-held data have been part of government information management for decades, in the digital-by-default environment, data and data management have come into sharp focus, raising a host of new questions relating to the nature of data and how it fits with more established approaches to information management and governance. Data issues arise from two current and related trends, open data and big data (Clarke and Margetts 2014). Open data involves ensuring the data collected by the government is publically available, at minimal or no cost, to be reused by individuals and organizations to create new businesses, applications, or to facilitate data-driven decision making (Gurin 2014). Governments are responsible for ensuring their open data repositories adhere to appropriate standards – including respecting personal and commercially-sensitive information – and that the information is easy to use and understand. Governments, in the nature of their socio-economic roles, as well as their unmatched ability to collect data, are also expected to maintain standards of data integrity and quality. These qualities of open data are challenging and still in flux.

Discussion of big data, by comparison, is generally focused on the characteristics of the stock of data, for example high volume, high velocity and highly varied data, but also on the computational and computing power necessary to work with and analyze this data universe (Gartner 2016). As noted by Gurin (2014), much big data is not public, and not all open data is big data. Big data does present a new set of management situations and

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challenges for public administration, however, in particular when on the boundary between internally-held records and information in the public domain. An area of growing interest is the potential for innovation at the intersection of big and open government data, as showcased through organizations such as GovLab (http://www.thegovlab.org/).

Constraints on change

There is a consistent requirement to adapt public institutions and procedures to the available technologies and what they offer – both to realize their potential but also to ensure that public administration is able to stay in touch, and on a wavelength, with the segments of society that are making the same adjustments (Johal and Galley 2014; Roy 2016). For example, government needs to adopt social media not just because they offer interesting possibilities but because important demographics in society are heavily oriented to using them, often to the exclusion of more traditional forms of communication. At the same time, however, the adoption of new technologies is not uniform in society, and neither are the technologies that are being adopted. In addition, government – unlike the private sector – in the nature of its role cannot choose to exclude elements of society that are unable or do not wish to move at the same technological pace. Governments have, for example, from the outset integrated electronic services with more traditional service channels – including telephone access, information kiosks, online and face-to-face (Kernaghan and Gunraj 2004); while they continue to maximize digitally-based service channels there is no suggestion that they consider that it is either desirable or even possible to eliminate the other channels.

A different constraint arises from the cost and logistics of introducing new technologies and systems of information management. This is particularly challenging because major investments are often required, but in situations where the underlying technological and managerial assumptions are changing even as they are being implemented. These are significant contributors to the notoriously poor record of major IT modernization projects, whose purpose is to house and process information. The resulting challenges are both managerial and political.

Reconciling new information dynamics with legacy system needs

A central challenge of information governance is to reconcile the elements of the new information environment with an extensive legacy of information-related legislation, policies, institutions and practices. Policies and procedures will continue to move to digital-by-default, but particularly

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those rooted in citizen rights and the public interest, such as Access to Information and Privacy, and administratively focused on records rather than data will at least partly retain their historical focus. There are also issues arising from the transition of government publications and libraries from a paper-based to a digital environment, including the implications for programs such as government depository libraries (Wakaruk 2014; Council of Canadian Academies 2015). Similarly there will be ongoing migration to digital from earlier formats in the case of the information holdings themselves, but there will also be substantial paper-based holdings to manage for the foreseeable future.

Towards digital-era public administration

These forces raise questions for public administration more widely. The most fundamental concern responsibility for information management and stewardship, creating tensions between individual and collective roles and accountability for all stages of the information life-cycle. Networked technologies and consolidated data management are inherently collective functions, while under ATIP and related information policies responsibility is assigned to ministers and their institutions individually (Brown 2013). Similar issues arise with respect to big data, to the extent that databases are stocked, administered or used by more than one responsibility centre.

Digital public administration reshapes the information-related skills that every public servant requires but also specialized functional disciplines, skills and governance processes that are needed by government institutions, individually and in combination and in both their vertical, individual and their networked, horizontal contexts (Jordan and de Stricker 2013). Additional skills also need to be held more widely to deal with the increasingly important and complex working relationship with the private sector and other suppliers of information and communications technologies, on the one hand, and users of government information, on the other (Council of Canadian Academies 2015).

A final element is under-investment by governments and parallel pressure from them to realize substantial savings (Wakaruk 2014). In the absence of good data on the cost structure of information management in government, anecdotal evidence suggests it has been overshadowed by the management of information technology, where a driving force has been to realize savings from automation of information management functions and reduction of related staff costs. This has generally involved a move to self-service-based services to the public and to public servants, which, however, places additional demands on the user and – as the federal government's

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move to the Phoenix pay administration system has demonstrated – can carry significant risks (Burke 2016).

These pressures cumulatively call for study of information governance by the public administration academic discipline. Yet, as discussed in the next section, to date conversations have been siloed across a diverse set of increasingly related fields, including library, archives and other information-defined disciplines, but also computer science in general and data management in particular. In many respects, public administration is the weak link in this disciplinary chain, but it is also one that is crucial as information and data play a foundational role in digital governance and administration.

A fragmented literature

What do we know about public sector information governance? Various disciplines have begun examining the move to digital, summarized in the Canadian federal government context as open data, open dialogue and open information – the structural components of its Open Government portal (Canada. Open Canada 2016). The majority of a growing literature has been descriptive and anecdotal, rather than substantive studies that incorporate models and theories (Lips 2016, Redden 2015, Roy 2016), and has tended to focus on technology and systems, rather than considering new types of information assets and mechanisms for sharing (Tallon, Ramirez and Short 2013). While the situation is fragmented, there is also an opportunity to bring together useful insights from a range of perspectives.

The aspect of public sector information governance that has generated the most interest is open data. The Government of Canada's Directive on Open Government anticipates a future in which "Canadians are able to find and use Government of Canada information and data to support accountability, to facilitate value-added analysis, to drive socio-economic benefits through reuse, and to support meaningful engagement with their government" (Canada. Treasury Board Secretariat 2014). In contrast, however, most studies to date have focussed on describing the empirical uses of open data, or the design of technology and systems, with limited attention to the transformative possibilities (Roy 2016; Lips 2016). Only a few studies have linked open data to innovations or provide measures of its economic impact. The potential for current open government initiatives to transform the relationship between citizens and their governments is not yet visible on a large scale. There has been limited discussion of the skills needed within both government and the public to work with data effectively (Jaeger and Bertot 2011). Opening data, information and government assumes an information-sharing culture, however changing governments' information culture has been identified as challenging (Wright 2013).

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By comparison there has been less interest in the records management, library and archives disciplines in a digitized public service. As noted by Lowry (2015), there is a vibrant conversation regarding critical issues at the intersection of open government data and records and archives management, but it is largely taking place in social and similar media but not in scholarly communication. Additionally, there are differing perspectives on key terms; for example, archival science and data management define the same terms differently, making conversation across disciplines challenging.

Lowry (2015), concludes that research has focused on questions related to access to data, with limited discussion of critical topics such as data quality. Technological standards are well documented, but the subject-specific knowledge of the records and archives fields has not been substantively discussed outside their domain. Key topics such as data preservation over time have not been fully considered. Emphasizing the existence of research silos, the examination of data visualization was also absent from the literature on open government data, while it can be found within computer science, data management, geographic information systems, and electrical engineering. An exception is the work of Desrochers (2011), who is looking at visualization as a way of increasing awareness and understanding of what government information is available to the public within the Canadian federal government. Léveillé and Timms (2015), in their article on using a records management lens to create a framework for trust in open government and open government information, point to more substantive discussions emerging that are grounded in archival and records management practice.

Similarly, there has been limited examination regarding how information management functions within governments are adapting to digital technologies. As highlighted in the previous section, information management has moved from a centralized function coordinated by records and information management specialists to a decentralized model where all employees must determine what is of business value and take steps to preserve such information. Policy work has been done in the federal government to adapt information management principles; however these policies have not been embraced in practice (Jordan and de Stricker 2013). As with open data, a core issue is the difficulty changing culture and ensuring that all employees are aware of, understand, and use information management policies (Wright 2013).

The Expert Panel convened through the Council of Canadian Academies (2015) attempted to address some of these perceived gaps. The panel, while optimistic about the opportunities of digital tools for Canadian memory institutions, highlighted serious concerns. They found that most federal and provincial government agencies are currently not safeguarding information for usefulness, employees find it difficult to assess value, and are

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saving everything, increasing future information management challenges. Beyond issues related to saving, the current decentralized model has led to less metadata being created, meaning information is less findable. The lack of copyright legislation that fully addresses digital realities was identified as a barrier. The role of memory institutions in ensuring reliability and authenticity was identified as increasingly critical in a Google world – and this study occurred before the recent issues with "fake news". The goal of becoming a reliable source of information can be aided by building trust through the creation of strong and meaningful relationships with the public. Based on this report changes are being implemented, but much more needs to be accomplished.

An enduring theme with government information is access: who has access to government information, and where are there barriers? The analogue world had an established process of depository libraries, originally established in furtherance of government's duty to inform the public about government programs and services and public rights and obligations. Within the digital world there is an assumption that all information is electronically available, which makes it accessible to all. There is little academic research into the effects of these changes, although government librarians are working to draw attention to the gaps in the systems (Wakaruk 2014). There has been some related research by public administration scholars, including on Access to Information (e.g., Roberts 2005), Privacy (e.g., Bennett 2003) and government communications (e.g., Thomas 2013, Glenn 2014); a major concern of this research has been the political sensitivity and growing risk of politicization of these administrative areas.

Canada has been a leader in parts of this conversation. We can also look to countries such as the United Kingdom, the United States, Australia and New Zealand for a robust information management discussion (Australia. Office of the Australian Information Commissioner 2012; Lips 2016), although as with any comparative discussion the differences can be as instructive as the similarities.

In sum, in order to take advantage of digital opportunites, more holistic and integrative studies are needed – but possible – that link the wide range of available disciplinary insights into information governance. To facilitate this, there needs to be a platform to discuss the broad agenda – what are the goals of information governance, what set of policies, tools and governance models will work best to support the new as well as the existing forms of information, and the new modes of information sharing, mobile access, and co-creations? How will we know that we are getting it right? These questions point to the need to return to information fundamentals in the changing digital environment and serve to drive the research agenda outlined in next section.

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An information governance research agenda

This discussion sets out a clear set of research imperatives. The research challenge is both to provide greater insights into the information governance terrain from a digital public administration perspective and to gauge the dynamics and direction of the changes that the terrain is undergoing. The goal is to make the most of the potential of the technologically-enhanced environment while mitigating its potential costs and pathologies. This situation is inherently both enduring and unstable. It suggests four broad research themes, each with a number of dimensions. In each, an underlying theme is to link with relevant research in other disciplines.

1. Information as a core asset of digital public administration

Information has always been a central medium of governance and, in that context, a core asset of public administration; it will only be more so in the digital future. There is, however, work to be done to understand its role and governance.

Defining information as a public resource

A basic task is to define the nature and characteristics of information as a public resource. While concepts such as the information hierarchy – which positions data as the foundation for information and through that knowledge – are available (Rowley 2007), along with other foundational concepts coming out of the discipline of information studies, they have only to a limited extent been considered specifically in the digital public administration context. For management purposes, public sector information in the past generation has been categorized as either internally-held records or published material, with data a subset of both spheres. But what happens to these categories when information is digitally produced, held and shared? When the nature and availability of data expand exponentially to become "big data," creating a situation of digital abundance, and data analytics, machine learning and artificial intelligence become major focuses both inside and outside government?

Valuing information

A related challenge is to value information as a public resource. Unlike public sector financial, human and material resources, there are no direct and very few indirect measures of what information is in a public sector, how and how much of it is held by government, or what it is worth.[2] This applies to both paper and digitally-held information and data. Identifiable costs can

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be associated with the physical demands of managing paper records[3] and published materials and with building and operating digital devices, electronic databases and the means of linking them together, but even this has not in fact been done systematically or in a way that enables a managerial or observer's understanding of public information resources. Similarly, governments can calculate salary costs of public servants working in identifiable information disciplines. But there is no framework to link these and related sightings of information resources together or to manage them in a comprehensive and enduring way as an end in themselves.

Consequently, there are no information "public accounts," either for the stock of information holdings or to monitor the dynamics of those stocks, and there is therefore no basis for assessing information value for money or the performance of government as an information manager. There has been initial discussion outside government of infonomics – the methods of quantifying information asset value (Laney 2012) – but as yet there are no established metrics. As governments increasingly move to open data models, studies that examine the indirect and direct value of open data to economies are emerging (e.g., Australia. Bureau of Communications Research 2016), but more work in this area is essential.

Information ownership and accountability

If there is no concrete understanding of what public information resources are or what they are worth, it follows that there is even less insight into the dynamics of the information-related environment and how the pieces fit together. Basic issues of responsibility and accountability arise (Jordan and de Stricker 2013). The legacy records-based information environment and key features such as the ATIP regimes are founded on vertical accountability models, at the apex of which are the roles assigned to Ministers, as "Heads" of government institutions, for decisions relating to records management and release.[4] This is in tension with the inherently collective, horizontal, nature of electronic records (Brown 2013); it is compounded by recent federal government decisions to consolidate electronic data holdings into seven common data centres (Canada. Auditor General 2015), raising new questions, including: who "owns" the data and is responsible for its management? Who has access to it, and how does this access fit with open data commitments on the one hand and ATIP provisions on the other? What happens when publicly-"owned" data are held and transmitted in and through privately-owned and managed environments, including the "cloud"? (Paquette, Jaeger, and Wilson 2010) And when the cloud and more tangible storage and transmission facilities are not necessarily physically located within Canada (and therefore under the authority of Canadian

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jurisdictions)? These important issues need to be understood in the context of current technologies.

Mapping the information ecosystem

These issues, then, call for basic work to be done to "map" the public information and related technology sphere and its characteristics and to position this administrative ecosystem in relation to the wider public administration environment. With an improved understanding of the terrain it will then be possible – as a matter of both academic and practical understanding – to gain better insights into the change dynamics and associated opportunities, risks and management challenges.

2. Information governance institutions and processes in the digital environment

The ultimate test of information governance is facilitating the effective use of information within the broader framework of public policy – more accurately, within the galaxy of public policies in different domains, including those relating to the management of the public sector itself as well as those oriented towards Canadian society and the economy. These demands are often poorly aligned, even contradictory, and a central role of information governance is to manage these tensions.

It is therefore important to identify and understand public sector information and technology governance institutions, legislation, policies and actors, both those that exist and those that are required going forward. This includes how authority over information is assigned and how decisions about it are taken. In most instances information governance is embedded in broader corporate (i.e., with government-wide authority) administrative institutions that are ultimately linked to Cabinet decision-making. In most instances, too, the core institutional models were established before the emergence of ICTs. Although there has been some adjustment in response, an underlying question is whether the models as currently operating are adequate for current and future requirements. That is the subject of this research theme.

Information leadership – the CIO and beyond

The federal, provincial and territorial governments have all adopted, in some form, the private sector ICT leadership model of a Chief Information Officer (CIO), or in some jurisdictions a Chief Digital Officer.[5] There has, however, been considerable variation with respect to the CIO's organizational location and role and responsibilities. Variables include the personal

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standing of the CIO and whether their office is a separate agency or linked to the wider corporate management environment; whether their mandate is focused on management of technology or also includes information management (and how widely that net is cast); what role they play in public sector reform; and, ultimately, what their leverage is within their jurisdiction, including their authority over budgets, purchasing and second-tier CIOs across government. The central question is whether the CIO model, as it has evolved, is the most effective governance model for meeting the challenges and dynamics of digital public administration. These issues need to be understood in themselves but also to situate and explain the broader dynamics of information governance.

Information and public service reform

The public service is not static, and ICTs have played an important role in the ongoing process of reform of services to government and the public (see next section) but also of the public service itself and how it works. These initiatives offer valuable case studies, looking at their governance and change management and the resulting impact on information governance. The federal government's Blueprint 2020 and related initiatives have identified ways that the digital environment can be harnessed to promote innovation and collaboration in the public service. Strengthening how information and data are managed, used and disseminated is a central component of public service reform (Jarvis 2016). An evaluation of the Digital Office Initiative (DOI) sounds a cautionary note, however, that infrastructure and policies can be changed, but this does not necessarily lead to transformation (Canada. Library and Archives Canada 2013).

Information-based services to government and to the public

A longstanding feature of government has been centralized services both to government and to the public. These have become even more important in digital public administration, enabled by networked communications and centralized databases, raising issues of both change management and information governance.

Significant cases can be identified in several areas. Of most direct interest to this research theme is those that seek to integrate the government "back" room and infrastructure, the areas that provide information services to government itself. These build on an aging technological environment (Canada. Auditor General 2010) that in many areas has been disaggregated across government. A case in point is Shared Services Canada, which has been working since 2011 to integrate core services including e-mail and desktops, purchasing of technology equipment, and an ambitious consolidation of data centres (Canada. Shared Services Canada 2016, Canada.

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Auditor General 2015). A related category is ongoing efforts to update already computerized administrative systems, a notorious example being the problem-filled introduction of the Phoenix system as a new-generation pay administration system based on information software criticized for its complexity (May 2016, Burke 2016). Similarly the success of the merger in 2002 to create Library and Archives Canada, the long-term custodian of all forms of government information, has not been fully examined; on a first outside look, its ability to absorb accelerating digital holdings was found wanting (Canada. Auditor General 2014).

The federal government has also continued the process, kick-started under the Government On-Line initiative in the early 2000s, of placing government programs and services to the public on-line. Closely related has been an effort to consolidate the government's Web presence, removing distinct departmental and agency identities and restructuring the government's Canada Site portal (www.canada.ca) (Pilieci 2016). All of these initiatives have a significant information management and governance dimension, as they seek to consolidate information holdings within government (Shared Services), to collectivize how information is presented to the public (Canada Site) or to change significantly how pay information is managed (Phoenix); in addition, all represent large-scale and costly change initiatives that cut across departmental and agency boundaries. Individually they represent important potential case studies, but collectively they raise significant research questions about the design and management of change in the complex environment created by networked technologies.

Evolving private sector role in digital public administration

These initiatives depend on new and revamped relationships with the private sector. In the realm of information management and governance, these can place the private sector in a number of roles, including: as technology and application developers and suppliers; as contracted systems architects, managers, staff and service providers in general (e.g., of cloud computing services); as holders and managers of government information; and as delivery agents for services to the public. These roles, where often governments have no choice but to rely on the private sector, raise issues about the public sector's capacities and ultimately its internal governance arrangements, notably in the areas of risk management, management of procurement, and management of major projects in which there is a significant private sector role. The relationship with the private sector has received research attention (Langford and Harrison 2001, Whorley 2001, Dunleavy et al. 2006, Langford and Roy 2009, Siemiatycki 2015), but this has not focused on the information governance dimension and in any case

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it is an area requiring continuing analysis, given the dynamic nature of technology and therefore of the private sector providing it.

Comparisons and collaboration in Canada

The federal government has the most extensive and complex information and technology environment within the Canadian public sector, but similar issues are at play in other Canadian jurisdictions. Provinces have over the years taken measures to integrate their use of technology and information that present alternatives to federal approaches. There is therefore considerable scope for comparative analysis. As a rule, corporate management systems and infrastructure are more integrated in provincial and territorial governments (although they are also smaller scale), and many provincial governments have different corporate management models than the federal model built around Treasury Board. Anecdotal evidence suggests that many provincial governments are more dependent on the private sector and proprietary solutions than the federal government and also have less formal institutional governance doctrines; these are all factors to explore in making comparisons within Canada. A further dimension is the extent of collaboration among Canadian jurisdictions, notably via the Institute for Citizen-Centred Service (ICCS) but through other linkages as well, for example arrangements to pool tax collection responsibilities and share taxpayer information (Brown 2009). Again, the current situation needs to be documented and understood.

International comparisons and collaboration

Similar institutional dynamics are at play in every government and public sector environment around the World. Many of these have insights to offer Canada (for example, with respect to the role of the CIO – see Tassabehji, Hackney, and Popovič 2016 or the British Government Digital Service and the related digital hub (UK GDS 2016), as well as the United States Digital Service, the Australian Digital Transformation Office and New Zealand's Government Service Innovation). There is in fact a good deal of information-sharing and even collaboration, informally and more formally, between Canadian jurisdictions and international counterparts, most recently through organizations such as the Open Government Partnership (OGP). Understanding such comparisons and relationships can form a research program on its own, highlighting comparisons and potential lessons for Canadian experience. There are also international organizations, both intergovernmental and private sector, that regularly conduct rankings and other forms of comparative analysis (Organisation for Economic Cooperation and Development 2016, OGP 2016, United Nations Department of

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Economic and Social Affairs 2016). These need to be consulted to provide perspective and also for insights moving forward.

3. Digital impacts on the information legacy and memory

It is tempting to think that new technologies are being introduced on a clean slate and that their potential can be fully realized without adjustments to existing circumstances. This is of course never the reality, although the aspiration can be realized more closely in some situations than in others; the introduction of mobile technologies, for example, and of some of the related applications has undoubtedly come closer to creating an essentially new situation, with the ability to go back to first principles that that brings. Public sector information management's extensive legacy makes such re-engineering much more difficult, however. Understanding this legacy and its intersection with ICTs and technological change is a third major area of research. A core objective is to help achieve a balance between realizing the potential of new technologies and not throwing the information baby out with the old-technology bathwater.

Paper

The most basic information legacy is paper records and published material that historically have, with only limited exceptions, provided the medium for government information. While much of this legacy is being digitized, not all of it will ever be, the transition to digital formats has been given a lower priority and has not always gone well, and in any case new paper information holdings are always been created. There is also reason to believe that paper in many ways remains a more enduring format for long-term preservation of information and institutional memory, a critical part of governance and public administration. The state of paper-based information holdings, their alignment with current and emerging digital holdings, and the prospects for institutional memory in the digital-by-default future are all matters for research.

Information-related administrative policies

A second legacy requiring ongoing research is with respect to the public and administrative policies that relate to and are built on "traditional" public sector information management. The starting point is what happens in the digital environment to the management of information as a government asset, including with respect to the established foundational categories of internal records and material in the public domain as well as the cross-cutting categories of open data and big data. This in turn raises questions

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about the future of government archives and libraries and the related functional skills as well as new ones, such as Website and database management, that arise from the requirements of the digital environment.

Building on that foundation is consideration of what happens to the information-based public administration policies,[6] each of which has associated with it a galaxy of legislation, directives and standards, institutions and procedures, and functional communities of public service staff. The list of the administrative areas that are involved is evocative: access to information and privacy as rights-based components of information governance; government communications, including information dissemination and information as a service to the public, both in traditional forms and in the form of Web presence and publishing; and information security and the securitization of information, which opens up issues ranging from protection of critical digital infrastructure (Quigley 2013) to the ongoing process of broadening the surveillance state (Geist 2015), with related issues of oversight and control.

This structuring of information management does not disappear in the digital environment, especially as many of the areas involved have important underlying public policy objectives (e.g., public right to know, government duty to inform, protection of personal information and privacy, national security and government security) that are important individually and cumulatively are foundational to the relationship between government and society. But these policies are profoundly affected in ways that, from a public administration perspective, are not well understood. The multidimensional nature of the digital environment also means that they are increasingly brought into contact with each other, creating both synergies and tensions that are even less well understood. Any hope of moving successfully to digital public administration will need to give a high priority to addressing these issues.

4. Preparing for the digital future of public sector information

The complement to understanding the nature and dynamics of the information legacy in the digital environment is to look at where information governance is headed under the influence of evolving technologies.

Understanding future directions of ICTs

A starting point is what is happening to the technologies themselves; while not a primary focus of research on information governance, the latter needs to have a solid understanding of the future directions and alternative scenarios of ICTs in order to consider its own prospects.

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Working with allied disciplines

As noted through the literature review, a clear requirement is the need for integrative cross-disciplinary research and conversations, managing and crossing silos among information and applied sciences – notably computer science and engineering – and between information sciences and public administration. This includes, most concretely, linking the disciplines of public management, library science, archives and records management. Underpinning this discussion is an examination of assumptions going forward about technological change dynamics as they relate to information governance. Consequential issues include: the role of information management in public administration practice and the related academic discipline; management, ethical (Kernaghan 2014) and public policy implications of the move to government as data base; and information-related public service skills needs, employment models and career models.

Managing a permanent revolution

Ultimately both public administration practitioners and academics are faced with the challenge of change management, of riding the tiger. The issue of how to manage a process of continuous and open-ended change while never totally leaving the legacy behind – moving forward in a difficult-to-predict environment – is a matter for research in its own right. This includes identifying and developing ongoing monitoring, evaluation and change management capacity. It also involves developing strategies for making it work, including institutional roles and leadership, integration with broader public service governance and reform, and managing the interface between politics and administration and between lay and expert within the larger public sector governance environment.

Conclusion

As the public sector increasingly transforms itself and its processes through digital technologies, information – the prime resource – the governance of information and the need for advanced information skills have moved to centre stage. This article has provided perspectives on the key information governance-related issues that need to be considered to ensure government information remains accessible, accurate, secure and available, both now and into the future. While the move is to a digitally-defined environment, information governance processes form a bridge between the legacy systems of the past and the agile and mobile platforms of the future. The tensions between the legacy and the new need to be considered, and they provide the context for how change can be imagined. Given the forces at play, which include new information formats, modes of transmission and use but also

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new skills and governance requirements, this article proposes an information governance-centred research agenda. Considering information governance through a holistic lens is essential to ensure that the new possibilities available through digital technology can be leveraged to transform government, drawing on the insights of the full range of information-related disciplines, while government information itself is preserved as the essential tool for government decision-making, as a critical service to the public, and as the foundation for public sector accountability and transparency.

Notes

1 The life-cycle underlies all government information management policies and procedures. See for example Library and Archives Canada's rendering of the cycle as it is used in the Government of Canada (Canada. Library and Archives Canada 2016).
2 There is also the longstanding issue of Crown copyright and the sale of government information. This will come into relief with a more robust effort to value information. Questions also arise with respect to how traditional claims of Crown copyright and efforts to charge for information on that basis are affected by Open Data initiatives.
3 An early royal commission calculated that there were over 127,000 linear feet of government records in 1914 (Canada Pope 1914) and recently the Auditor General reported 98,000 boxes of unprocessed records in Library and Archives Canada a century later (Canada. Auditor General 2014).
4 This is a rare example of an administrative authority being assigned to the Head of a department alone rather than jointly to the head and deputy head (deputy minister) or to the deputy head alone. This highlights – and undoubtedly contributes to – the political importance of government information.
5 The Ontario government, for example, has announced that it has created a new deputy minister-level position of Chief Digital Officer to head a new Digital Government Office (Ontario 2016).
6 See Canada. Treasury Board Secretariat (n.d.) for listings of current Treasury Board policies, standards, directives and guidelines relating to information management and related areas of administration.

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