

EXTERNAL TIES THAT BIND: SHAPING GEOSPATIAL COORDINATION

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ITC

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EXTERNAL TIES THAT BIND: SHAPING GEOSPATIAL COORDINATION

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born on 2 February 1965

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CHAPTER 1: General Introduction

1.1 Background/Problem description

The increasing complexity and 'wickedness' of public problems, such as climate change, sustainable development, and national security, increase the need for government agencies, to work across administrative boundaries to address the problems. A traditional single agency approach cannot resolve these modern environmental, social, and economic problems. Cross-agency coordination involves the linking or sharing of information, resources, activities, and capabilities by agencies to achieve jointly an outcome that could not be achieved by an agency separately (Bryson et al. 2006).

Geographic information often underpins the development and implementation of government policies and strategies to address public problems, related to the allocation and management of natural resources, for defense and public safety purposes, in support of a variety of regulatory activities, for spatial planning and in promoting a better understanding of the physical, economic and human geography of the nation. The assessment of the magnitude of problems and the formulation of effective strategies call for reliable geospatial data at different scales, an improved understanding of the spatial and temporal patterns involved, and better modeling and prediction methods. Again, cross-agency coordination is required to ensure that the geographic information 'silos' of individual government agencies are integrated into a cost-effective, interoperable system to support the nation's spatial data infrastructure (SDI). SDI is an evolving concept about coordinating and facilitating the exchange and sharing of geospatial data and services between stakeholders from different levels in the geospatial data community (Hjelmager et al., 2008). SDI enables geospatial data discovery, visualization, and evaluation through data catalogues and a variety of web-based data processing and access mechanisms.

SDI development and use involves government and non-government actors. This thesis, though, focuses on the nature of coordination within government, and in particular, within central government, since central government agencies - ministries, departments, bureaus, and authorities, or parts thereof - have core responsibilities for the design and maintenance of social, economic, and environmental systems and policies. Instruments of cross-agency geospatial coordination in use include formal mandates or directives, legislation, policy, and a committee or some form of coordinating body (Vandenbroucke, 2011; Global Spatial Data Infrastructure Association, 2009). An active coordination body, such as a committee or commission, in particular, is seen as a basic 'building block' to coordinate tasks and provide leadership during the process of creating a national SDI (GSDI, 2009, p.86). A cross-agency committee or coordinating body does not replace bureaucratic organization, but it adds a layer of structural complexity, as government

agencies are interwoven with counterparts from the same government into a multi-organizational web of action (O'Toole, 2010). Generally, no one government agency is subordinate to the others. Government agencies are meant to jointly agree upon how they will exchange and share data, develop and maintain common databases and web portals (one-stop-shops), and deliver geospatial services to a wide community of users within and outside of government. Furthermore, agencies need to mobilize human and financial resources, make decisions about resource allocation between agencies, and share the responsibility for outputs and communication of societal benefits of SDI.

Half the countries of the world are thought to have embarked on some form of SDI initiative over the last 15 years (Masser, 2011). Though governments have formulated policies and coordinating bodies for cross-agency geospatial coordination, in many cases, researchers and practitioners alike have questioned the effectiveness of these coordination instruments. Managing an SDI has been likened to "kicking a 40-foot sponge" — because it involves a complex social system with interrelated parts, and it has a tremendous amount of mass that resists movement (Bellafiore et al., 2008). SDI researchers have indicated that "practical and operational implementation appears unruly (de Man, 2006, p.331)," and "institutional inertia" overrides most well-intentioned efforts (Craig, 1995, p.107).

SDI, like most cross-agency endeavors, is notoriously difficult to achieve (Hudson et al., 1999). Cross-agency coordination typically is an unfunded mandate, with agencies having no resources specifically reserved for or allocated to coordination efforts (Bakvis and Juillet 2004). Thomas (2006, p. 2) pointed out in his commentary on government committees, that "[r]equiring agency officials to sit on such committees is like leading the proverbial horse to water: you can require them to sit at the table, but that does not mean they will cooperate." Wilson's (1989, p. 269) explanation on the poor performance of committees was that "[n]o agency head is willing to subordinate his or her organization to a procedure that allows other agencies to define tasks or allocate its resources." Also, agencies are focused on their primary mission and not necessarily on broader, cross-sector policy issues. Furthermore, there could be an element of 'turf protection,' also known as departmentalism, which is a reflection of the structure within which agencies operate (Richards and Kavanagh, 2000). Agencies seek to claim the largest possible amount they can of the national budget. So, a fundamental dilemma exists when it comes to SDI within government between the need to "join-up" to achieve cross-agency aims and the institutional drivers that favor departmentalism. Richards and Kavanagh ask, "[d]oes the highly competitive manner in which ministries vie for political capital mean that the pathology of departmentalism is a permanent structural characteristic?" Put another way,

"[a]re the incentives strong enough for individuals to shift away from their customary competitive and departmental behaviors (Pollitt, 2003, p.47)?"

As challenging as cross-agency coordination is to effective SDI implementation, SDI research seldom has explicitly focused on the nature of coordination in the public sector (Olsson, 2009). Often, research on spatial data infrastructure tends to be anecdotal, unsystematic, and isolated from the broader discourse in social science (Budhathoki and Nedović-Budić, 2007, p.18) and tends to prescribe structures and practices that are not grounded in empirical findings (Koerten and Veenswijk, 2011). Cross-agency coordination has been scoped to a narrower question of coordination structure and participation (Masser, 2009) or cross-agency data sharing (Nedovic-Budic et al., 2004). SDI researchers have made progress in advancing our understanding of individual and organizational behavior with respect to spatial data infrastructure sharing (Nedovic-Budic et al., 2011a; Omran and van Etten, 2007; Harvey and Tulloch 2006; Nedović-Budić et al., 2004; Harvey 2003; Wehn de Montalvo, 2003). Nevertheless, the academic findings apparently are not being translated into concrete, actionable solutions by public managers to affect change. Budhathoki and Nedović-Budić (2007, p.10) note that "[w]hile all these solutions are quite pragmatic and relevant to SDI policy, they are yet to be fully applied in practice." Also, the findings point to change as a gradual endeavor, as a result of building of trust over time (Harvey, 2003), rather than a result of deliberate intervention. SDI research offers limited understanding of the interventions to stimulate cross-agency coordination behavior in the public sector.

1.2 Motivation

In the early 2000's, I was a government contractor based at the U.S. Federal Geographic Data Committee (FGDC) secretariat. FGDC is an organized structure of federal geospatial professionals and constituents that aims to enable cross-agency coordination and implementation of initiatives across the Federal government. While there, I began noticing increased pressure coming from the Office of Management and Budget (OMB) for greater public sector, cross-agency efficiency and evaluation of agency investment in geospatial technologies. The OMB's predominant mission is to assist the President in overseeing the preparation of the federal budget and to supervise its administration in Executive Branch agencies. An upsurge in interaction and reporting between OMB and FGDC was evident and geared to the development of a government-wide geospatial data discovery and access portal. The flurry of activity was striking compared to what otherwise was perceived in the years prior as lackluster progress on the data availability, discovery, and systems interoperability front (Sietzen, 2003).

The interaction between OMB and FGDC intrigued me, because it was taking place outside the locus of SDI cross-agency arrangements with which I was familiar. I had been versed in the concept of SDI “building blocks” or “cookbook elements” covering strategy, policy, organizational issues, legal framework and funding, reference data, and core thematic data, technology standards, metadata, and access services (Vandenbroucke, 2011; Global Spatial Data Infrastructure Association, 2009). Bodies such as the FGDC were commonly included as an indicator for the ‘building block’ element of ‘coordination mechanism’ by SDI benchmarking or comparison studies (Vandenbroucke, 2011; Vandenbroucke et al., 2008; Fernández and Crompvoets, 2007; Masser, 2005; Masser, 1999). Coordination was defined by the lead organization of the coordination body, membership or participation (involvement of users), and whether a formal mandate gave the coordination body authority (Vandenbroucke et al., 2008). The studies did not consider geospatial governance elements such oversight by an executive agency, resource planning and allocation, management systems and routines, and accountability procedures. This was the first inkling I had that a central, Cabinet-level agency such as OMB could, or rather would, exert influence over line agencies to improve cross-agency geospatial practices.

I set out on a PhD journey to look beyond the usual cookbook components of SDI coordination and get a fuller picture of cross-agency coordination in the context of broader public sector reform. I was not the first to recognize the importance of ‘taking context seriously.’ Crompvoets et al. (2009) pointed out that even though the European Commission through the INSPIRE Directive lays down general rules for establishing an SDI, the SDIs “will never be the same, and sometimes will differ considerably depending on political, economic and cultural national circumstances (Crompvoets et al., 2009, p.2).” A small, but growing community of researchers has been making inroads to conceptually and empirically understand how SDI initiatives are shaped by the broader social, institutional, historical, political, economic, financial, and cultural systems in which they are embedded (Nedovic-Budic et al., 2011b; Koerten, 2011; Richter et al., 2011; Mukherjee, under review; de Vries, 2009; Georgiadou and Harvey, 2007; de Man, 2007; Georgiadou et al., 2005; Chan and Williamson, 1999). However, few studies have looked at SDI as a public management reform in an explicit way, even though public sector data custodians are central to SDI. This thesis fills the gap. It analyses the nature of geospatial cross-agency coordination by drawing upon public management and public policy literature.

A central aspect of this thesis is the distinction between ‘foreground,’ ‘context,’ and ‘background.’ Most researchers who have analyzed the cross-agency geospatial coordination challenge have focused on the interaction between geospatial practitioners or professionals, who can be viewed as the

"foreground" of SDI, actively responsible for making joint decisions and implementing agreed upon actions. A few researchers also have considered the 'context' in which professionals are embedded. When considered, context typically is treated as an 'impersonal' concept, referring to macro-level political systems and structures (Masser, 1999), external environmental forces (Rajabifard, 2002), technological innovations (van Loenen and van Rij, 2008), cultural norms (de Man, 2006), and broader social change (Nedovic-Budic et al. 2011c, p. xiv) that result in what is referred in public management as "path dependencies (Pollitt, 2005)" or "lock-ins" (Georgiadou et al., 2005) that may constrain opportunities for change. The implication is that no one is responsible for context; it just exists - a natural or inevitable state (Kennedy, 2005). This thesis unpacks context into 'background' and 'context,' so we can begin to consider that agents, in the background, influence or decide upon practices that ultimately shape context (ibid). The 'background' is that part of the 'context' that captures the direct, but often invisible, work of agents who influence context and ultimately the 'foreground' - the civil servants involved in cross-agency coordination. In the FGDC example, the OMB is such an actor and likely is an influential constituent in the development of the national SDI. With this finer resolution of context, into background and the rest of the context, we take the focus off the internal coordination mechanisms of the foreground geospatial practitioners, and explore external agents and processes that otherwise would not be visible. Focusing on the background may also expand our sense of change that is politically or bureaucratically possible.

1.3 Research aims and scope

1.3.1 Research objective

The objective of this thesis is to examine how external agents in the background go about influencing cross-agency geospatial governance elements, such as oversight strategy, resource planning and allocation, management routines, and accountability procedures, and how these elements foster coordination of public agencies for the purpose of data acquisition, integration, and overall system interoperability. Actual practices are explored through in depth case studies, drawing upon public management and public policy literature. A defining element of the 'external agent' concept is that one agency is attempting to shape the behavior of other agencies. Hood et al. (1999) coined the phrase "regulation within government." Regulation typically is seen as something government does to business, but regulation of public sector bodies by arms-length overseers also is present and of increasing importance (ibid). Based on my experience at the FGDC secretariat, the research is scoped to external agents who have control over resource flows – those with the ability to direct or withhold funding or put stipulations on the use of funds.

Figure 1.1 presents a simple conceptual framework to convey the focus/locus of research. This framework consists of two spheres of influence – external to the coordination structure of government geospatial practitioners or professionals who participate in decision-making related to SDI design and implementation (the background) and internal to the coordination structure of government geospatial practitioners or professionals (the foreground). The research focuses on the left side of the conceptual framework (red oval) -- the external sphere of influence. I am bringing to the fore an element of cross-agency geospatial coordination that thus far has been neglected in SDI research. The traditional focus of analysis has been on the internal sphere, and several researchers recently have been focusing on improving our understanding of dynamics in this area with theory and empirical studies (Dessers et al., 2012; Vancauwenberghe et al., 2011; de Vries and Lance, 2011).

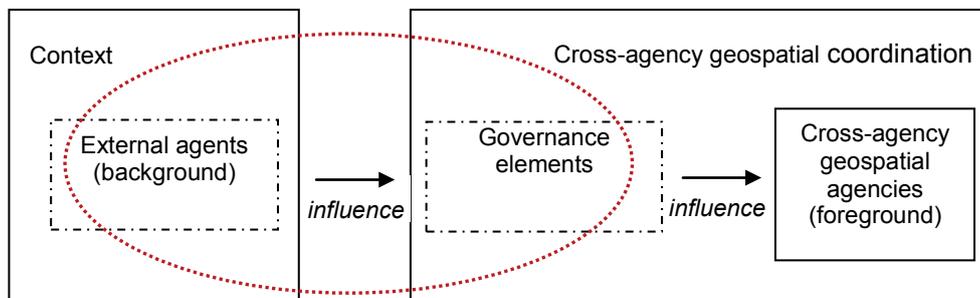


Figure 1.1: Conceptual framework

1.3.2 Research sub-objectives

The research is divided into four sub-objectives, each defined by a research question (Table 1.1). The first sub-objective is to identify the 'playing field' and establish a causal link between external agents and public sector SDI coordination. The second sub-objective is to empirically examine the interventions of different external agents who control resource flows, so that I can develop a conceptual framework that illuminates how external agents steer or influence coordination conditions in the public sector. The third and fourth sub-objectives are meant to apply the conceptual framework to different contexts in order to refine and validate it.

Table 1.1: Summary of sub-objectives and research questions.

No.	Sub-objective	Research Question
1	Establish causal link [Chapter 2]	Are there institutions that hold public sector spatial data infrastructure (SDI) implementers accountable, thereby steering public sector SDI coordination?
2	Develop conceptual framework [Chapter 3]	How does the central budget agency influence cross-agency coordination?
3	Apply conceptual framework to different politico-administrative context [Chapter 4]	How do public principals influence private (or quasi-private) agency coordination and practice?
4	Apply conceptual framework to another context -- extend from national to supra-national environment [Chapter 5]	How do donors influence recipient policies and practices, and how do the interventions shift or evolve over time?

Figure 1.2 depicts the key phases and steps in the research process. The first phase involves an extensive inventory of SDI evaluation practice and literature review of evaluation in the information systems domain to identify the research problem and gaps in the knowledge in evaluation adoption. The review also encompasses closer examination of public management literature that focuses on modes of coordination aspects of behavioral change within government with respect to performance measurement. Two case studies of federal SDI programs are conducted, involving semi-structured interviews. Together these steps lead to the first iteration of the conceptual framework. This first phase then feeds into a second phase designed to refine the conceptual framework with a third empirical case study and further review of public management literature to theoretically inform the analysis. A fourth study is conducted to 'validate' the conceptual framework and expand it yet further. The fourth study was based on interviews, participant observation, analysis of documents, and review of literature, and was informed theoretically by concepts from political science.

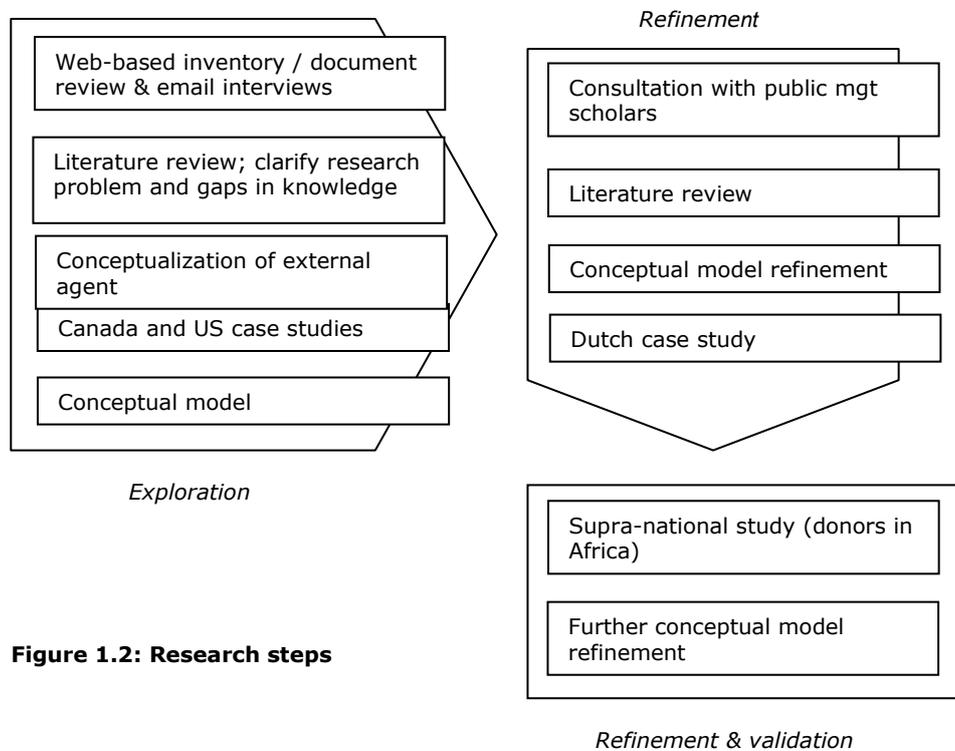


Figure 1.2: Research steps

1.3.3 Level of analysis

In terms of analysis level, this thesis focuses on changes in geospatial governance conditions within a single tier of government, leading to cross-agency (horizontal) coordination at the federal level. I am not looking at changes of governance conditions that pertain to vertical coordination across tiers of government, national and local government agencies. This is an important distinction, which may speak to generalizability of results. Public management literature differentiates between horizontal and vertical coordination (Bouckaert et al., 2010), each having particular concepts and body of literature (Budhathoki and Nedovic-Budic, 2009). With respect to level of analysis, the research, as previously stated, also focuses on the external sphere of influence on cross-agency geospatial coordination, as opposed to the internal sphere. By paying closer attention to the level of and locus of analysis, researchers likely will have an easier time deciphering and comparing the lessons from different studies (Masser, 1999).

1.4 Outline of the thesis

The core of the thesis (chapters 2-5) is based on a series of four papers that have been published in international peer-reviewed journals. The chapters

explore the role of external agents in shaping public sector geospatial coordination, how they do it, and to what effect. Each chapter focuses on a sub-objective as discussed earlier.

Chapter 2 investigates how and why SDI practitioners 'on the ground' are evaluating their 'own' efforts in developing SDI. Concepts regarding evaluation are mobilized from the information systems and public management domains. Despite the number of SDI initiatives underway worldwide, routine SDI evaluation by public managers is limited. To explore this lack of attention to SDI evaluation, this chapter examines the institutional arrangements governing the demand for evaluation (internal, external), as well as the content of existing evaluations (inputs, outputs, outcomes). The chapter opens the door to looking at 'external demand' for evaluation. Two examples identified in Chapter 2 become the focus of Chapters 3 and 4, because they were found to have the most comprehensive evaluations in terms of the perspectives covered, while both pointed to the central budget agency as a source for imposed cross-agency geospatial coordination.

Chapter 3 explores the dynamics of coordination in the geospatial realm within the federal government of the U.S. and Canada. Recent shifts in the relationship between line agencies, such as ministries, departments, bureaus, and authorities, and the central budget agency is facilitating cross-agency coordination of human and financial resources. The governments of these two countries have had a national SDI initiative for more than ten years. Their strategies often are framed as models to emulate globally, yet only now are the central budget agencies taking a particular interest in government geospatial investments and playing a more formal role in coordination and assessment processes. The central budget agencies are devising and instituting control mechanisms to prompt agencies to reduce duplicative geospatial investments and improve cross-agency resource allocation. We describe the evolution of this shift and elaborate on the controls that are being manifested.

Chapter 4 explores the dynamics of coordination in the geospatial realm in The Netherlands. In contrast to Chapter 3, which focuses on two cases in Anglo-American federal systems, this Chapter applies the conceptual framework in a different politico-administrative setting, heavily influenced by New Public Management (NPM). This paper examines how administrative arrangements for the Dutch subsurface SDI (DINO) are linked to geoportal development and evaluation. This case was selected to explore changes in geospatial governance conditions in a different public administration system (Pollitt and Bouckaert, 2004), allowing us to refine the conceptual framework and improve the formulation of analytical or logical generalizations.

Chapter 5 opens the black box of donor influence on Digital Earth in Africa. It addresses the relation between donors and policy makers in Africa and identifies practices that influence (or could influence) cross-agency geospatial coordination and the uptake of practices. The Chapter extends the concept of external agent to a supranational context.

Finally, Chapter 6 concludes the thesis with a synthesis of the main findings, reflection upon the research and discussion of the limitations, and recommendations for further research.

Each case is set in a different institutional context, and each explores how external agents, who exert control over resource flows, shape from the background the governance elements that affect cross-agency coordination in the foreground (Table 1.2). Central budget agencies (US and Canada cases) are core executive central agencies of government which set, monitor, and/or enforce rules for the conduct of central government (e.g., for expenditure). Regulators (principals in the Dutch case) set, monitor, and enforce conditions for the provision of public services which are partly or wholly funded by the regulators. Donors (Africa 'case') are supra-national bodies that advance reform in developing countries and fund the delivery of public goods.

Table 1.2: Summary of foreground, background, and context for research cases.

Case	Foreground	Background	Context
US	Federal Geographic Data Committee (FGDC)	Office of Management and Budget (OMB)	Anglo-American politico-administrative system; federal government
Canada	GeoConnections; Inter-Agency Committee on Geomatics	Treasury Secretariat	Anglo-American politico-administrative system; federal government
The Netherlands	DINO, subsurface data custodians (public and private)	Ministerial principals/sponsors	Unitary, consensual system; New Public Management, quasi-autonomous non-governmental organizations (quangos)
Africa (developing countries)	Geospatial policy makers	Donors/International Financial Institutions (IFIs)	Aid system; weak states in development

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CHAPTER 2: Understanding how and why practitioners evaluate SDI performance

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Understanding how and why practitioners evaluate SDI performance

Abstract

Practitioners around the world are busy building frameworks for spatial data interoperability and cross-agency coordination, referred to as spatial data infrastructure (SDI). In this study, we attempt to understand how and why SDI practitioners 'on the ground' are evaluating their 'own' efforts in developing such frameworks. For this purpose, we mobilize concepts from 'control' evaluation, as well as from public sector evaluation research, because 'control' evaluation appears to be the approach most favored by SDI practitioners, and SDI evaluation is unfolding within public sector settings. 'Control' evaluation emphasizes operations, supports rationalistic investment decisions and efficiency analysis, and typically is based on measures such as ratios, percentages, and indexes; evaluators act as auditors, controlling, ranking or assessing success.

We examine and classify several recent examples of SDI 'control' evaluation by using the concepts of 'timing', 'perspective', 'formal demand', 'use', and 'input specificity'. Our study reveals that the most comprehensive practices have resulted when 'control' evaluations have been in compliance with a *demand* from an executive agency, such as a central budget agency, and when there has been *specificity of inputs*. We anticipate that these dimensions of evaluation are key to the institutionalization of SDI evaluation and point to the need for further research to understand how such evaluation practices emerge.

Keywords: spatial data infrastructure, efficiency, evaluation, performance measurement, institutionalization

2.1 Introduction

Public managers of geographic information systems, since the early 1990s, have emphasized the need for a framework for data interoperability and cross-agency coordination, referred to as spatial data infrastructure (SDI). Researchers, too, have stressed the need for evaluation to monitor and assess SDI progress over time (Craglia and Nowak, 2006; Grus et al, 2006; Masser, 2005). Evaluation of SDI efforts can be seen as the cornerstone of SDI implementation, especially when improved efficiency is a primary stated SDI objective. For example, a review of the US National Spatial Data Infrastructure (NSDI) and the Federal Geographic Data Committee (FGDC) underscores the importance of evaluation (NAS, 2001, p.74):

"[t]he success of future partnership programs should be assessed by

determining, in a rigorous fashion, how these NSDI partnerships have reduced redundancy in geospatial data collection and maintenance; reduced overall costs in performing these tasks; improved access to geospatial data; and improved the accuracy of the data used. Because much of the FGDC's effort has been devoted to promotion of the NSDI, there has been little opportunity to develop programs that can monitor long-term effects. The FGDC should develop metrics that can be used to monitor long-term progress in the adoption of the principles and programs of the NSDI among agencies at all levels of government, academia, and the private sector... Such procedures would be of great value in assessing whether the NSDI program succeeds in moving beyond the missionary phase, and in arguing for future funding allocations."

SDI evaluation research is maturing with a steady increase in research instruments, from questionnaires, to case studies, to the use of theoretical grounding (e.g. Onsrud, 1998; Crompvoets et al, 2004; Delgado et al, 2005; Masser, 1999, 1999; Rodriguez, 2005; Steudler, 2003). At the same time, a growing number of SDI practitioners² are conducting SDI evaluation, though the practice still is not widespread. Surprisingly though, few evaluations by SDI researchers or practitioners address specific agency inputs, despite the popular justification of SDI as a guarantor of improved efficiency, which is a ratio of inputs to outputs. In some cases, costs are estimated, but these, at best, are done with a broad stroke at the onset of a project; the estimates may provide a figure for particular service or activity, but they do not identify which agency is contributing what portion to the activity, which is what input specificity does. Furthermore, when SDI evaluation is discussed, the tendency has been to dwell on the difficulty of measuring benefits or impacts, not the costs or actual inputs, with the assumption being that costs or inputs are more easily quantified (Craglia and Nowak, 2006, p.14, p.52). However this is not the case (Rhind, 2000). In most SDI evaluations, cost estimation has focused only on staffing and set-up costs rather than the less immediately visible indirect and organizational costs. Similarly, inputs have been overlooked, because they typically are sunk, indirect, or concealed in program budgets. Complicating matters further, SDI inputs span multiple agencies, each having different budgeting and accounting practices, resulting in a lack of budgetary interoperability (Lance, 2005).

The drive to evaluate SDI is consistent with a longer-running pursuit to evaluate the broader sphere of information systems/information technologies (IS/IT). After close to four decades of investigation, IS/IT evaluation has become a veritable industry, with specialized academic journals such as the

² SDI practitioners are managers of public geographic information assets developing an SDI, a framework for interoperability and cross-agency coordination.

Electronic Journal of Information Systems Evaluation and conferences such as the European Conference on IT Evaluation. IS/IT evaluation has been defined as "a process, or group of parallel processes, which take place at different points in time or continuously, for searching and for making explicit, quantitatively or qualitatively, all the impacts of an IT project and the program and strategy of which it is a part (Farbey et al, 1999a)." While much of the IS/IT evaluation research has focused on commercial settings, where organizations are driven to attain significant future gains, IS/IT evaluation is becoming prevalent in the public sector as well. In the public sector, "the use of scarce resources has to be monitored, in order to maintain a correct relation between inputs and outputs, in respects of economic efficiency (Dameri, 2005, p.109)."

Despite the multitude of IS/IT evaluation studies, the results are inconclusive. Researchers and practitioners, noting the static productivity and rising IS/IT expenditure, have coined the term "IT productivity paradox" (Roach, 1987; Brynjolfsson, 1993). While this predicament causes concern, it may have more to do with flaws in evaluation than actual IS/IT impacts. Bannister and Remenyi (1999) pointed out "[i]f the economists are right, this [investment] is an act of collective ineptitude on a massive scale. Few, however, would argue that so many managers and organizations are so irrational." Even so, the debate over IS/IT impacts continues.

However, there is general agreement that IS/IT evaluation, as a process, has value and facilitates implementation in different ways. Evaluation can serve: as a basis for decision-making, control or accountability; legitimization of a decision already taken; to gain and retain commitment from stakeholders; as a learning process for the organization and its partners; and as a starting point for negotiation and collective decision-making (Farbey, 1995, p.207-8). Although rarely explicitly stated as such, IS/IT evaluation is inherently associated with IS/IT success and failure (Beynon-Davies et al, 2000). Most importantly, evaluation should be an institutionalized process, since "it is only through effective evaluation that an organization may develop an effective knowledge base on which to found successful development practice (ibid, p.2)." The institutionalization of evaluation refers to the establishment of rules, procedures, and organizational arrangements by which evaluations are produced (Boyle and Lemaire, 1999).

In this paper, we attempt to understand how and why SDI practitioners 'on the ground' are evaluating their 'own' efforts in implementing SDI. For this purpose, we draw upon concepts from IS/IT 'control' evaluation, since 'control' evaluation appears to be the approach most favored by SDI practitioners. We also draw upon public sector evaluation research, since SDI evaluation usually unfolds in public sector settings. Our approach is

consistent with Grover et. al. (1996) in establishing a more cumulative tradition, taking prior research into account as a basis of learning and avoiding reinvention of concepts already well-established in the literature.

The rest of the paper is organized as follows. In section 2, we review the IS/IT 'control' evaluation and public sector evaluation literature and identify dimensions that pertain to comprehensive 'control' evaluation within a public sector setting. In section 3, we use these dimensions to examine concrete examples of SDI control evaluation carried out by SDI practitioners. Section 4 is devoted to an analysis of the findings. In section 5, we summarize some conclusions.

2.2 IS/IT Evaluation and public administration research

IS/IT evaluation has been an area of scrutiny by practitioners and researchers over the past four decades. Originally IS/IT evaluation focused on commercial sector practices, fueled by the need of managers to balance large IT investments, limited organizational resources, and the expectation for the highest future gains (Willcocks and Lester, 1999). More recently, IS/IT evaluation has grown in prominence in the public sector as well (e.g., Yu and Wang, 2005; Atkinson, 2004; Lin and Pervan, 2003; Sedera et al, 2001). Public agencies are under increasing pressure to improve the efficiency of the services they deliver. In the drive to achieve this, various commercial sector management techniques have been introduced, under reforms often coined as 'New Public Management.' While some commentators have expressed doubts regarding the uncritical import of evaluation approaches from the commercial to public sector, the push for efficiency and the evaluation thereof is comparable in both commercial and public sectors (Bannister, 2001).

The specific approach to IS/IT evaluation depends on the degree of clarity (or certainty) of IS/IT objectives and the degree of clarity (or certainty) regarding the potential impact, resulting in four evaluation orientations: 'control' evaluation, 'learning', 'sense-making', and 'exploratory' evaluation (Serafeimidis and Smithson, 2003). Table 1 summarizes these four orientations, while further details can be found in Georgiadou et al (2006). With control evaluation, evaluators act as auditors, controlling, ranking or assessing tangible aspects of progress; the objectives and the impacts of the information system in question are clearly defined. In contrast, 'learning' evaluators increase knowledge through critical processes of inquiry, debate, and interpretation; they are more concerned with intangible IS/IT outcomes. This approach is typical of situations in which there are clear IS/IT objectives, but there is uncertainty of cause and effect. 'Sense making' evaluators work

under the inverse situation, in which there is clarity as to the envisioned end results, but limited consensus as to means to achieve them; they use prototyping or simulation to facilitate dialogue among stakeholders. In the fourth evaluation orientation, 'exploratory' evaluators are confronted with high uncertainty for both the objectives and the impacts; they rely upon interpretive methods and attempt to generate ideas and experiences to understand and explain the ambiguities. The boundary between the evaluation orientations is not necessarily crisp, and some evaluations may exhibit characteristics of another class, but the taxonomy still is useful to be able to discuss evaluations in the context of one another.

Table 2.1: Orientations of evaluation, after Farbey et. al. (1999b, p.208) and Serafeimidis and Smithson (2003)

		Uncertainty as to impacts & strategies	
		Low	High
Uncertainty as to objectives	Low	<u>Evaluation as control</u> Answer machine Goal monitoring Evaluator as auditor e.g. Return-on-investment	<u>Evaluation as learning</u> Learning machine Experiment Evaluator as knowledge creator e.g. Cost-benefit analysis
	High	<u>Evaluation as sense-making</u> Dialogue machine Consensus Evaluator as facilitator e.g. Simulation, prototyping, etc.	<u>Exploratory evaluation</u> Idea machine Exploration Evaluator as catalyst e.g. Value analysis

Each of the four evaluation orientations has its merits, depending on the IS/IT lifecycle (Willcocks and Lester, 1999). Nevertheless, 'control' evaluation is most commonly conducted by IS/IT practitioners, who tend to justify their efforts based on cost savings or cost reduction (Willcocks, 1992; Ward et. al., 1996; Hinton and Kaye, 1996), rather than the realization of more intangible benefits. 'Control' evaluation typically considers financial and technical issues using tangible, quantifiable measures.

Figure 1 represents the logic model that underpins 'control' evaluation. The figure, based on van Dooren's (2006) analytic framework for evaluation in the public sector, also helps clarify the definition of terms used for control evaluation. Each public agency or program is shaped by a complex socio-economic environment, and to the extent possible, management controls are used to influence the behavior of employees. Only program objectives (1), inputs (2), activities (3), and outputs (4) are under direct control, denoted by the box shaded in gray (5). 'Control' evaluation focuses on measurable inputs and outputs and is popular for efficiency-oriented projects, with efficiency (6) referring to the ratio of inputs to outputs. The actual outcomes of a program

(7, 8) largely depend on the impulses of society (9) and most often are intangible. Effectiveness (10), which is the ratio of outputs to outcomes, also is influenced by environmental conditions.³ To assess outcomes and effectiveness, a different evaluation orientation would be needed, one that is sensitive to ambiguities and social transformation (e.g., learning or exploratory evaluation).

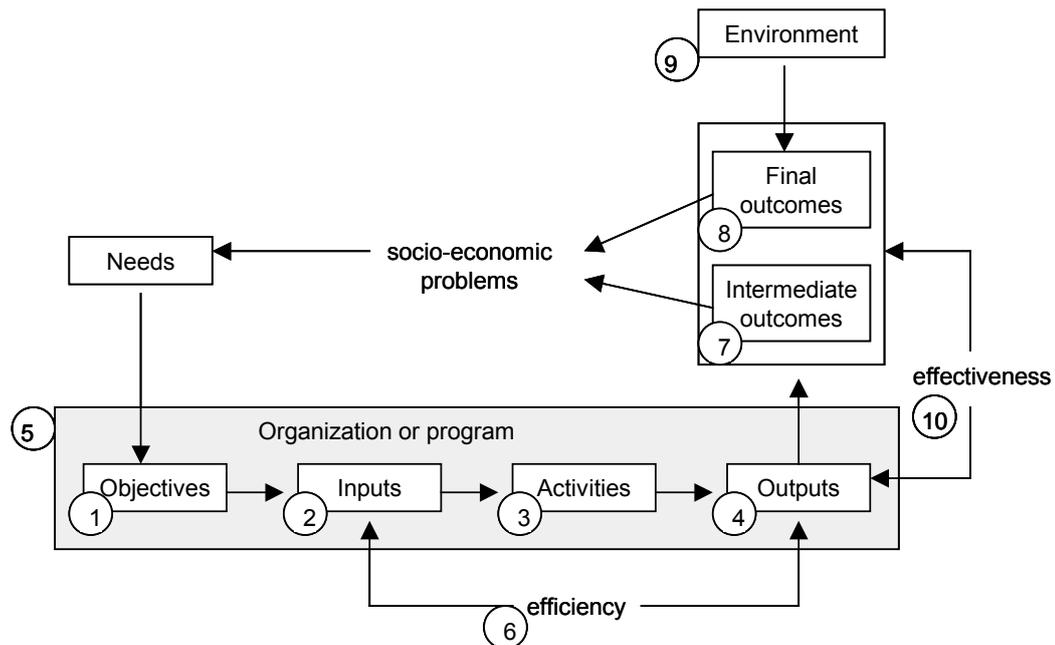


Figure 2.1. Analytical framework for control evaluation in the public sector, after van Dooren (2006, p.29) and Pollitt and Bouckaert (2004, p.106)

Efficiency, rather than effectiveness, is more commonly stated by SDI initiatives as their objective, as indicated in Appendix A. It does not come as a surprise, then, that 'control' evaluation is popular with SDI practitioners, just as it is with IS/IT practitioners. Since we aim in this study to understand and classify SDI evaluation practices 'on the ground', we look further to IS/IT 'control' evaluation and public administration literature for appropriate concepts in the following sub-sections.

2.2.1 'Control' evaluation in the IS/IT literature

'Control' evaluation supports rationalistic decision models and analysis about efficiency of IS/IT investment (e.g.: Saleh and Alshawi, 2005; Aladwani,

³ Pollitt and Bouckaert (2004), whose work is the basis for van Dooren's model, originally characterized effectiveness as the ratio of outputs to objectives, which would put effectiveness under the realm of control. However, the concept of effectiveness is mixed in the literature (Bannister, 2001), and we concur with van Dooren whose definition of effectiveness takes unintended effects or externalities into account.

2002; Chin and Lee, 2000; Brynjolfsson and Hitt, 1999; DeLone and McLean, 1992; Davis, 1989; Cameron and Whetten, 1983). It has its emphasis on operations and fits well with bureaucratic environments (Serafeimidis and Smithson, 2003). The objective of control evaluation is goal monitoring; evaluators act as auditors, controlling, ranking or assessing success. Common types of measurements include ratios, percentages, and indexes. Mostly quantitative issues are considered, while social and soft (intangible) issues are either ignored or handled prescriptively. The classic example of evaluation as 'control' is Return-On-Investment (ROI), a method requiring tight financial discipline.

The IS/IT evaluation literature discusses two dimensions, 'timing' and 'perspective', that influence how control evaluations are conducted. With respect to 'timing,' authors differentiate between three moments: 'a priori', 'a posteriori', and 'during' (Doherty and King, 2004; Farbey et al, 1999b; Hirschheim and Smithson, 1999; Walter and Spitta, 2004). 'A priori' evaluation is essentially an ex ante assessment, conducted to aid the decision as to whether to implement an IS/IT project and, especially, to justify it. 'A posteriori' evaluation is an ex post attempt to demonstrate whether the adopted IS/IT solutions produced the expected results and gains. 'During' evaluation focuses on the routine monitoring of IS/IT implementation and performance over time. 'During' evaluation, better known as performance measurement, can be viewed as a management information system that assists the control of organizational functions, resources or other responsibilities (Heeks, 1998). Specific targets or referents are used, and the process serves as a *feedback loop* that strengthens accountability (ibid, p.3).

Most research and practice has centered on ex ante IS/IT evaluation (Frisk and Platén, 2004); comparatively little ex post evaluation is being done (Ward et al, 1996; Gwillim, 2005), even though many organizations "pay lip service to the concept (Farbey et al, 1999c, p.216)." According to Lin and Pervan (2001), organizations are focusing on justifying the investment through ex-ante evaluation, rather than ensuring a planned benefits management approach. Researchers have recommended that, instead, an integrative approach to evaluation be applied across the full IS/IT life-cycle – covering ex ante, ex-post, and during evaluation – as this would improve the delivery of results (Willcocks, 1992; Peters, 1996).

Control evaluation may be conducted from various 'perspectives.' Combining multiple perspectives yields a more balanced or comprehensive evaluation and allows an organization to align organization goals and internal business processes (Kaplan and Norton, 1992). Existing IS/IT evaluation frameworks can be seen to converge on five perspectives (Yu and Wang, 2005; Shang and Seddon, 2002; Applegate et al, 1999; Kaplan and Norton, 1992). These

perspectives are: 'platform improvements', 'operational', 'financial', 'beneficiaries', and 'learning and growth'. The 'platform improvements' perspective addresses the improved technical ability to share information and communicate; the 'operational' perspective refers to improved efficiency of day-to-day operating activities and supply/distribution channels; the 'financial' perspective refers to upgrades in economic control and improved allocation of resources (benefits from financial management as opposed to those derived directly from the platform or operational perspective); the 'beneficiaries' perspective reflects the enhanced collaboration and commitment of stakeholders and the degree to which their needs are being met; 'learning and growth' addresses increased functionality, flexibility, and useful/future life of IT infrastructure. The classification is not watertight; the perspectives may overlap and there is ample room for interpretation, but together, the perspectives provide a framework for a comprehensive evaluation.

The perspectives are relevant to both public and commercial IS/IT initiatives, though the emphasis for each may be slightly different. For instance, from a financial perspective, evaluation of commercial IS/IT may center on revenue generation and profitability, whereas the primary financial concern of public IS/IT evaluation may be appropriations and transparency. Table 2 summarizes the five evaluation perspectives, the measurement focus, and the emphasis of evaluation depending on the setting (commercial/public). Table 2 also includes, for illustrative purposes, quantifiable measures commonly used to align or assess goals and outputs from the different perspectives. Measures may be inventory-based, transaction-based, time-based, cost-based, budget-based, use-based, and option-based (Young, 2001; Applegate et al, 1999).

Table 2.2: Convergence of IS/IT control evaluation frameworks, after Yu and Wang (2005), Shang and Seddon (2002), Applegate et al (1999), Kaplan and Norton (1992), Young (2001).

Perspective	Description	Measurement focus	Commercial sector emphasis	Public sector emphasis	Measures
Platform improve-ments	Improved ability to share information and communicate	Technical functionality	Quality, reliability	Quality, reliability	Inventory-based: system content, system quality, degree of interoperability. Transaction-based: number of sessions, downloads, patrons, domain and host addresses
Operational	Improved efficiency of day-to-day operating activities and supply/distribution channels	Processes, transactions	Productivity, efficiency	Productivity, efficiency	Time-based measures: session length/duration; decreased time needed due to IS/IT service. Cost-based measures: cost/expenditure for staff, training, maintenance, site licenses; cost reduction, cost savings, cost avoidance
Financial	Improved allocation and control of resources	Resource allocation/ business results	Revenue generation, profitability, shareholder value	Appropriations, funding longevity, transparency, accountability	Budget-based measures: source of investment, resource flows, resource inter-dependency, alignment of resources to priorities
Beneficiaries	Enhanced collaboration and commitment	Use	New customer acquisition, customer retention	User satisfaction	Use-based measures: user activities, sessions/patron, user satisfaction
Learning and growth	Increased functionality, flexibility, and useful/future life of IT infrastructure	Human resources	Competencies, innovation	Competencies, cultural change	Option-based measures: extent of partnerships, added value, research, depth of contributors to services, educational offerings, human capital
	Added value to products and services Leveraged the level of information literacy				

2.2.2 Evaluation research in public sector settings

The literature on public sector evaluation suggests three further dimensions of evaluation, in addition to those of 'timing' and 'perspective' discussed in the previous section. These are 'formal demand', 'use' of evaluation results, and the 'specificity of inputs'. These additional dimensions are thought to be determinants of institutionalization of evaluation practices in the public sector.

The first dimension is 'formal demand' from government, providing a motivation for conducting the evaluation. As MacKay (2006, p.5) stressed, "Substantive demand from the government is a prerequisite to successful institutionalization [of evaluation]." Experience has shown that "without effective demand, that is demand based on real pressures on governments, any effort to institutionalize public sector evaluation will quickly lead to lack of interest and evaporation [of the effort] (Guerrero, 1999, p.2)." Formal demand can be internal, such as meeting managerial needs or fulfilling an organizational directive, or external, driven by accountability to, for instance, the central budget agency and complying with regulatory oversight (Guerrero, 1999). External demand also can arise from social pressure from stakeholders who are not part of management, but who still induce a formal, obligatory response. Some commentators have pointed out that the distinction between internal and external determinants for evaluation is too simplistic and should be elaborated further in order to understand interrelations between various internal and external drivers (Hill and Lynn, 2005; Forbes and Lynn, 2005). However, in this paper, we use the internal-external dichotomy to keep the analysis concise.

The second dimension is that of the intended 'use' of the evaluation results, which is closely associated to the 'formal demand'. Five distinct 'uses' have been articulated (Treasury Board Secretariat, 2005): supporting expenditure and resource management decisions such as ongoing program funding and justification for new funding; substantiating the need to review policy or strategic direction for a program; steering service delivery design or implementation; improving relations with stakeholders; and strengthening accountability and reporting regimes.

The third key dimension in public sector evaluation, particularly for cross-agency initiatives, is 'specificity of inputs' across agencies. This means that individual, agency contributions to activities are documented and known. This goes much further than estimating costs of activities. Rather, this involves the integration of evaluation with other mainstream tools of governance, such as investment planning, budgeting, and auditing (Boyle, 2003; Pollitt, 2001). The actual inputs – investment and risks – that each agency commits to an SDI initiative are made transparent. This is important because the

inputs influence the power-relationship between agencies and hence the structure of the partnership. Identifying and acknowledging interdependencies, the level of power each partner has in the relationship, and the perceived fairness in terms of risk or input from each partner, is critical for inter-organizational synthesis (Pitsis et al, 2004; Keast et al, 2004). To ensure synthesis, "much work has to be done at the front end of the collaborative relationship (Pitsis et al, 2004, p.56)." Practitioners need to establish how to share inputs in terms of risk and resources and match them to outputs and outcomes. The specification of inputs can be seen as mechanistic and "basic plumbing" (Schiavo-Campo, 2005, p.11), but "the first order of business should be expenditure tracking – not in the sense of value-for-money, but in the pedestrian but critical sense of following the money step by step (ibid)."

2.3 SDI 'Control' Evaluation

SDI evaluations span all four of the IS/IT evaluation orientations mentioned earlier – 'control', 'learning', 'sense-making', and 'exploratory' (Georgiadou et al, 2006). However, 'control' evaluation is the focus of our analysis, because it appears to be the approach most favored by SDI practitioners. In this section, we examine SDI 'control' evaluation practices using the lens of the five dimensions described in the previous section. The 'timing', 'perspective', and 'input specificity' dimensions point to 'how' the evaluation is being carried out, while 'demand' and 'use' point to 'why' the evaluations are being carried out.

2.3.1 Survey methods

Between February and April 2006, we conducted a global review of websites, searching for evaluations in which the input and/or outputs were articulated. We also corresponded with SDI experts to identify potential examples. In some instances, we relied on annual reports, which researchers have used as a proxy for the extent of 'control' evaluation (Boyne and Law 1991; Hyndman and Anderson 1995; Johnsen, 1999). The annual reports confirmed that performance measurement has been adopted; however, the reports could not provide insight into how performance information was used. Thus, we also relied on e-interviews for some qualitative perspective. Conducted online, these conversations constituted a text-based virtual ethnography (Crichton and Kinash, 2003; Clarke, 2000).

Overall, despite the number of SDI initiatives underway worldwide, the available evidence of evaluation practices was limited. Originally the idea was to focus on 'control' evaluation of SDI at the macro (whole-of-government) level, but due to the paucity of findings, we extended the search to meso (sectors, administrative unit) and micro (specific services)

levels. There were a number of examples of 'control' evaluation of GIS for particular applications, but unless the examples focused on issues of interoperability, data standards, data access, and inter-organization coordination, they were omitted. We also omitted SDI 'control' evaluation studies conducted by authors for research purposes (Booz Allen Hamilton, 2005; Cromptvoets et al, 2004; Cromptvoets and Bregt, 2003; van Orshoven, 2004; Vandenbrouke, 2005; Pavlova et al, 2002, Delgado et al, 2005; Abdelsalam and Mostafa, 2005; Kok and van Loenen, 2005), since they were not management control instruments, conducted by SDI practitioners evaluating their 'own' efforts.

The next section provides a brief description of the 'control' evaluation examples from our review. We focused on the evaluations that have been conducted in the past two years, since they reflect current practice best. Earlier work over the past decade (KPMG Peat Marwick, 1991; Tomlinson Associates, 1993; Price Waterhouse, 1995; OXERA, 1999; M-NCPPC, 1999; Baltimore County, Maryland Office of Information Technology, 2001; Warnecke et al 2001; Berends et al 2001; ECORYS-NEI, 2002; GeoAnalytics, Inc., 2003. Ayan, 2003) mainly consisted of ex ante evaluations.⁴

2.3.2 SDI control evaluation examples

We identified eleven evaluation examples, from the following ten SDI initiatives: Oregon Statewide GIS Utility (USA), Thailand NSDI, Gigateway (UK), Western Australian Land Information System (WALIS), Spatial Data Warehouse Ltd. (SDW)/ AltaLIS (Canada), MetroGIS (USA), Public Sector Mapping Agencies (PSMA) Limited (Australia), National Geo-data Repository of The Netherlands (DINO), Geospatial One Stop (USA), and Geoconnections (Canada). Each example fulfills the criteria of a 'control' evaluation by having clarity of objectives and clarity (or perceived clarity) of impact (Serafeimidis and Smithson, 2003). Appendix A details the specific SDI objectives and explicit measures used for evaluation in each one of the case studies. Table 3 provides a summary of the evaluation examples and indicates each example's comprehensiveness based on which perspectives were covered. We discerned which perspectives were covered through an analysis of the measures used (Appendix A) and their correspondence to a given perspective, as shown in Table 3. For example, a time-based measure such as 'reduced time involved in data development and acquisition' corresponded to the operational perspective. The comprehensiveness of the evaluation can be further viewed

⁴ Some of these SDI control evaluations were incorrectly identified as a cost-benefit analysis (CBA), which is a method representative of learning evaluation (see Georgiadou et al, 2006). To be considered learning evaluation rather than control evaluation, the studies either would have analyzed costs and benefits between alternative scenarios, thus providing insights, or they would have measured intangible benefits in more than a cursory manner, which was not the case.

in the context of timing, demand, use, and input specificity, as explained in the descriptions below and summarized in Table 4 at the end of the section. The details were up-to-date at the time of publication of this paper; however, activities and procedures are susceptible to change with time.

Table 2.3: SDI 'control' evaluation comprehensiveness based on types of measures used.

	Inventory & transaction-based measures	Time & cost-based measures	Budget-based measures	Use-based measures	Option-based measures	Comprehensiveness
	P	O	F	B	L	Perspective
Oregon Statewide GIS Utility	x	x				P, O
Thailand NSDI	x	x		x		P, O, B
Gigateway (UK)	x			x		P, B
WALIS (Australia) - during		x		x	x	O, B, L
SDW/AltaLIS (Canada)	x	x	x			P, O, F, B
MetroGIS (USA)	x	x		x		P, O, B
PSMA (Australia)	x	x	x	x	x	P, O, F, B, L
DINO (The Netherlands)	x	x	x	x		P, O, F, B
Geospatial One Stop (USA)	x	x	x	x	x	P, O, F, B, L
WALIS (Australia) - ex post		x		x		O, B
Geoconnections (Canada)	x	x	x	x	x	P, O, F, B, L

Key: Platform improvements (P), Operational (O), Financial (F), Beneficiaries (B), Learning and growth (L)

Oregon Statewide GIS Utility (USA)

The Oregon Statewide GIS Utility initiative is meant to establish and maintain an administrative and operational structure to support effective creation, maintenance, sharing, and access to geographic information. Its overall impact should be the reduction of costs and duplication of geographic information management while delivering tangible benefits to a large community of users statewide. The 2005 ex-ante business case study was a one-time evaluation requested by the Oregon Geographic Information Council (OGIC) and Information Resources Management Division (IRMD), Department of Administrative Services, State of Oregon. The evaluation confirmed the short-term and long-term benefits of the GIS Utility and justified the investment in time and resources to initiate the program and bring the GIS Utility to a full operational status (Oregon Geospatial Enterprise Office, 2006). The evaluation focused on platform and operational aspects and quantified expected efficiency gains, cost savings, and cost avoidance. Inputs also were quantified, but as a collective estimation, not according to

investments that individual state agencies would need to make.

Thailand NSDI

The 2004 ex-ante evaluation was requested by and prepared for the Deputy Prime Minister to inform an investment decision regarding Thailand's NSDI (Environmental Systems Research Institute, 2004). The NSDI was seen as a means to develop a better environment for the integration and sharing of information across all government sectors and society at large. The evaluation focused on platform and operational impacts. The automation and sharing of the fundamental geographic datasets was seen as largest area for benefit. Thus, measures focused on quantifying the benefits of having datasets in digital form, rather than manual, such as reduced time involved in data development and acquisition, reduction in ongoing data maintenance and dissemination, reduction in computing infrastructure allocation, and reduction in staff training allocation. The evaluation was circulated to all public stakeholders for review and comment; a large committee comprising representatives from all the agencies worked closely with the consultants who conducted the study. Inputs and benefits were quantified, but as a collective government-wide estimation, not according to costs and benefits to individual agencies. One of the consultants who worked on the Thailand NSDI evaluation explained, "Perhaps more valuable than the actual numbers to me was the exercise of defining costs and benefits which got everybody thinking and talking to each other (e-interview with Mark Sorensen, September 1, 2005)."

Gigateway (U.K.)

The objective of the Gigateway is to maintain a metadata service that is seen as a vital part of the national spatial data infrastructure (May, 2005). The Association for Geographic Information (AGI) implements Gigateway under a contractual agreement with the Ordnance Survey, who in turn receives funding for this activity through the Office of the Deputy Prime Minister's National Interest Mapping Services Agreement (NIMSA). Performance measurement is a new, annual activity with set targets, largely based on quantifiable outputs. Use cases also will be used to demonstrate tangible benefit. The evaluation is being administered by AGI under the terms and conditions of the agreement. It was recognized at the midyear point that many of the statistical targets agreed for delivery in 2004/5 were not going to be met, so the Operating Plan for 2005/6 is focusing on ensuring quality is given precedence over quantity, and that the provision of core datasets is the main objective around which the Gigateway team is targeting their energy. For this revised approach to evaluation, platform-based measures will be used and the beneficiaries' perspective will be measured with quantifiable business benefit statements. Evaluation is seen as critical to demonstrate that Gigateway is a useful service. If not, then 'national interest' public

funding for the metadata service will be seriously challenged.

Western Australian Land Information System (WALIS)

Established in 1981, WALIS is the longest standing, land information system (LIS)-geographical information system (GIS), cooperative arrangement in Australia. It is designed to build networks of people and technology to share information, mostly by Western Australia government agencies, and improve information usefulness and accessibility. The Department of Land Information (DLI) is a lead agency in WALIS, and WALIS's offices are situated within the DLI organizational structure. DLI is legally required to submit to Parliament an annual report (Department of Land Information, 2005). In 2003, WALIS undertook a Performance Evaluation Project (Deloitte Touche Tohmatsu, 2003), and followed up this study with another independent assessment in 2004. The objective of this ex-post study was to identify the value contributed by WALIS to both users and producers of spatial data, as represented by efficiency savings and willingness to pay (ACIL Tasman, 2004). The results of the evaluation study serve as a basis for educational and promotional material aimed to advance the wider appreciation and use of the Western Australia SDI throughout the community of Western Australia (ibid, p.vii).

The 2003 Performance Evaluation study also led to the establishment of key performance indicators and targets for annual evaluation, which are included in the annual report. Operational benefits are assessed by a measure of the cost for delivering different results; in this way, inputs are part of the evaluation. However, only the inputs of DLI to WALIS are included, not the inputs of the full range of contributors. The beneficiaries' perspective is assessed with measures of awareness and acceptance. The Auditor General independently audits the WALIS performance indicators. Although the performance indicators are in place, the process is more of a formality for accountability purposes than a tool for service delivery improvement (e-interview with Genevieve Gongora-Mesas, May 30, 2006). However, it is likely to become more rigorous once the Shared Land Information Platform (SLIP) becomes operational (ibid). The SLIP, driven by DLI, was endorsed by the State Cabinet in 2005. The SLIP governance arrangements include the development of a cross-government reporting framework. Also, DLI is transitioning to becoming a land information statutory authority with commercial powers. As a statutory authority, DLI is meant to deliver a greater return to government and the community on the State's land information assets.

Spatial Data Warehouse Ltd./AltaLIS (Alberta, Canada)

The Spatial Data Warehouse (SDW) is a self-financing, not-for-profit organization formed in June 1996 when the Government of Alberta

discontinued its traditional role of funding and managing Alberta's digital mapping (Spatial Data Warehouse Ltd., 1998; Chorel, 2001). SDW is meant to maintain and promote the broadest possible distribution of provincial digital mapping that meets the immediate needs of the Alberta market place and preserves the mapping systems for the long-term benefit of Albertans. SDW has a Board of Directors with representatives from provincial government and local utility and communications companies who are the largest users of Alberta's base mapping information. In 1998, AltaLIS Ltd. ("AltaLIS"), a joint-venture company, signed a long-term contract with SDW for the management, marketing and distribution of Alberta's base mapping, property mapping and terrain information. AltaLIS keeps statistics on its performance, as well as accounting records, which are audited by SDW annually. AltaLIS provides SDW with detailed monthly production reporting and invoicing on work completed. SDW's role is to monitor performance, costs, and profit to ensure all contract agreement terms are met (Schlachter, 1999). The performance statistics are for AltaLIS and SDW internal use only and are communicated through a management committee. Various aspects of service are monitored with hard/quantifiable measures, while others are monitored by user feedback. There are a couple of External Advisory Groups run by SDW that solicit and encourage user feedback on data quality and other data related issues. Although the general user community does not have access to internal measures or financials, they can assess performance directly by observing the reduction in delivery times, update cycles, and pricing, as well as increased data and service quality.

MetroGIS (Minneapolis/St. Paul, Minnesota, USA)

MetroGIS is a voluntary regional geographic information systems initiative serving the seven-county Minneapolis-St. Paul (Minnesota) metropolitan area. It was initiated in 1995 to improve participant operations, reduce costs, and support cross-jurisdictional decision-making. In April 2001, the MetroGIS Policy Board adopted a Performance Measurement Plan to enable the organization to more clearly state to its stakeholders what it expects to accomplish, and to demonstrate accountability for results (Richardson, Richter & Associates, Inc., 2002). The demand for the plan initially came from within. As the manager of MetroGIS explained, "To sustain continued support for MetroGIS's collaborative environment, we believed that a systematic mechanism was needed to demonstrate progress. The Policy Board concurred and authorized the creation of the current performance measurement program (e-interview with Randall Johnson, July 5, 2006)." Performance measurement now is an ongoing annual activity, largely based on automatic registration of platform-based "events" that include visits to a DataFinder, number of data downloaded, frequently downloaded datasets, identification of entities downloading data, the number of DataFinder publishers, etc. Performance measures of benefits to data producers have not

yet been quantified, while non-quantitative instruments, such as testimonials, are expected to gauge intermediate outcomes, such as improved decision making and better service delivery them to public (MetroGIS, 2004; MetroGIS, 2005). Since 2003, performance results have been reported annually by MetroGIS staff to the MetroGIS Policy Board, with the Policy Board acting as auditor. The Performance Measurement Plan recommends that the organization review performance results prior to building the annual budget and work plan (MetroGIS, 2002, p.5). Thus, performance information is meant to support the budgeting process, and while it may be used to modify activities and policies, and the performance report demonstrates accountability for results, the primary use and preoccupation of performance measurement is to clearly state accomplishments to stakeholders. The availability of performance information helps “demonstrate that MetroGIS is serious about making a difference and conducting its operations as a mainstream organization, with accountability mechanisms in place (e-interview with Randall Johnson, June 12, 2006).”

Inputs are not covered in the annual evaluations. The focus is on what the organization delivers in terms of products and services (outputs), rather than what resources allocated or expended (inputs). Meanwhile, the 2005 performance measurement report mentioned that the reporting process helps with understanding the “causal relationship between resources allocated to specific activities and desired outcomes.” The MetroGIS Staff Coordinator acknowledges that the report is flawed in this respect and explains, “The simple answers are: 1) the MetroGIS community has yet to define a sufficient means to accurately measure the breadth of resources allocated to MetroGIS by the various organizations performing custodial roles, and 2) regarding the matter of causal relationship, in addition to not having a good handle on the resources involved, not enough historical perspective has yet been accumulated through the performance program thus far to draw definitive causal relationships (e-interview with Randall Johnson, June 12, 2006).” Over time, however, the plan is to incorporate efficiency measures that show what has been achieved in relation to the input of resources (MetroGIS, 2002, p.4).

MetroGIS also submits an annual report to the Metropolitan Council, MetroGIS’s primary sponsor. The annual report must accompany MetroGIS’s annual funding request to the Council and must outline how MetroGIS’s efforts are beneficial to Council. To verify that MetroGIS contributes to the Metropolitan Council’s operations, the Council recently conducted its own detailed evaluation of MetroGIS. The Council concluded that it benefits substantially more than its annual contribution. This study was the first and only time an individual stakeholder conducted an in-depth evaluation of its cost versus benefit for participating in the joint MetroGIS activity.

National Geo-data Repository of The Netherlands - DINO (The Netherlands)

The Netherlands Institute of Applied Geoscience (TNO) is the central geoscience institute in the Netherlands for information and research to promote the sustainable management and use of the subsurface and its natural resources. Five ministries provide financial support, and public and private agencies are obligated to provide their data to TNO. The national geo-data repository (Dutch acronym: DINO), which is managed by TNO, is meant to contain all relevant data and information of the subsurface of the Netherlands. This data and information should be easily accessible and almost free of charge. To ensure the continued financial support to DINO, the manager proactively established a balanced scorecard with measurable targets with which to assess performance, many of which are automated (Kuipers, 2005; 2004). In turn, this created the current formal internal demand from the participating ministries for performance information. TNO also gathers information from users via interviews and questionnaires. Given that the primary drivers for the establishment of TNO were to promote investment in the country, share costs of data development, and reduce costs of data storage, the broad benefits of DINO to the economy were evaluated in 2003. Also, there is a strong financial perspective to the annual evaluation of DINO and careful accounting of DINO's costs. However, the operating costs incurred by contributing public and private agencies for data development are not part of the assessment.

PSMA (Public Sector Mapping Agencies) Australia Limited

PSMA (Public Sector Mapping Agencies) Australia was established in 1992 as an unincorporated joint venture. It started as a project and since has developed into a business with the incorporation of the entity in June 2001. The initial business plan was developed in 1998 to support the incorporation process. The company constitution adopted at that time requires the company to prepare an annual program each year and deliver this draft program to the shareholders, prior to the commencement of the financial year. The annual program must be approved unanimously by shareholders. The degree of completion of the annual program along with responses to opportunities and circumstances during the year constitutes the measure of success on an annual basis. This is reflected in the annual report (PSMA, 2005), which is for the benefit of the shareholders and is required for the company under corporation law.

More analytical measures are made at the Board level to assist with strategic planning, but these measures are not in the public domain. PSMA Australia is not profit driven despite being a commercial entity, so revenue is not a key measure per se, but rather how broadly the datasets built and maintained by

the company are being used. However, since PSMA uses Value Added Resellers (VARs) for data distribution, and VARs are profit driven, returns to PSMA Australia are a surrogate for measuring success. With ubiquity being a key goal, increasing PSMA's markets and market penetration are seen as important feedback from existing clients. In the last few years, this feedback has been structured into surveys so that definitive measurements can be made. As the PSMA manager explained, "Like any other business we need to be able to measure that we are achieving (e-interview with Dan Paull, July 7, 2006)."

PSMA Australia's Annual Program 2005-06 has inspired a new approach in the structure of the annual planning document. The new project based structure provides clearer understanding of the planned activities and superior connectivity between the Strategic Plan and the Implementation Program within the PSMA Australia national office. Individual performance contracts are developed with key performance indicators being derived directly from the Implementation Plan. Staff can readily identify how their activities relate to the company's strategic outcomes.

Geospatial One Stop (USA)

Geospatial One-Stop (GOS) is a geographic information system (GIS) portal that serves as a public gateway for improving access to geospatial information and data. The portal went "live" in 2003. GOS is one of 24 e-government initiatives sponsored by the Federal Office of Management and Budget (OMB) to enhance government efficiency and to improve citizen services. GOS uses several different measures to fulfill its reporting requirements to OMB. Some are based on WebTrend data and others revolve around participation in the portal and partnerships formed because of the portal. GOS identifies milestones that it plans to achieve, against which OMB and an Intergovernmental Board assesses progress. The portal also has a statistics portlet, which is a reporting area showing usage of the GOS portal. This portlet provides statistics on-demand so that stakeholders can readily evaluate the services that GOS offers. The system includes tools to generate reports on contents and activity of the portal and its underlying databases on a daily, weekly, and monthly basis. A number of agencies contribute to GOS, and each is required to report annually to the Office of Management and Budget, as established through the OMB Circular A-11. Each agency that contributes to GOS reports its GOS expenditures in its respective reporting, and these figures are meant to match the figure that is used in the collective GOS report. Currently, government agencies are discussing a joint budgeting and reporting process that would be broader than just GOS. It is part of the new Geospatial Lines of Business initiative focusing on shared resources under a service-oriented architecture. The GOS Technical Lead contemplates that in due time, "A shared funding algorithm will have to be developed and

agreed to by the partners, as well as a shared performance measurement process (e-interview with Robert Dollison, May, 31, 2006)."

Geoconnections (Canada)

GeoConnections Phase I was a seven-component, sunset program of the Canadian government, funded for five years starting in 1999. The primary objective of Phase I was to develop the infrastructure that enables greater use of geo-information by users that apply the infrastructure to new products and services and to leverage investments to increase the supply of geo-information on the Internet and accelerate technology development and commercialization by the private sector. The Program itself did not make user applications available; rather it built the infrastructure to enable and others to develop applications more flexibly and efficiently. NRCanada had the responsibility to implement the program. A Management Board, consisting of 17 members from federal, provincial and municipal agencies, industry and academia, recommended targeted deliverables and reviewed performance measures for evaluating GeoConnections. Geoconnections now is in Phase II, but at the end of Phase I, before signing off on a second phase, the Treasury Board conducted a comprehensive ex-post evaluation of each of Geoconnections' components. The evaluations covered the full range of perspectives and were performed using evidence gathered from interviews and reviews of strategic documents including key project reports (i.e., proposals, progress reports, final reports, and analysis documents) and other relevant material. Particular emphasis was given to the leveraging of public financial resources. Earlier on in the project a Performance Management and Evaluation Framework was prepared to guide short-, medium- and long-term performance measurement, as well as the planning of evaluations and reporting on progress (Andari Consultants, 2001). With the start of Phase II in 2005, GeoConnections established a new Value Management Office (VMO), which will provide more rigor and flexibility for future evaluations of both inputs and outputs. Geoconnections also will pursue other evaluation orientations to assess broader SDI outcomes.

Table 2.4: Summary of SDI control evaluation: dimensions of institutionalization

SDI Initiative	Perspective	Formal Demand	Primary use	Input specificity across agencies	Evaluation formality, periodicity
A. prior/lex-ante evaluation					
Oregon Statewide GIS Utility (USA)	P, O	Fulfillment of an organizational directive	Expenditure decision – supporting new investment	n/a	One-time contracted evaluation requested by Oregon Geographic Information Council (OGIC) and Information Resources Mgt. Division (IRMD), Oregon Department of Administrative Services
Thailand NSDI	P, O, B	Fulfillment of an organizational directive	Expenditure decision – supporting new investment	n/a	One-time contracted evaluation requested by and prepared for Deputy Prime Minister; report circulated to public stakeholders for review and comment.
During/performance measurement					
Gigateway (UK)	P, B	Fulfillment of an organizational directive	Steering service delivery	n/a	Evaluation administered under terms and conditions of a contractual agreement between Association for Geographic Information and Ordnance Survey.
WALIS (Australia)	O, B, L	Compliance with regulatory oversight	Strengthening accountability	n/a	Legally required annual reporting to Parliament with independent audit by the Auditor General.
SDW/ItalLIS (Canada)	P, O, F, B	Fulfillment of an organizational directive	Steering service delivery	n/a	Formal annual reporting and financial audit under terms of contract.
MetroGIS (USA)	P, O, B	Fulfillment of an organizational directive	Documenting benefit / Improving relations with stakeholders	n/a	Formal annual reporting to stakeholders; obligatory annual report to Metropolitan Council as part of budget request.
PSMA	P, O, F, B, L	Fulfillment of an organizational directive	Informing stakeholders	n/a	Formal annual reporting to shareholders, required under corporation law.
DINO (The Netherlands)	P, O, F, B	Fulfillment of an organizational directive	Steering service delivery	n/a	Formal annual reporting and financial audit.
Geospatial One Stop (USA)	P, O, F, B, L	Compliance with regulatory oversight	Expenditure decision - continuing program funding	Cross-agency specification of inputs	Formal, mandated annual reporting to OMB and on-demand web-based reporting to stakeholders.
A. posterior/lex-post evaluation					
WALIS (Australia)	O, B	Response to stakeholders	Improving relations with stakeholders	n/a	One-time contracted study of value ascribed to WALIS by Western Australian community; extension to 2003 performance review.
Geconnections (Canada)	P, O, F, B, L	Compliance with regulatory oversight	Expenditure decision - continuing program funding	Cross-agency specification of inputs	Formal 'budgetary sunset' evaluation by Treasury Board Secretariat for each of project's seven components.

Key: Platform improvements (P), Operational (O), Financial (F), Beneficiaries (B), Learning and growth (L)

2.4 Analysis

The eleven 'control' evaluation examples explored in the previous section help us understand how and why practitioners 'on the ground' are evaluating their own SDI implementation efforts. 'How' the evaluation is being carried out points to aspects of 'timing', 'perspective' and 'input specificity' in the evaluation process. 'Why' the evaluations are being carried out points to issues of 'demand' for and 'use' of the evaluation results. In this section, we analyze each of the five dimensions - timing, perspective, demand, use, and specificity of inputs.

'Timing': 'During' evaluation, or performance measurement, increasingly has been conducted since 2002. This trend reflects a growing recognition of the need for more management controls in order to achieve SDI objectives. It is in line with suggestions from IS evaluation literature that a more integrative approach to evaluation be applied across the full IS/IT life-cycle. Prior to 2002, few performance measurement examples existed. The majority of 'control' evaluation examples were ex ante, driven by the need to justify investment and secure funding. Examples of ex-post evaluation are scarce. This is understandable, because most SDI initiatives still are in their infancy and post-implementation evaluation of SDI is premature. The two cases of ex-post SDI evaluation from our survey were for efforts that have been underway for many years. WALIS was established in 1981 and Geoconnections was a project funded to support the Canadian Spatial Data Infrastructure, whose origins date back to 1996.

'Perspective': Practitioners are using several evaluation perspectives (and related measures) resulting in more comprehensive evaluations. The examples show that operational concern such as productivity or efficiency is not the only aspect that is addressed. In several instances, the 'beneficiaries' perspective such as user satisfaction is included, presumably in response to concerns that services should be user-driven. Still, overall, the operational perspective is dominant, with the consequence of time and cost-based measures being most frequently used. Although evaluations incorporating multiple perspectives are more comprehensive, this does not mean that a universally-relevant set of indicators is desirable or meaningful. Practitioners identify measures for each evaluation perspective according to their own objectives and their own perception of benefits/impacts.

'Demand': Formal demand appears to be the key trigger for the unfolding of an evaluation process. The few examples we identified in our worldwide review are in response to a formal demand. In the examples, demand most often is internal, with evaluation sought by those government agencies principally involved in the operations of the SDI initiative. Only in three

examples, WALIS, GOS, and Geoconnections, is the demand external, from an executive or central agency not directly involved in operations. In these cases the demand is enforced through legislation or administrative policy. Sunset legislation management was the basis for the Geoconnections' evaluation, requiring evaluation by the Treasury Board in order to justify the continuation of the program. Performance audits of GOS and WALIS are required by the central agencies responsible for budgetary oversight. Irrespective of whether the demand is internal or external, our results are consistent with assertions by authors emphasizing the importance of specific *push factors* in overcoming evaluation inhibitors (Gwillim et al, 2005; Seddon et al, 2002).

For MetroGIS and DINO, it may appear that formal demand was not the key trigger for evaluation and that instead, the supply of performance information by proactive managers preceded the demand. However, in both cases, there was the potential for budget cuts, and the managers' impetus for carrying out the evaluation and supplying performance measures was to ensure that funding would be continued. Thus, the uncertainty of budgetary decisions served as the demand. The respective management structures recognized that evaluation would be constructive in the validation of activities and thus sanctioned the practice. Performance measurement since has become a standard operating procedure for both initiatives. Gigateway's revision to its performance measurement approach similarly was driven by the budget situation. In order to ensure future funding, more attention was given to the 'beneficiaries' perspective of evaluation to demonstrate the relevance of Gigateway to national interests and thus its worthiness of national budgetary support.

External demand may be a contributing factor to the comprehensiveness of the evaluation. GOS and Geoconnections were two of the three most comprehensive evaluation examples. Both were formally linked to a regulatory process in which the evaluation was part of compliance with an executive agency. Evaluation "works best if it is a centrally driven initiative of a powerful finance ministry, linked closely to its main area of influence, the annual budget process (Carin and Good, 2004, p.8). Boyle (2003) concurs that evaluation should have strong central support from central government bodies. Central agencies should "provide an oversight and coordination role, and also provide guidance and advice (ibid)." PSMA also was among the most comprehensive evaluations. Although PSMA is not under the oversight of a finance ministry, the comprehensiveness of its evaluation perhaps can be attributed to the fact that it is run as a business with conventional structures for oversight. AltaLIS, too, has a similar business orientation which dictates tight monitoring of inputs and outputs and reporting to a Board of Directors. The oversight role of the central budget agency can be compared to the

Board of Directors oversight of PSMA and of AltaLIS. 'Control' evaluation practices after all were honed in the commercial sector.

'Use': Since most of the evaluation examples are recent, it is too early to confirm the use and utility of the performance information. At a superficial level, we see that performance information is being used for service development, budget decisions, and accountability purposes, but ultimately, the test of utility will be signs of marked improvement in outputs over time. A further complication is that improved performance is the collective consequence of the behavior of individuals. While performance information at the organizational or corporate level can contribute to decisions about investment priorities and service delivery, most improvements eventually rely upon people choosing to change the way they carry out their work for their organization. Consequently, performance information also must be linked to human resources management. PSMA, for example, has been moving in this direction with the development of individual performance contracts with key performance indicators.

'Input specificity': Perhaps the thorniest issue with respect to how SDI 'control' evaluations are conducted involves input specificity. While practitioners are showing a clear trend in documenting outputs, the public sector evaluation literature indicates that both outputs and inputs need to be specified. However, inputs are not receiving adequate attention, in part because the information is so difficult to obtain; inputs typically are sunk, indirect, or concealed in program budgets. Also, agencies refrain from divulging their inputs, as this is seen as impinging on their autonomy. Among the examples, only GOS and GeoConnections make an attempt to identify inputs or leveraged resources from across a spectrum of contributing agencies. For GOS, agencies are obliged to report their geospatial expenditures that contribute to GOS, as well as other activities; this is part of the OMB A-11 requirement. Geoconnections has established a Value Management Office with staff trained to deal with the complexity of accounting for geospatial investments and leveraged resources by agency, program area, and locality. The other evaluation examples account only for the inputs of the SDI coordinating body, or their emphasis is on outputs alone. The lack of specificity of inputs in most examples calls into the question the interdependencies between agencies and their ability to pursue cross-agency investment planning. Moreover, without clarity about inputs, evaluation of efficiency suffers. It is not enough for the coordinating body to assess only its own inputs (and outputs), rather the discrete (or disaggregated) inputs (and outputs) of all agencies must be taken into account to determine the overall state of efficiency. MetroGIS recognizes this and envisions that more emphasis will be given to inputs in the future.

2.5 Conclusion

In this paper, we mobilized concepts from IS/IT and public sector evaluation research to analyze how and why SDI practitioners 'on the ground' are evaluating their 'own' efforts in implementing SDI. Practitioners tend to conceive SDI with a cost savings/cost reduction objective, and in recent years, they have begun to develop control-driven performance measurement systems focusing on inputs and outputs. This convergence on 'control' evaluation pointed to an opportunity for research. By exploring control evaluation in practice – pulling lessons out of the woodwork – we aimed to move SDI evaluation research to a new level of inquiry.

'Formal demand', 'use', and 'input specificity' are thought to be determinants of institutionalization of evaluation practices in the public sector. Since SDI evaluation is unfolding in the public sector, we anticipate that these dimensions in turn will have a bearing on SDI evaluation institutionalization. As we have shown, demand for SDI evaluation can be both internal and external, but external demand from a central budget agency appears to lead to greater 'input specificity', and thus greater clarity of interdependencies between agencies, as in the examples of GOS and Geoconnections. Since these two evaluation examples also exhibit a high degree of comprehensiveness in terms of the perspectives they cover, we believe that an in-depth study of how the evaluation process in these particular examples has evolved over time is warranted. This will be the topic of further research.

Even though authors have highlighted the complexity of SDI and the intangible nature of its benefits (Georgiadou et al, 2006; Rodriguez-Pabon, 2005), hard, quantitative measures are the dominant basis for evaluation. In bureaucratic settings, practitioners are wedded to 'hard evidence' of IS/IT effects. ACIL Tasman (2004, p.15), in their SDI valuation study in Western Australia, acknowledged that "[q]ualitative values are just as real and important as those that can be quantified," but they pointed out that qualitative values "usually do not receive the same level of recognition." Similarly, Wilson (1989) noted that the observability and measurability of outputs are vital supports for understandability by non-expert 'outsiders'. This explains why executives are drawn to quantitative measures. For these two reasons, recognition and understandability, bureaucracies are likely to continue to cling to 'control' evaluation. Also, 'control' evaluation is what is most familiar, so there is a cultural lock-in for this approach. Given these predispositions, we anticipate more examples of SDI control evaluation in the coming years, provided formal demand is present. Instituting evaluation is particularly timely, not just because of the growing attention to SDI, but because public institutions worldwide are being held ever more accountable.

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Appendix A. Summary of SDI control evaluation: SDI initiative, year of evaluation, specific objectives, and explicit measures used for evaluation.

DI Initiative	Year of evaluation	Low uncertainty as to objectives	Low uncertainty as to impacts and strategies
		<i>specific objectives</i>	<i>explicit measures</i>
regon Statewide IS Utility (USA)	2005	Reduce the cost of geographic information gathering and access by state, regional, and local government agencies	<ul style="list-style-type: none"> Operational and Efficiency Benefits: Expected gains in current personnel efficiency and productivity will allow them to carry out their work in less time with less expense Cost Savings and Cost Avoidance: Actual savings of money (contract costs, direct expenses) or the avoidance of future costs that might be necessary to support or comply with new program requirements Revenue Enhancement: Opportunities for additional revenue by using geographic data and technology to support more effective real property tax and fee collection, increases in federal appropriations, and the location of the revenue sources.
hailand NSDI	2004	Develop a better environment for the integration and sharing of information across all government sectors and society at large.	Automation and sharing of the fundamental geographic datasets seen as largest area for benefit, thus measures focused on benefits of having datasets in digital form, rather than manual: <ul style="list-style-type: none"> Reduced time involved in data development and acquisition Reduction in ongoing data maintenance and dissemination Reduction in computing infrastructure allocation Reduction in staff training allocation.
igateway (UK)	2005 (new approach begun)	Provide a national metadata service as a vital part of the national spatial data infrastructure. The primary focus for 2005-6 is the inclusion in the service of discovery metadata that describe 'core' datasets, with emphasis on quality, including currency, rather than quantity.	<ul style="list-style-type: none"> Number of core datasets on the service as percentage of those defined as core. Number of organizations providing metadata as a percentage of those defined as core. Percent of new datasets on service reaching Gigateway 'accreditation standard'. Number of visits to the site itself; Use cases demonstrating tangible benefit Availability of Gigateway Data Locator and Node as a percentage of stated service level
estern ustralian Land formation ystem (WALIS)	2003-present	Build networks of people and technology to share information and improve its usefulness and accessibility. There are six key result areas: <ul style="list-style-type: none"> Facilitate whole of government spatial information (SI) strategic planning and program management. Lead in spatial information (SI) policy formulation and implementation. Manage government SI quality (including metadata). Lead government SI access piloting and the provision of 'free' government SI. Facilitate and negotiating stakeholder relationships across the WALIS community. Oversee the WALIS Program via a four-part governance framework. 	<ul style="list-style-type: none"> Average cost of delivering each of the key results Awareness - Percentage increase in first time participants at WALIS functions Awareness - Percentage increase in repeat participants at WALIS functions Acceptance - Percentage increase in number of first time customers accessing spatial information from WALIS community members Reuse - Percentage increase in number of return customers accessing spatial information from WALIS community members
	2004	(see above)	<ul style="list-style-type: none"> Savings that government agencies achieve due to reduced duplication of work in collection of information & reduced effort required to manipulate data to make it compatible with other data sets (producer surplus) Extra value contributed by WALIS to spatial data, as identified by the final users of that data (consumer surplus)
patial Data arehouse d./AitaLIS anada)	1998 - present	<ul style="list-style-type: none"> Reduce cost of operations significantly. Improve operational efficiency and service levels to all users. Increase demand for SDW data by improving the product and improving the product for SDW participants. Increase data sales to third parties by making data more available and accessible. Increase data revenues from third parties by improving the marketing, pricing, and licensing arrangements. 	<ul style="list-style-type: none"> Reduction in delivery times, update cycles, and pricing, as well as increased data and service quality. User feedback
etroGIS (USA)	2002-present	Facilitate widespread sharing of geospatial data, by means of <ul style="list-style-type: none"> Improve participant operations 	<ul style="list-style-type: none"> Number of visits/sessions to DataFinder Web site; Number of entities visiting DataFinder; Number of whole or partial datasets and regional datasets

CHAPTER 3: Cross-agency coordination in the shadow of hierarchy: 'joining up' government geospatial information systems

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Cross-agency coordination in the shadow of hierarchy: 'joining up' government geospatial information systems

Abstract

Government agencies striving to make geospatial information systems interoperable and cost-effective often appear to function as a self-regulating network shaped only by internal trust and reciprocity. However, recent public management research suggests that external steering of a network, exercised by authoritative bodies through hierarchical means, may invigorate cross-agency coordination. The two case studies of federal geospatial coordination in Canada and the USA confirm this emerging theory of network-hierarchy dynamics. In these countries, the central budget agency (CBA) is influencing resource flows and accountabilities within a federal geospatial network of government agencies, which in turn affects how these agencies deliver 'joined up' services. The CBA relies upon three types of tools: the shaping of network governing structures, promotion of uptake of new management information systems, and the use of evaluation (scrutiny) to solidify accountabilities of the network. Since these tools cast a shadow of hierarchy upon the network, they may be viewed as counter to the voluntary ethos of networks. However, the case studies suggest that the CBA's actions appear to confer legitimacy to the network – resulting in a seeming contradiction – greater central control, more vigorous, distributed geospatial coordination.

Keywords: cross-agency coordination, SDI implementation, joined-up government, metagovernance

3.1 Introduction

Government agencies* are increasingly obliged to 'join up'[†], to establish common web portals (one-stop shops) and common databases, making their information systems accessible, interoperable, and cost-effective. However, the 'joining up' of geospatial information systems has been deeply problematic; 'practical and operational implementation appears unruly (de Man 2006: 331),' and 'institutional inertia' has overridden most well-intentioned efforts (Craig 1995).

The 'joining up' of geospatial information systems can be viewed as synonymous with spatial data infrastructure (SDI). SDI encompasses the standards and information technologies, decision-making processes, human and financial management systems, and social structures that govern the acquisition, processing, distribution, use, and maintenance of geospatial information. SDI extends beyond government information systems, but for the purpose of this paper, we are focusing on government efforts, and in particular central (national or federal government) efforts. Central government is a primary provider of geographic information and exerts a profound influence on national SDI development (Masser 1999, Rhind 1996). One of the tenets of SDI discourse is that geospatial information should not be managed centrally; rather, each producer or custodian agency should manage its own data, while a variety of online tools and services should permit users to access and seamlessly integrate government information sources. Agencies also should coordinate geospatial information and service investments, delivery, and maintenance.

To achieve SDI coordination, a commonly held view is that 'individual agencies become a component of a new network organization (van Loenen 2006: 44),' one that is 'optimally described as a web (Harvey 2001: 36)'. Interdependent agencies retain their autonomy, but they consciously agree to operate as a collective government enterprise to address societal information needs, develop demand-driven services, and acquire the resources necessary to do so. This network organization, either officially recognized or *de facto*, is considered a key SDI building block and an indicator for evaluating SDI (Vandenbrouke 2005). When SDI is at its most mature stage, the network is said to consist of 'equal players, with a clear vision and operating proactively (van Loenen 2006: 51)'. The implication is

* In this paper, the term 'agency' refers to an administrative organization of a government, such as ministry, department, bureau, or authority.

[†] The expression 'joined up government' is interchangeable with terms such as whole-of-government, horizontal management, managing for shared outcomes, and collaborative public management, which are used by different countries for the same concept.

that the network is self-organizing or self-regulating (Grus *et al.* 2006), that parties in the network spontaneously interact, communicate, and collaborate to create new solutions.

This network vision for SDI is consistent with the stream of public management literature that draws upon network theory and focuses on governance (Kikert *et al.* 1997, Keast *et al.* 2004, Kooiman 2000). The literature emphasizes that network structures, largely built on interaction among peers and fortified by increasing trust over time, are flexible and inclusive. Network structures are distinguished from hierarchical structures in that unilateral power and authority are not present or exercised (Kikert *et al.* 1997, Keast *et al.* 2004, Kooiman 2000). Increasingly, networks are viewed as a more effective form of coordination – more effective than traditional hierarchy, for which government is known. The study of networks has ‘exploded’ in recent years; networks are discussed as new and positive, revealing a veritable ‘network euphoria (Kenis and Provan 2006: 2)’.

The network literature commonly contrasts networks and hierarchies, almost in a black and white way (i.e. with networks seen as good, and hierarchy as bad). A more nuanced view of coordination is needed, recognizing that a blending of hierarchical and network forms of coordination occurs in practice (McGuire 2006, Meuleman 2006). Considine (2002: 6) emphasizes that ‘[w]hile it may be fashionable to assume a high level of non-hierarchical coordination, the reality is probably very different. Many of these networks retain strong forms of centralisation, and power is asymmetric. What this may tell us is that the inter-organizational network is really just a new form of complexity within the older hierarchical mode’. Thus far, there has been little empirical data on the topic.

In this paper, we explore the dynamics between hierarchical and network coordination in the geospatial realm. Our overall aim is to understand how external institutions affect public geospatial network elements, such as strategy and operations, resource distribution, routines, and accountabilities, and how these elements influence geospatial network behaviour. In this paper, we focus on the involvement of a specific external institution, the central budget agency (CBA), in geospatial cross-agency coordination in Canada and the United States of America (USA). Canada and the USA, two nations with compelling cases in geospatial coordination, often are cited as leaders in national SDI development (Masser 2003) and as a source of inspiration for e-government (World Bank 2005). In the Anglo-American politico-administrative systems of these two countries, the central budget agency has a unique position of authority to induce agencies to operate less autonomously. In other countries, with different politico-administrative systems, hierarchical influences may stem from other entities. Nevertheless,

the hierarchical-network dynamic still may be a significant factor in inducing cross-agency geospatial coordination.

The SDI domain was considered for two reasons: familiarity of the authors with the domain since the early nineties and the domain's unique appropriateness for understanding complex issues of whole-of-government coordination. Geospatial information systems span all government policy sectors, so the 'joining up' of these systems cannot be limited to a set of government agencies working in a particular policy area.

The rest of the paper is organized as follows. In section 2, we outline the conceptual framework of this research. In section 3, we present the case studies and provide details of the CBA's evolving interventions and public managers' perceptions in Canada and the USA. In the fourth section, we highlight the similarities and differences between the Canadian and the USA situations and discuss the empirical evidence in relation to theory. We then conclude with suggestions for further research.

3.2 Conceptual framework

Cross-agency coordination has been a long-standing preoccupation of public management (Pollitt 2003, Hood 2005, Seidman 1999, Gulick 1937). Policy issues such as public health, national security, and natural resources management require that multiple agencies work across vertical and horizontal administrative lines. The public management literature identifies three forms of coordination: hierarchy, network, and market (Powell 1990). Each form of coordination has its unique orientation, goals, decision process mode, means of communication, and theoretical basis. Each coordination form draws upon factors that motivate parties both positively and negatively. We focus on hierarchy and network coordination, not because the market form of coordination is not present or influential; rather, we are using a network-hierarchy lens to understand how network coordination functions in a hierarchical environment. As summarized in table 1, the network form relies primarily on moral, social, and professional inducements or constraints, while the hierarchical form relies on the coercive authority of rules and regulations supported by budgetary control.

Table 3.1: Fundamental forms of coordination (derived from Verhoest et al. 2006: 5, Herranz 2006: 40, Meuleman 2006: 4).

Characteristics	Hierarchy	Network
Basis of interaction (or control)	Authority, oversight	Mutuality, solidarity, self-regulation
General orientation	Bureaucratic	Community
Motivation of parties involved	Rules and regulations, supported by budgetary controls (top-down norms and standards, inspection, intervention)	Moral, social, and professional inducements or constraints (shared values, consensus, loyalty, reciprocity, trust)
Goals, preferences	Accountability, equitable treatment	Social balance, equitable outcomes
Decision process mode	Procedural, rational, top-down	Participatory, bottom-up
Means of communication	Rules, routines	Relational
Theoretical basis	Weberian bureaucracy	Network theory; Resource-dependency theory

Much of the public management discourse of the early 20th century centred on the hierarchy form of coordination. Hierarchy was seen as positive, as a rational form of organization that emphasized efficiency through the division of tasks, establishment of rules and regulations, and supervision (Weber 1947). By the 1980s, hierarchy was considered defective, synonymous with bureaucratic red-tape and government's inability to adequately deliver services to citizens. Over the next twenty years, researchers and practitioners explored reforms to address the limitations of hierarchy. One stream of reforms, encapsulated under the term New Public Management (NPM), was oriented towards markets. NPM espoused the adoption of practices from the private sector by the public sector in order to bring about leaner and entrepreneurial government (Osborne and Gaebler 1992). The other stream of reforms, encapsulated under the term governance, was oriented towards networks, exploring greater interaction with non-governmental organizations to address the needs of citizens and communities (Kikert et al. 1997).

3.2.1 Trajectories of coordination forms

Both network- and market-orientated reforms have exhibited similar trajectories. Governments turned to contracts or third-party partnerships as a response to the defects of hierarchy. In effect, government 'off-loaded' functions either to markets or networks involving non-governmental parties (Bell and Park, 2006). However, by the late 1990s/early 2000s, this agenda of devolution, away from central authority, began to show cracks. It is now thought that NPM reforms fragmented the public sector, provided incentives for individual organizations to focus on their own missions, and created pressures for competition rather than collaboration (James 2004, Ling 2002). A new wave of second-generation NPM reforms is focused on 'joining up'

government agencies for the delivery of public services, and central agencies are having a significant role in this agenda (Halligan 2005, Verhoest *et al.* 2005, James 2004). Stronger central coordination does not necessarily mean a return to traditional hierarchy; rather, it implies a blending of coordination approaches and a 'softer' form of oversight or steering. Instead of policies, rules, and prescribed processes, the modus operandi tends to be incentives, guidance, and training.

The importance of central agencies in network coordination also has become clearer. Researchers have noted that political authorities are regulating self-regulating networks (an apparent paradox), and the term metagovernance has been used for this idea (Whitehead 2003; Bell and Park 2006, Kelly 2006). The Prime Minister or President's Office, the Cabinet Office, or the CBA, for instance, are said to be providing the ground rules for networks, deploying a relative monopoly of organizational intelligence and information with which to shape the cognitive expectations of network members and modifying the strategic capacities and tactics of agencies in the interest of system integration (Jessop 1997: 575).

In other words, though public networks may self-regulate in some respects, they still are embedded in hierarchical structures and are affected by hierarchical controls that are meant to shape and strengthen the network. In this way, they operate 'in the shadow of hierarchy (Scharpf 1994)'. As much as the network form of coordination is 'refreshing', constitutional authority, manifested in hierarchy, and the 'fiscal spine' of appropriated funds remain the structures within which relational and networked forms are enabled to flourish (Hill and Lynn 2005: 189). Thus, '[i]t is not so much that the horizontal relationships have supplanted the vertical ones, but rather that the horizontal links have been added to the vertical ones (Kettl 2002: 128)'.

3.2.2 Tools of hierarchical influence and coordination

While NPM and network researchers articulate the trend in central coordination, the actual tools to 'join up' government or metagovern are poorly explained in the literature. The specifics are difficult to unravel, but a body of work is developing (6 2004, Christensen and Laegreid 2006, Pollitt 2003, Ling 2002, Whitehead 2003). Whitehead (2003) categorized three broad tools: a) strategic frameworks and guidance, b) discipline, and c) monitoring and assessment. 6 (2004) distinguished tools as well: a) mandated or incentivized partnerships, b) budgeting, c) plans, targets, and performance management. These do not correspond precisely to those of Whitehead, but they reinforce the basic framework. The work of Ling (2002) also can be matched to the simple framework, again not precisely, but with a degree of concurrence. In order to meld all three groupings, the tools can be related under the broader categories of: shaping governing structures,

promoting the uptake of new management information systems, and using evaluation (scrutiny) to solidify accountabilities (see table 2). Together, these broader categories constitute the conceptual framework of this research.

Table 3.2: Conceptual framework: tools of hierarchical influence and coordination

Tool	Whitehead (2003: 12)	6 (2004: 126)	Ling (2002: 626)
Shaping governing structures	Strategic frameworks and guidance	Mandated or incentivized partnerships	New type of organization joined by culture and values; information; training
Promoting the uptake of new management information systems	Discipline	Budget/financial management	New ways of working across agencies joined by shared leadership, pooled budgets, merged structures, joint teams New ways of delivering services joined by joint consultation/ involvement; shared client/citizen focus
Using evaluation (scrutiny) to solidify accountabilities	Monitoring and assessment	Plans, targets, and performance management	New accountabilities and incentives joined by shared outcome targets, performance measures

The use of hierarchical tools, as mentioned above, denotes a degree of political or central authority. A CBA, given its function of assembling and controlling resources for a government, may be an influential organization in this regard (Morin 1994, Tomkin 1998). Research conducted in the USA found that public managers considered CBA scrutiny and budget changes among the most effective means to influence agency policies (Furlong 1998). Government agencies may defer to the CBA because they perceive the CBA as objective, or they may find it difficult to oppose the CBA's direction, if the CBA has strong central power and legitimacy (Wanna 2003: 254). Thus, the CBA may enjoy a 'privileged position among its peers as a 'power house' (Hou *et al.* 2005: 5),' in which case, the CBA could be in a unique and pivotal position to assume the role of metagovernor and facilitator of 'joined up' government. The influence of the CBA will vary from country to country, depending on the country's politico-administrative system.

3.3 Methods

Our objective is to enrich the literature on SDI implementation in a grounded and inductive fashion, drawing upon public management theory on metagovernance and 'joined up government'. In our selection of the two case

studies (Canada and the USA), we followed a theory-based case sampling strategy (Paré 2004). In both countries, the CBA was found to be influential in guiding the practices of a network of government agencies focused on SDI development (Lance *et al.* 2006). Also, logistically, offices in Canada and the USA were easy to access for the lead author, but this factor was secondary in the case selection process.

We used qualitative methods for both data collection and analysis. Semi-structured interviews were conducted with questions covering five broad areas: 1) control and accountability, 2) cross-agency planning, 3) investment tracking and transparency, 4) relationship between IT and geospatial governance, and 5) evolution/history of change. The semi-structured format allowed both the interviewer and the interviewee the flexibility to probe for details or discuss issues as they came up. The average interview length was one hour, and interviews were recorded with notes or with a digital recorder. Two interviews spanned several hours, interspersed with the interviewees' busy work schedule. Informal conversations during workshops or ad hoc encounters also contributed additional, supporting data. In most cases, the researcher who conducted the interviews had a pre-existing professional relationship with the interviewee or was known to the interviewee through a trusted third party. We mention this familiarity, since it likely influenced the tone and content of the dialogue.

We focused the interviews on senior individuals responsible for execution of programme activities, five Canadian and eight from the USA. This resulted in a small sample size. Yet, these individuals, as key decision makers, can be assumed to have an accurate understanding of their organization's position, and the perceptions of these decision-makers do indicate the organization's behaviour (Elliott *et al.* 1995). Staw (1991) suggested that studying key organizational decision-makers is a more fruitful means to understanding organizational action than examining in detail all individual behaviour within an organization.

We offered to protect the interviewees' anonymity in order to generate more candour from the interviewees. This practice is common in qualitative research and used to increase the reliability of the data (Walsham 2006). In Sections 3.1 and 3.2 data from the interviews is referred to as "[Country code] [x]", where CA or US denotes Canada or USA, while x marks the number of the interview.

The data collected through interviews were triangulated with documentary evidence in the form of minutes of meetings, agency reports and assessments, and academic work dealing with the cases involved. We also reinforced the results with analysis from public media sources. When specific

details were missing in the case descriptions or to update our data, we contacted interviewees by phone or email. For verification of the findings, a draft version of paper with our interpretation of the data was shared with interviewees for their comments.

3.3.1 Case descriptions

Each case starts with a section that describes the evolving relationship between the central budget agency and line agencies in the geospatial sector. Then, different programs or activities are described, providing further details on the interaction between the CBA and line agencies.

In both the Canadian and USA cases, there is a designated federal geospatial coordinating body, with a staffed secretariat, and a cooperation incentive programme. In Canada, the coordination body is called the Inter-Agency Committee on Geomatics (IACG), and the cooperation incentive programme is called GeoConnections. In the USA, the Federal Geographic Data Committee (FGDC) is the coordinating body, and it manages a Cooperative Agreements Programme. In both countries, the central budget agency -- the Treasury Board Secretariat (TBS) in Canada and the Office of Management and Budget (OMB) in the USA -- is a member of the federal geospatial coordinating body. However, from an operational standpoint, the central budget agency is not involved in geospatial service delivery or use and thus can be viewed as external to the geospatial network. Federal geospatial investments of both countries are comparable with respect to percent of total national expenditures, and both countries have a sizable geospatial industry that relies upon public sector geospatial information. These characteristics are summarized in Table 3.

Table 3.3: Summary characteristics of case studies

Description	Canada	USA
Federal geospatial coordinating body	Inter-Agency Committee on Geomatics (IACG) (15 agencies)	Federal Geographic Data Committee (FGDC) (19 agencies)
Central budget agency	Treasury Board Secretariat (TBS)	Office of Management and Budget (OMB)
Federal staffing for geospatial coordination	2.5 (IACG Secretariat)	14 (FGDC Secretariat)
Federal budget for geospatial coordination	CA\$300 000	US\$4 million (FGDC budget, i.e. this figure does not include The National Map or other related federal SDI efforts)
Estimated annual federal geospatial investment	CA\$240 million	US\$4 billion
Estimated annual federal geospatial investment per capita (based on 2006 population est. *)	CA\$7.59 per citizen	US\$13.36 per citizen
Estimated percent of overall national expenditures on geospatial investments (based on 2005 budget expenditure est. †)	0.11% of expenditures	0.16% of expenditures
Estimated annual geospatial industry revenue	CA\$2.8 billion (2004), based on a formal census ‡	US\$21 billion, based 2004 global industry growth projection ¶

* Canada 2006 population est.,

<http://www12.statcan.ca/english/census06/analysis/popdwell/highlights.cfm>; US 2006 population est., <http://www.census.gov/popest/states/tables/NST-EST2006-01.xls>

† Canada 2005 budget expenditures est.

<https://www.cia.gov/cia/publications/factbook/geos/ca.html> (converted to Canadian dollars); US 2005 budget expenditures est.,

http://www.theodora.com/wfb2006/united_states/united_states_economy.html

‡ 2004 Statistics Canada Census Survey of the Geomatics Industry,

<http://www.nrcan.gc.ca/statistics/geomatics/default.html> (This figure included geophysical surveying and mapping for petroleum and mineral exploration along with more traditional land surveying, mapping, remote sensing and GIS activities).

¶ OECD, 2006, Digital broadband content: public sector information and content, p.23, <http://www.oecd.org/dataoecd/10/22/36481524.pdf>

3.3.1.1 Canada – evolving IACG and TBS interaction

For more than a decade, the IACG did not figure prominently in TBS's horizon. IACG was established in the late 1980s to coordinate Canadian government geospatial investments and activities and thus enable the broader Canadian SDI. IACG was seen as a mechanism to deal with Canada's geospatial institutions and programmes, which were overlapping and competing with one another, interfering with the negotiation of appropriate cooperative arrangements (Coleman and Cooper 2004). Cooperative

arrangements also were hindered by agencies having different data production schedules and by government programme funding cycles that were out-of-phase with one another, making it difficult to cost-share expensive, multi-year projects (Coleman 1999: 6).

Even though TBS was a member of IACG from the committee's onset and potentially could have been constructive in discussions on cost-sharing and funding cycles, for many years, TBS remained a passive observer [CA1]. A representative from TBS, from the Chief Information Officer Branch, attended IACG steering committee meetings, but the Branch had only minimal recognition of geospatial matters [CA1]. Although it was responsible for government-wide information management and information technology activities, its information technology efforts centred on hardware, and its information management efforts, on how to manage email archives, access to information requests, and documents. Geospatial data and content activities were not taken into consideration.

By June 2005, TBS's interaction with IACG was quite different. The Canadian government had announced the creation of Service Canada, a programme focusing on collaboration across federal agencies. In this political climate, the Treasury Board was on the lookout for success stories demonstrating horizontal accountability. The President of the Treasury Board, a Cabinet member and hence someone of high political stature, made a special call on the IACG to hear first-hand how IACG was enabling the joint development and maintenance of key national datasets. Once IACG was in TBS's spotlight, IACG meetings became more formalized and its members more engaged [CA1].

3.3.1.2 Canada – Federal Geomatics Strategy and Policy Framework

IACG took advantage of TBS's attention and proposed to TBS the development a Treasury Board Directive on a Federal Geomatics Strategy and Policy Framework (in short, the Strategy). The Strategy would serve to align geospatial investments and prevent duplication and overlap (see Inter-Agency Committee on Geomatics 2006). IACG had been contemplating such a strategy, but the idea had not gained sufficient traction. This is because, '[n]o agency will contribute to another agency. Nobody voluntarily contributes to common good [...] sticks have to be there [CA1]'. So, TBS's endorsement of the Strategy was instrumental to the Strategy's formulation.

Part of the reason TBS endorsed the Strategy is that it recognized that its existing investment control mechanisms did not adequately capture geospatial activities. In early 2004, by coincidence, four multi-million dollar proposals, each strongly based on geospatial technologies, were simultaneously under review by TBS. Such large proposals of a geospatial

nature at the same time were not common. To a TBS analyst, unfamiliar with geospatial technologies, these proposals, submitted by three separate agencies, set off a red flag of possible duplication. TBS summoned the three big players, Ministry of Agriculture, Environment Canada, and Natural Resources Canada, and asked them for advice. In effect, they said, 'Ministry of Agriculture, you've got a proposal, your two colleagues from the other two ministries are going to look over your shoulder and make sure you're not taking us to the cleaners [CA1]'. Natural Resources Canada and Environment Canada then had the task of reviewing the Ministry of Agriculture's proposal, a 3-inch thick document, analysing its delivery options and assessing whether the proposal was rational given existing work underway in the agencies. According to one of those involved, 'This was unheard of; TBS asking colleague agencies to review proposals and provide advice; it was uncharted water [CA1]'.

In the future, TBS will routinely rely upon IACG to play an advisory role, though investment decision-making still will rest with TBS. The Strategy formalizes the procedures for cross-agency review of funding proposals. The Strategy defines when TBS should refer proposals to IACG for review, and it establishes accepted criteria for reviewing the proposals. It also spells out that IACG will report annually to TBS and that TBS will ensure that agencies are consistently complying with the Strategy.

Even though the review of funding submissions is an added and unfunded activity, IACG members saw that it was far more favourable to craft a voluntary investment oversight approach that the Treasury Board would endorse, than to leave investment decisions to TBS officers who potentially could take drastic or ill-informed measures such as cutting resources or centralizing geospatial activities [CA1]. Initially, proposal review will be on a select basis and will not concern all geospatial activity, but in time, a more comprehensive review of all proposed geospatial expenditures could be possible. As explained by an interviewee, 'I expect the next shoe to drop will be exactly that, exactly how much money is being spent, and can we set up a profile to manage which investments are being made by whom and in what horizon? I expect that to be next [...] Very much so. And then setting things like consequences for not delivering [CA1]'.

3.3.1.3 Canada – Value Management Office

In order to improve analysis of geospatial activity, TBS has provided support and guidance to line agencies. TBS funded a general study on value management (Trailstone Value Management Consulting 2006) and another study specifically on outcomes management for IACG (Fujitsu Consulting (Canada) Ltd. 2005). Both studies recommended a more rigorous handling and linkage of accounting information and results. When TBS evaluated the

1st phase of GeoConnections -- the Canadian cooperation incentive programme -- TBS pointed out the limitations caused by dual accountability, meaning vertical fiduciary accountability and horizontal performance accountability to the broader community (Treasury Board Secretariat, 2005). It advised that greater management information discipline could rectify the situation. Similarly problematic was that each of GeoConnections' seven components was being evaluated separately without connection to each other, while cost-sharing activities were not adequately tracked [CA2].

These various analyses led to the GeoConnections Secretariat's decision to establish a Value Management Office (VMO) [CA3]. Value management since has become one of the core tracks of GeoConnections, on par with the original tracks dealing with user capacity, content, standards and technology, and policy and communications. The VMO is responsible for the coordination of internal government financial, accountability, and parliamentary reporting (vertical); coordination of evaluation and reporting to stakeholders (horizontal); establishment of criteria for project selection, tracking, and evaluation; and handling project contracting and contribution agreements (Last 2006).

3.3.1.4 Canada – Sunset program and results-based management

TBS established GeoConnections as a sunset programme, which is a budgeting mechanism that gives an automatic termination date unless the programme is expressly reauthorized. From the onset, GeoConnections managers knew that they must achieve the outcomes proposed or risk having the programme abolished. They had to undergo a rigorous review. For example, the TBS evaluation of the GeoBase component of the 1st phase of GeoConnections was performed using evidence gathered from programme documents, project reports, and more than 70 interviews with those responsible for and dependent upon the component activities.

In addition to the comprehensive, sunset evaluation requirement for continued programmatic funding, TBS also introduced in 2001 a Results-based Management Accountability Framework. Every Government of Canada programme is required to submit a blueprint to ensure results-based management. The blueprint must contain a programme logic model that maps out how programme activities relate to business processes (for example, public health, public safety, Aboriginal matters, environment and sustainable development). The blueprint also must contain a performance measurement framework and timetable. This sets performance targets, both quantitative, to be measured annually, and qualitative, to be measured in the mid-term and tail end of the programme (Stewart 2006).

3.3.1.5 US – evolving FGDC and OMB interaction

Though FGDC was formally established through an OMB Circular in 1990, more than a decade later, the federal government's many geospatial programmes were described as 'unfocused, duplicative, underfunded, overpromised, poorly defined, and not easily accessed (Sietzen 2003)'. At issue was that the FGDC Chairman 'has no formal authority over his fellow committee members (National Academy of Public Administration 1998: 63)'. Butler et al. (2005) reflected, 'Frankly, you can't put a committee in charge and expect much to happen. Committees dilute accountability and have limited direct access to funding. The federal government has been trying the committee approach through executive orders since 1906 [...] The country needs a real organizational entity with budget authority to be responsible for building the NSDI (ibid)'.

A June 2004 Government Accountability Office report reverberated the issue of poor SDI coordination (Government Accountability Office 2004), pointing out that a complete and up-to-date strategic plan [to coordinate geospatial investments] was not in place, federal agencies were not consistently complying with Office of Management and Budget (OMB) guidance to coordinate their investments, and OMB's oversight methods were not effective in identifying or eliminating instances of duplication (ibid: 2).

It was not until 2001 that OMB began to have close interaction with federal geospatial managers. When the Bush administration took office, it made e-government one of the administration's five management priorities. FGDC strongly courted the opportunity to be selected for one of the pilot e-government projects. The result was Geospatial One-Stop, a catalogue service meant to reduce duplicative mapping investments by improving the discovery and sharing of existing geospatial information resources. Since OMB was responsible for implementing the President's e-government projects, including Geospatial One-Stop, it became aware of geospatial information coordination issues, and it increasingly established a tighter coupling with line agencies. According to one manager, 'OMB is getting smarter at this [...] Layers of the onion are being peeled off,' or from a slightly more uneasy perspective, now 'OMB is definitely in our shorts [US1]'.

3.3.1.6 US - Geospatial One-Stop and Geospatial Line-of-Business

OMB did not allocate 'extra' funds for Geospatial One-Stop; rather, it required line agencies to dedicate resources and staff time from their own budgets. Funding was pooled into a Geospatial One-Stop account used to support activities. This funding mechanism potentially fits into the category of coercion or 'strong-arming' by OMB. Some even referred to it as extortion [US1]. However, OMB's 'heavy hand' potentially was a necessary ingredient to change agencies' behaviour in support of a joined up approach; as one

interviewee indicated: 'I don't think things will change unless someone is forcing change [US3]'.

As the Geospatial One-Stop pilot was ending, OMB's extended its geospatial sphere of influence. It initiated the Geospatial Line of Business initiative in order to align and consolidate agency budgets to support all joint geospatial government services. In March 2006, OMB asked agencies to designate a senior official who has agency-wide responsibility, accountability, and authority for geospatial information issues. OMB will coordinate through these officials and optimise the government's overall geospatial investment. OMB's intention is to formalize the roles, responsibilities, and performance metrics for geospatial information stewards. Accountability and compliance mechanisms are being explored, and OMB is likely to develop geospatial budget coding structure for tracking all government geospatial expenditures. OMB already prepared and released guidelines for agencies to report all major and non-major geospatial investments back to OMB. Karen Evans, OMB's administrator for IT and e-government, said 'With the E-Government initiatives deployed and operational, and the [Line-of-Business] initiatives underway, we are currently realizing the goals of improved citizen services, and increased efficiency and effectiveness. ... We must now concentrate on identifying and realizing the cost savings these initiatives are providing on a government-wide basis (Miller 2006)'.

3.3.1.7 US - Federal Enterprise Architecture

Since February 2002, the Office of Management and Budget has been developing the Federal Enterprise Architecture (FEA), a business-based framework to improve and transform the federal government's use of information technologies, including geospatial technologies. In due time, all geospatial capabilities should be documented and implemented in a systematic way, leading to cross-agency interoperability and potential cost savings. OMB has required agencies to conform to the FEA as a condition for budget approval. The FEA covers a variety of key areas such as: budget allocation, information sharing, performance measurement, budget / performance integration, cross-agency collaboration, e-government, and component-based architectures. Agencies are meant to identify opportunities to simplify processes and unify work across agencies and within business areas. Ultimately, OMB wants agencies to ask and answer what effect their architecture is having on their mission (Miller 2007). OMB's chief architect, Richard Burk, suggests that agencies 'must integrate the FEA with the budget and find and show value (ibid)'.

With FEA underway, there now is regular interaction between OMB and line agencies, with OMB trying to push transformation solutions. In 2005, the Department of the Interior, which hosts the FGDC Secretariat, began meeting

with OMB weekly. One of the FEA specialists involved explained, the E-Government Portfolio Manager at OMB 'asks very pointed questions. This is not just a 'jumping through the hoop' exercise [US4]'. At one point, OMB had asked for background material, and it was clear they actually were looking at it, because the Department of Interior inadvertently had sent in a draft version, and OMB quickly noted this and asked for the final version [US4].

Although the FEA is meant to maximize technology investments to better achieve policy outcomes, the management information systems currently available are not yet adequate to address the particular budgetary characteristics of geospatial activities. A USA interviewee pointed out, 'We're slowly evolving to having better accounting, but it's another 5-10 years away... It's not that nobody is willing to report on [geospatial investments]; I'm not sure they can. They're not capturing the information, because the information is an orthogonal slice across the enterprise [US5]'. Few agencies identify their investments in a geospatial context.

3.3.1.8 US - Circular No. A-11 Exhibit 300 business case

OMB uses Circular No. A-11 as an evaluation tool, although originally it was established for Capital Planning and Investment Control and still is a stronger tool for planning than evaluation. OMB revised Circular No. A-11 in 2002, and the revisions were much more comprehensive in scope than previous versions (Office of Management and Budget 2002). The revised Circular merged together budget formulation and execution, thus integrating agencies' budget planning, accounting, and evaluation functions. As part of the Circular No. A-11 requirement, agencies must submit an Exhibit 300 business case in which they demonstrate that a project is in the overall best interest of the Government and will achieve government-wide and agency objectives at the lowest risk cost. They must also address performance goals and how the goals relate to the agency's annual performance plan. Projects, once funded, are then evaluated against the Exhibit 300 business case. In this way, project proposals, performance measurement, and evaluation are all linked through the same tool.

A management consultant who works closely with government agencies noted, 'There's a lot OMB now wants to see -- life cycle costs, NPV, benefits, risks. To have OMB bless you and give you money, it's not a trivial process' ... 'OMB intensely pursued the Exhibit 300 process, and each year, OMB gets more serious. You get scored lower if you don't do what is required [US6]'.

3.4 Analysis

Looking simultaneously at the cases, we see that the central budget agencies in Canada and the USA have become involved in cross-agency geospatial

coordination in recent years and are casting a shadow of hierarchy on the public sector geospatial networks in these countries. Furthermore, TBS and OMB tool-based efforts are consistent with the conceptual framework in table 2, thus validating the emergent consensus that network behaviour may be steered in part by hierarchical means. With respect to shaping governing structures, the Canadian Federal Geomatics Strategy and Policy Framework and the US Geospatial Line of Business articulate respectively a new relationship between IACG and TBS, and FGDC and OMB, a relationship that brings cross-agency geospatial investment planning to the forefront. On the management information systems front, the GeoConnections' Value Management Office (VMO) and the USA Federal Enterprise Architecture (FEA) are meant to improve implementation by providing clarity in the links between financial resources, geospatial services, and citizen needs, as well as by tightening up accounting practices. The evaluation of GeoConnections Phase I and OMB's Circular A-11 annual requirement for business cases and performance measurement reinforce shared accountability and ensure that agencies achieve intended results. Table 4 provides a summary of the tools that TBS and OMB are using to influence network elements, and the subsequent changes that have taken or are taking place.

Below, we discuss further the hierarchical influence of TBS and OMB and highlight how Canada and the United States compare. For the most part, the cases have more in common than differences. The patterns of innovation in public sector reform in these two wealthy countries tend to be very similar (Borins 2000: 47). Even so, the countries still diverge in consistent ways across a spectrum of institutions/structures, behaviours, and values. Canada tends to have greater orientation to innovating for society as a whole or in large groups, resulting in fewer, larger programmes, whereas the USA has a more targeted approach, resulting in a great number of smaller programmes (ibid). Inevitably, this affects the size, membership, and behaviour of the public sector geospatial networks.

Table 3.4: Hierarchical tools and their influence on SDI network behaviour.

Tool	Canada	Network change	US	Network change
Shaping governing structures	Federal Geomatics Strategy and Policy Framework	review of and consensus on investment; alignment of investment	Geospatial Line of Business	dialogue on investment management; joint budget planning
Promoting the uptake of new management information systems	Value Management Office (VMO)	financial transparency; clarity between inputs, outputs, and outcomes	Federal enterprise architecture (FEA)	diagnostic discipline; clarity of linkage btw business, services, and performance
Using evaluation (scrutiny) to solidify accountabilities	Sunset evaluation of Geo-Connections Phase I; Results-based Management Accountability Framework	orientation to managing for results	Circular A-11 annual business case & performance measurement	communication of benefits in relationship to costs; tracking of outputs

3.4.1 Shaping governing structures

By working with agencies in shaping a new governance regime, TBS and OMB are attempting to provide more coherent direction to the federal geospatial networks of Canada and the USA. These efforts stem from broader public sector policy reform agendas focusing on efficient and effective delivery of services to citizens. Prior to CBA intervention, line agencies had not successfully 'joined up' their efforts. In the USA, OMB's pooling of funding was instrumental to the establishment of Geospatial One Stop. In Canada, the potential threat of TBS stepping in and deciding what to do, mobilized IACG to become more proactive and propose a plan that TBS would find acceptable. As Thomas (2006: 262) explained, 'Though agencies seek autonomy, 'they may pool their resources when external forces threaten an even greater loss of autonomy should they attempt to operate independently. Under these circumstances, cooperation provides more stability for managers than does autonomy'. Even when the CBA is shaping governing structures through informal communication or guidance, rather than central planning and regulation, this can take on greater weight precisely because it is coming from the CBA.

Despite TBS and OMB's authority, their interaction with line agencies for cross-agency coordination cannot be characterized as coercive. Both IACG and FGDC courted CBA involvement. IACG and FGDC recognized the limits to self-regulation of the federal geospatial network and reasoned that the CBA's influence could be constructive. A new governance regime involving the CBA and geospatial investment management would elevate the geospatial arena from an obscure technical initiative comprised of agency professionals and technicians to a primary management objective with line manager involvement. The interviewees emphasized that there is no 'grand scheme', no planned and carefully executed sequence of steps; instead, in both

countries, the unfolding relationships are more in the tradition of incrementalism or 'muddling through'. The CBAs are taking a shepherding approach for activities characterized by uncooperative behaviour. They do not appear to be assuming more responsibility or authority than necessary. IACG and FGDC still maintain responsibility for overall management.

3.4.2 Promoting uptake of new management information systems

While new governance regimes in Canada and the USA address the first hierarchical tool, the second tool, management information systems, amounts to increasing institutional capacity and fiscal discipline through technical means. In Canada, TBS guidance contributed to the formation of the GeoConnections' VMO. The VMO enables the classification of programme inputs horizontally, according to projects, provinces, and sector, and vertically, according to cost centres. In the USA, OMB has been championing the adoption of the FEA. Agency managers recognize that the FEA ultimately will serve cross-agency objectives, so agencies are not just merely complying with OMB's FEA requirements; rather, they are working in partnership with OMB to improve available systems and analysis. Both management information systems put emphasis on making post-budgetary financial information more readily accessible, one of the tools discussed by 6 (2004). They also provide clarity between investments, development of services, and business functions, a tool that Ling (2002) highlighted. Yet, further improvements are needed to be able to identify and track geospatial investments more comprehensively.

Where Canada and the USA differ is in the use of management information systems. At the moment, OMB appears to be more preoccupied with what broadly could be called 'managerial' issues – improving efficiency and reducing duplication, whereas TBS is more concerned with improved systems for managing accountability. It is likely that the sheer size of the government drives the USA approach. The more numerous the organizations within government, the greater the number of interests articulated within government, and the greater the number of potential conflicts between government organizations (Rose 1984: 174). The USA is grappling with 'getting a handle' on an enormous array of activity, whereas the Canadian aggregate of activity is more manageable, thus Canada can focus more on ensuring agencies perform well with the resources they are allocated.

3.4.3 Using evaluation to solidify accountabilities

TBS appears to be putting more emphasis on the third coordination tool than OMB, particularly when it comes to outcomes, as opposed to outputs. OMB's Circular No. A-11 still is evolving as an evaluation tool; it currently lacks the

refinement that GeoConnections Results-based Management Accountability Framework has. Also, GeoConnections underwent a thorough review by TBS in order to secure funding for its second phase. As a sunset programme, procedures were in place to make sure that once launched, the programme stayed on track. By specifying a discrete period of time, TBS was able to motivate federal agencies to achieve specified outcomes or risk having their programme abolished. In contrast, the budget for FGDC and its cooperative agreements programme remains nearly the same, year after year. This implies that there are no consequences for good or bad performance.

Some research has indicated that performance measurement is not effective in advancing coordination among agencies or reducing duplicative services (Willoughby, 2004). Such activities are 'fraught with politics and other factors that will not change immediately with the introduction of new processes (Melkers and Willoughby 2004: 19)'. However, in spite of the cynicism about performance measurement or lack of effects, 'administrators today have acknowledged that developing and implementing performance measurement have resulted in some 'spillover effects' on communication during the budgeting process (ibid)'. Improved communication between agency personnel and budget officers is an 'interim' or 'initial' (positive) outcome in itself (ibid).

3.4.4 Relevance beyond the case studies

TBS and OMB are not alone in their use of hierarchical tools to influence network elements. Australia has strengthened central bodies like the Australia Public Service Commission and New Zealand, the State Service Commission, to provide leadership across government organizations and set standards for administrative policy and behaviour (Christensen and Lægreid 2006: 19). The Treasury in the UK has promoted joined up working through the Public Service Agreements, the Public Services Productivity Panel (advising on the way of improving productivity in the public sector), and in improving an accounting and budgetary framework within which joined up work can take place (Ling 2002: 623). Saxby (2006) suggests that better results would be likely in the UK if a geographic information strategy group were established within HM Treasury to evaluate and respond to input from a government advisory panel on resource issues; 'this would be particularly helpful in evaluating potential [geographic information] efficiency gains when assessing departmental bids during the annual spending review (ibid: 184) [...] At a time when the government wants to build the tools and define regulation to make better use of all its information resources, it must now assess the merits of investing in and developing the means to exploit spatial information as a sub-set of its broader information portfolio (ibid: 191)'.

In most countries, SDI still remains at the periphery of budgetary decision-

making. However, as governments increasingly invest in the development of geospatial services, they may put more emphasis on accountability for the use of these funds. This form of external steering appears to strengthen the focus of geospatial network members on delivering results, as well as bolster the overall legitimacy of the SDI initiative. Longitudinal research over a number of years can lead to firmer conclusions regarding conferring legitimacy. Additional case studies, including non-Anglo-American (or Saxon) countries with different politico-administrative systems, would enrich the empirical base on the interplay between hierarchical controls and 'joining up' government geospatial information systems. Research should also extend to the coordination dynamics between central and local government. Our initial findings seem to be in line with a recent report looking at coordination for land parcel data in the USA. The report stresses that organizational and financial issues are not trivial and that an expanded federal role in providing funding and coordination for geospatial data under the Geospatial Line of Business holds promise (National Research Council 2007: 136). In order to do so, it is essential to establish clear and unambiguous authority within the federal bureaucracy (ibid: 140).

While this paper is not meant as a blueprint of 'how to coordinate', we do hope that it offers useful areas for reflection. Hierarchical controls may facilitate coordination to an extent that autonomy-seeking public managers need not automatically disparage such intervention; in fact, they may seek it. SDI managers at all levels (national, regional, state, local) conceivably could benefit from exploring earlier on accountability arrangements, evaluation procedures, and means for attaining greater transparency of geospatial investments. However, the dynamics between agencies and external institutions such as the CBA depend on the politico-administrative regime, making it difficult to generalize across all contexts.

3.5 Conclusion

This paper enriches our understanding of how cross-agency geospatial coordination is unfolding in practice. It confirms the emerging consensus in public management scholarship that external steering of a network, exercised by authoritative bodies through hierarchical means, may invigorate cross-agency coordination. The evolving relationship between the CBA and line agencies in Canada and the USA partly can be attributed to each country's national public service reform agenda, but it may also reflect a maturation of each country's SDI initiatives. Further research is needed in countries with different politico-administrative systems to broaden the empirical base of the theory on network-hierarchy dynamics.

At first glance, the presence of hierarchical controls may seem contrary to SDI conventional wisdom, which has emphasized the voluntary nature of

SDI. The use of hierarchical controls also runs contrary to the public management discourse on network governance, which purports that informal, horizontal networks are replacing formal, vertical/hierarchical organization. However, a shadow of hierarchy may actually facilitate the 'joining up' of government geospatial information systems. Lazer and Binz-Scharf (2004: 19) came to a similar conclusion, remarking, '[i]t is the ultimate irony that the transformation of government into a networked form requires the support of "old-fashioned" hierarchic structure of the state'.

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CHAPTER 4: Evaluation of the Dutch subsurface geoportal: What lies beneath?

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Evaluation of the Dutch subsurface geoportal: What lies beneath?

Abstract

This paper focuses on a geoportal from a “what lies beneath” perspective. It analyses processes of budgeting, planning, monitoring, performance measurement, and reporting of the national initiative titled Digital Information of the Dutch Subsurface (known by its Dutch acronym, DINO). The study is used as a means to empirically refine a conceptual model that illuminates how external agents influence or control the coordination of geo-information in the public sector. DINO is developed and maintained in a formal principal-agent relationship with clear objectives and accountability. DINO is managed by the Netherlands Institute of Applied Geoscience (the agent) through a performance-based management contract with the sponsoring Geo-Information Commission (the principals). The DINO program is characterized by the pooling of financial resources from five ministries, the internal tracking of activity progression, the routine reporting to the user community, and the regular monitoring and evaluation of DINO by the Geo-Information Commission. The case study reveals that ‘soft’ rather than ‘hard’ controls are used and that ‘mutual shaping’ takes place, with the agent influencing how it is ‘controlled’ by the principal. However, the management contract still relies on a power disparity and reinforces previous research findings that external parties can influence network/coordination conditions. In-depth case studies such as this work can increase understanding of evaluation in the context of politico-administrative processes and improve researchers’ ability to critically compare geoportal initiatives.

Keywords: Geoportal, Governance, Accountability, Autonomy, Result control

4.1 Introduction

Nearly 40 years ago, Wildavsky (1972, p. 509) asked, “Why don’t organizations evaluate their own activities? Why do they not appear to manifest rudimentary self-awareness?” This question is still relevant in the public-sector geospatial community. Despite the significant investment in geospatial technologies, including and establishment of geodata portals, examples of public agencies assessing spatial data initiatives are scarce (Lance, 2008; Lance et al., 2006).

In an effort to understand the striking lack of evaluation in the geospatial sector, we sought examples in which evaluation actually has occurred (e.g.,

Geospatial One-stop⁵, GeoConnections Discovery Portal⁶). We anticipated that these examples would shed light on factors that are conducive to evaluation and enable evaluation to stabilize over time. In studying these examples, we would potentially avoid putting the proverbial cart before the horse (i.e., prescriptively promoting evaluation, absent of context).

Our research differs from that of other authors looking at spatial data infrastructure (SDI) evaluation, and geoportal evaluation in particular. Their emphasis has been on benchmarking and the supply side of evaluation, the “production process” (i.e. determining what to measure and the indicators to use) (Giff & Cromptoets, 2008; Delgado, 2005; Steudler, 2003), as if “one size fits all.” Instead, we are interested in the underlying demand for evaluation, the contextual factors that foster adoption of evaluation and influence evaluation practice. Our empirical approach to studying SDI evaluation can enable scholars to critically assess why and how a regime of evaluation operates. From this knowledge, we can begin to compare initiatives and possibly scale up evaluation practice. This is timely in light of recent SDI regulation in Europe (i.e., INSPIRE) which requires monitoring and reporting (European Commission, 2007).

We first conducted a broad survey (Lance et al., 2006) and then pursued in-depth case studies of evaluation practice. We found that evaluation in Canada and the U.S. was a response to the (external) hierarchical influence of the central budget authority, rather than an internal drive by managers to learn or improve operations (Lance et al., 2009). To expand our empirical base to a different politico-administrative setting, we explore in-depth a case in The Netherlands, a country without a strong central authority and characterized by quasi-autonomous non-governmental organizations (quangos) that have been established by public law to execute public tasks (van Thiel, 2004). The case, Digital Information of the Dutch Subsurface (known by its Dutch acronym, DINO), is among the few initiatives that have been evaluated routinely since 2001. DINO was conceived as the central databank for geoscientific information concerning both the shallow and deep subsurface of the Netherlands; its implementation encompasses policies, organizational remits, data, technologies, standards, delivery mechanisms, and financial and human resources, all of which correspond to the comprehensive definition that Masser (2005, p.16) established for an SDI. DINO is achieved through the coordinated actions of multiple ministries, state agencies, water boards, and industry stakeholders. DINO’s sponsors, staff, and data contributors jointly enable the development and availability of interoperable digital geographic data and technologies to support decision making for multiple

⁵ <http://gos2.geodata.gov>

⁶ <http://geodiscover.cgdi.ca>

purposes.

DINO maintains DINOShop⁷, a central portal for access to data and information on the subsurface. The portal connects geospatial resources from multiple custodians, and DINO caters to an array of clients. DINO's geoportal can be viewed as the 'front end' of the Dutch underground SDI. It is the fulcrum or users' point of interaction for data discovery, acquisition, and visualization, and thus has garnered the lion's share of attention with respect to DINO's overall evaluation. DINO does monitor and evaluate data management and mapping activities, as well as user participation and value-added outcomes, but the value to most end users concerns their ability to access available data via the portal. Hence, the focus of DINO's evaluation has been on the geoportal.

The DINO case represents a significant departure from the previous case studies of evaluation practice in Canada and the United States in that it focuses on evaluation by an autonomous public body, as opposed to a body that is part of the organizational hierarchy of government. While the case reinforces our previous findings, it reveals an unexpected element of 'mutual shaping,' which shows managers, not as passive actors conducting evaluation to conform with external demands, but rather as proactive strategists using evaluation to gain legitimacy.

The rest of the paper is organized as follows. In section 2, we outline the conceptual framework of the research, which draws upon public management literature focusing on quangos. This is followed by a description of the Dutch case in section 3. In section 4, we summarize the methods used and then present the findings in section 5. In section 6, we discuss the empirical evidence as it relates to theory. We then conclude by summarizing the implications of the findings to researchers and managers.

4.2 Conceptual Framework

Since the late 1980's, in many countries worldwide, government departments have established a purchaser-provider relationship that is governed by a performance-oriented contract. This is the result of a wide reaching, market-based approach to public sector reform known as New Public Management (NPM), designed to make the delivery of public services more flexible, responsive, and customer-oriented (Osborne & Gaebler, 1992). In contrast to bureaucratic control and oversight from the top, the (ideal) market form of governance upon which NPM is based has no authoritative bodies; rather, the "hidden hand" of supply and demand keeps the system in order (Table 1).

⁷ <http://www.dinoloket.nl>

Market-based governance introduces new elements of steering and control via the use of contracts and performance measurement.

In the Netherlands, and other countries pursuing NPM reforms, semi-autonomous (and more autonomous), non-governmental organizations (quangos) are publicly funded and charged with the implementation of one or more public policies (van Thiel, 2004). These entities, however, have no immediate hierarchical relationship with a minister. They are freed from many of the normal rules governing civil service bodies, but are more closely monitored and evaluated to ensure that they meet pre-set performance targets.

Table 4.1: Hierarchy and market forms of governance (adapated from Verhoest et al., 2005, p. 5).

Characteristics	Hierarchy	Market
Basis of interaction (or control)	Authority, oversight	Competition, exchange
Structure of organizations	Line organization, centralized control systems, project teams, stable-fixed	Decentralized, semi-autonomous units/agencies/teams; contracts
General orientation	Bureaucratic	Entrepreneurial
Motivation of parties involved	Rules and regulations, supported by budgetary controls (top-down norms and standards, inspection, intervention)	Competition, pricing, and economic incentives (self-interest, profit and losses)
Goals, preferences	Accountability, equitable treatment	Value-maximization
Theoretical basis	Weberian bureaucracy	Neoinstitutional economics

The NPM idea of putting public services under contracts draws upon concepts from agency theory (Eisenhardt, 1989). Agency theory characterizes actors as pursuing their own agendas (goal incongruence), which means that principals need to control agents and prevent them from not delivering as agreed (shirking). However, principals may lack sufficient information about agency performance and may have limited ability to oversee agents effectively (information asymmetry). Hence, contracts are put in place to organize the relationship between principals and agents.

The market governance approach, as implemented, can be differentiated according to three main variables: the degree of separation of the new entity from the parent body (structural disaggregation), the degree of flexibility given for internal operations (managerial autonomy), and the degree of accountability for results (result control) (Pollitt et al., 2005; Talbot et al., 2000). The first variable deals with how structures, goals, and accountabilities are shaped. The second explains the day-to-day operating

procedures, and the third focuses on the use of evaluation (scrutiny) to ensure that performance targets are met (Table 2). These variables and the processes that characterize them provide an analytical framework for the context of evaluation under market-based governance.

Table 4.2. Market governance variables and processes (adapted from Talbot et al., 2000).

Variable	Processes
Structural disaggregation	Administrative arrangements, finance, performance contracting, task specification, accountability, steering
Autonomization	Internal management (human resources mgt, accounting, back-office front-office mgt), use of management information systems
Result control (performance contracting/ performance measurement)	Identification of performance measures, setting of performance targets, reporting to principals, reporting to users, impact assessment, use of performance information, changes in performance measurement system over time, consequences of not achieving targets

Scholars have found that organizational culture and the internal management of organizational operations are significant determinants of organizational performance (O'Toole & Meier, 2008; Brewer & Selden, 2000). In theory, a stronger form of disaggregation/autonomization can be governed in a more business-like way, with techniques of business administration and private-sector management playing a more important role (ter Bogt, 1999). Agencies may be able to set their own salaries and benefits structures, appoint and remove employees with greater ease, and they do not need to comply with civil service regulations. Managers and staff often are drawn from outside traditional civil service ranks (Talbot, 2004).

Principals may use a management contract, performance measures, monitoring systems, and performance audits as their main instruments of result control. From the perspective of agency theory, result contracts emphasize ex post monitoring of the achieved results. The information asymmetry between principal and agent is tempered by information gathering instruments (e.g. the business plan, output budget, cost accounting, and performance evaluations). Also, the goals of the principal and agent become aligned by setting clear objectives and targets and by negotiation or consultation (Bouckaert, 1998).

4.3 Background / empirical setting

DINO is part of the Netherlands Institute of Applied Geoscience - Geological Survey of the Netherlands (abbreviated as TNO), a key national geoscience institute for information and research used to promote the sustainable management and use of the subsurface and its natural resources. TNO operates under the Ministerial responsibility of the Ministry of Education,

Culture and Science (OCW). This means that the Minister is politically responsible for the legislation and budget related to management of the Dutch subsurface. However, TNO is a legally independent entity and has control over day-to-day decision making processes. The TNO Act determines the structure of the organization and its relationship to the Ministry of Education, Culture and Science. DINO is a relevant case study for students of geodata portal evaluation in that it pioneered geoportal performance measurement (Lance et al., 2006; Lance, 2008). A range of perspectives is used for the evaluation of DINO, and over time, new performance measures have been added (Table 3).

In 1997, the Dutch government commissioned TNO to develop an integrated database system and portal interface for the management of all subsurface data. The commission also included direction to make the non-confidential part of this data available to the public. The geoscience information function was assigned to TNO because of TNO's independent status and because there was a long historical relationship between the Ministry, the geological survey, and the groundwater survey (Peersmann, 2007). TNO is known for stimulating technology change; whereas government agencies are considered less technologically inclined. A Mining Law requires that all data and information of the oil and gas industry is provided to TNO and stored in DINO. Similarly, a Groundwater Law ensures that groundwater data and information goes to DINO. While there is no law for geological engineering data used in the building and construction sector, the Ministry of Transport, Public Works and Water Management stipulates in their contracts that such data be supplied to TNO and stored in DINO.

To implement DINO, TNO plays the role of "mediator" between the government and the subsurface users by defining procedures for data collection and public release. About one third of the data that DINO hosts is managed by others, outside of DINO. In 2001, the first online interface for the data repository was launched and was named DINOloket (DINOShop). DINOShop provides access to shallow and deep borings, groundwater and soil quality data, cone penetration tests, geo-electrical measurements, borehole measurements, seismic data, and the results from geological, geochemical, and geomechanical sample analyses. Mining exploration and survey data are also part of the holdings. Visualization is enabled via a 3D atlas of the Netherlands subsurface.

Table 4.3: DINO performance measurement summary

Perspective	Measure	Initiated	Results
Platform performance; (Platform improvements)	Server up/down time	2001	High uptime (>97%)
	Data delivery time	2001	
Productivity; system content / completeness (Operational)	Data volume (data type amount and size stored in database)	2001	
	External review	2002 (non-recurrent assessment)	Gartner invited to review DINO's approach to developing an integrated database, to give suggestions on how best to manage and structure operations
	Amount from analog to digital for each data type	2006	Charting of progress against goals (green = completed; red = behind; gray = in process)
	Data density (by location)	2006	Routines developed; feasible to do, but time consuming
System use (Operational)	Visitors	2001	Web statistics on DINOShop; number of visitors/month (10-15K); Percent of visitors who submit requests (~30%)
	No. active accounts	2001	Based on DINOShop registration, in 2000, had ~800 different users. Now, more than 3000 government agencies using data daily, and 38,000 concurrent users per day; No. of (E&P) operators that have started to request data from NL have increased from about 18 to 35.
	Data usage/downloads by data type (initially boreholes, and then more data types added each year (225 geoscientific data types in total)	2001	Systematic monitoring of DINO user requests. From 65 (2001) to 750 (2006) requests per week
	Data usage by user type (e.g., water	2001	Private entities use most (e.g.,

	boards, provincial agencies, municipalities) (e.g., foreign versus local)		engineering companies) – direct linkages to stimulating NL economy
Resource allocation (Financial)	Financial inputs	2004	Breakdown of processes (%) between data management, mapping, internal assistance, outsourced, software development, other
Usability (Beneficiaries)	Customer satisfaction audit	2004	Formal interviews with 10 users
	Interface preferences; 2D & 3D interface user friendliness	2004	Qualitative inputs from users
Value (Growth)	Value to economy/society (cost benefit analysis; value added approach)	2003 (non-recurrent assessment)	Annual government investment in DINO (€15 million) is 0.1 % of assessed value of geo-scientific data & information resources being managed (€ 20 billion) / Added value is 3-7% of GNP (EUR 14-29 billion) per annum
	No. of contributors to the database	2006	Agreements with data source/holders; approx 1/3 data managed by non-DINO staff
	No. spin off companies	2006	More than 20 spin off companies are depending on data availability from DINO
	No. new exploration licenses granted	2008	Indirect measure of value of improved access to information (for new entrants) through Dutch Oil & Gas portal (launched Dec'07)

4.4 Methods

A single in-depth case study was conducted for this paper, but the study is part of a broader, multiple-case study design that explores the external influences on public sector geospatial management. Benbasat et al. (1987) recommend case studies for capturing the knowledge of practitioners and for enriching existing theories with the this knowledge. Largely because of the limited means to manipulate the variables and context under investigation,

case studies are commonly used for research of practice-based concerns in public management and information systems (Meijer et al., 2009).

We collected data in February 2007 through semi-structured, face-to-face interviews with seven managers and two geoscience researchers familiar with the institutions involved. Additional interviews were conducted in 2007 and 2008, focusing more broadly on evaluation in The Netherlands, rather than the DINO case in particular. The interviewees were typically senior individuals responsible for execution of program activities. This resulted in a small sample size, yet these individuals, as key decision makers, can be assumed to have an accurate understanding of their organization's position. Also, the perceptions of these decision makers do indicate the organization's behavior (Elliott et al., 1995).

Questions for the semi-structured interviews revolved around the operations listed in Table 2. Respondents discussed DINO's formation and funding arrangements, the implementation of DINOShop, the indicators used for performance measurement, the relationship with the ministries supporting DINO, and the nature of negotiations. The questions asked of each respondent varied based on the respondent, his/her role in DINO implementation activities, discussions with previous respondents, and the respondent's answers to previous questions. Approximately 20 hours of interviews were recorded on a digital tape recorder to ensure the accuracy of the data, and interviewees' consent was obtained in advance. Interviews lasted from between one and two and a half hours. Several of the interviewees also provided follow-up feedback and clarification on some of the issues discussed. In section 5, data from the interviews is followed with a code "[x]", with x denoting the number of the interviewee.

The transcribed interview data were coded using concepts from agency theory. As the analysis continued, tables and figures were used to identify trends (Miles & Huberman, 1994) such as the mutual shaping of structure, autonomy, and control. The research findings presented in the next section are organized according to the notion of mutual shaping. When coding the data, quotes and short vignettes were identified to add context and to provide additional support for the observations and conclusions reported from the case study (ibid). The validity of the interview data was strengthened by means of triangulation with contractual documents, annual reports, external consultancy reports, communication materials used at conferences and meetings with user groups, the organization's web sites, and academic papers focusing on TNO-DINO.

4.5 Findings

4.5.1 Structural disaggregation

4.5.1.1 DINO shaped by governing structure

Four ministries, shown in Figure 1, are responsible for aspects of the management and use of the soil/subsurface: Economic Affairs (EZ); Agriculture, Nature and Food Quality (LNV); Housing, Spatial Planning and Environment (VROM); and Transport, Public Works and Water Management (V&W). These ministries pooled their resources and jointly agreed to contract the government's geosciences information function to TNO. In so doing, they removed an immediate hierarchical relationship between the central government and TNO. They provided for a five-year formation period, and after that, a series of mid-long (four year) contracts between TNO and the Dutch state. They can cancel the contract, but not without two contract periods of notice (i.e. eight years in advance). The philosophy of this arrangement is that management of national data assets is a long-term issue, so frequent change is ill-advised.

A key aspect to the contract arrangements is the Geo-Information Commission (GIC) constituted by the ministries. This governing structure enables cross-ministerial coordination and joint steering of the work program. The control of the funds earmarked for DINO is under the supervision of the four ministries, plus the Ministry of Education. According to one interview, "Education is the President of the Commission, because it was considered as neutral; it doesn't have any special interests in the underground itself. The other guys compete with each other (i.e., "I want more money for the deep subsurface or I want more money for environment"). Sometimes, there can be real competition [for use of funds] [2]." Another interview confirmed that, "some ministries are more equal than others. For instance, the Ministry of Economic Affairs is most powerful. Economic Affairs wants the data for the deep subsurface to be available, more so than the shallow subsurface [1]." For the most part, though, the disagreements between ministries are not so strong. Ultimately, the ministries reach a consensus on how to spend the money. GIC submits its advice to the National Council for the Geological Survey of The Netherlands (GSN), and the Council approves the program.

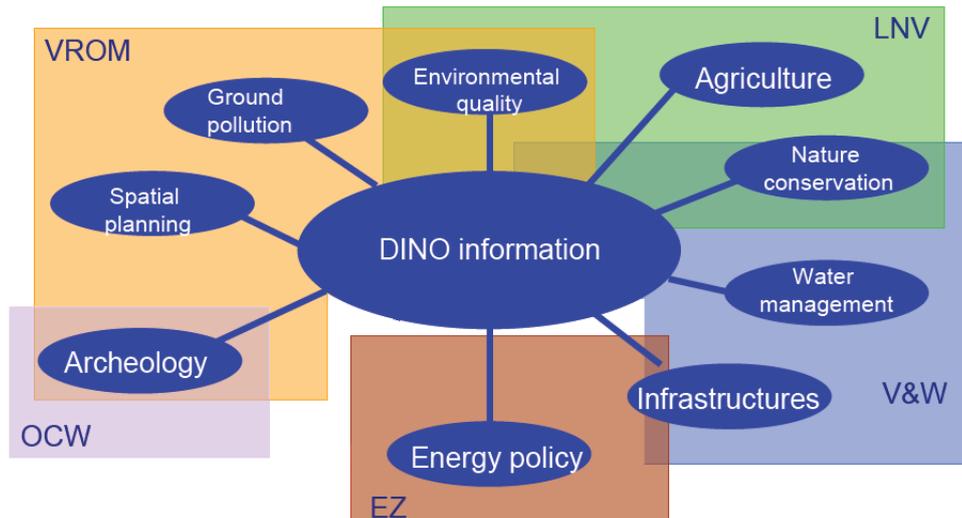


Figure 4.1: Multiple principals (and stakeholders) involved in DINO (Ministry names are abbreviated)

The Commission determines the priorities for each year's annual plan, and also determines a four-year plan. There is a structured planning cycle for both periods. The priorities get translated into the work program and targets. The GIC meets three to four times per year, partly to review the previous year's progress and partly to look ahead. "They make a thick program for the coming year as to what they're going to do with the 15 million Euros to improve the system or whether to give more focus on specific data types - whatever they think is important [1]." Policy strategy comes into the Commission's discussions when they identify priorities for their ministries and advise DINO on what to focus. For instance, the "Gaswinningsbrief" issued by Minister Brinkhorst of Economic Affairs in October 2004 stated that improving access to oil and gas information was an urgent priority, and this letter resulted in the construction of a separate interface dedicated specifically to oil and gas (TNO, 2008). In so doing, other work that previously had been prioritized was shifted to a later date.

GIC also establishes the extent to which guidance, discussion, and progress reports need to take place, and it spells out terms and conditions for the provision and use of geoscientific data and information and pricing (Speelman and Maas, 2000). The Dutch political climate dictates transparency and justification of public spending. The ministries see themselves as partners in the subsurface information task. "They look at the project from a distance. They exchange views about whether it is useful to their ministries. They have fairly frequent contact if you count it up, maybe a dozen times per year,

formal and informal, maybe more maybe less, it depends on personal attitudes [2].”

As shown in Figure 2, DINO reports vertically to TNO, and the GIC is an advisory body. Formally, DINO has vertical accountability to TNO. However, the accountability to GIC “overrules” the accountability to TNO. “If something is not according to plan, GIC makes remedies [2].” The TNO National Council does review results at the corporate level, in terms of purpose and process, but it does not review the specific content. “As far as the content of the DINO program is concerned, it is the Commission that oversees. The National Council for GSN just looks at it from the point of view that procedures were executed as they were meant to be [2].”

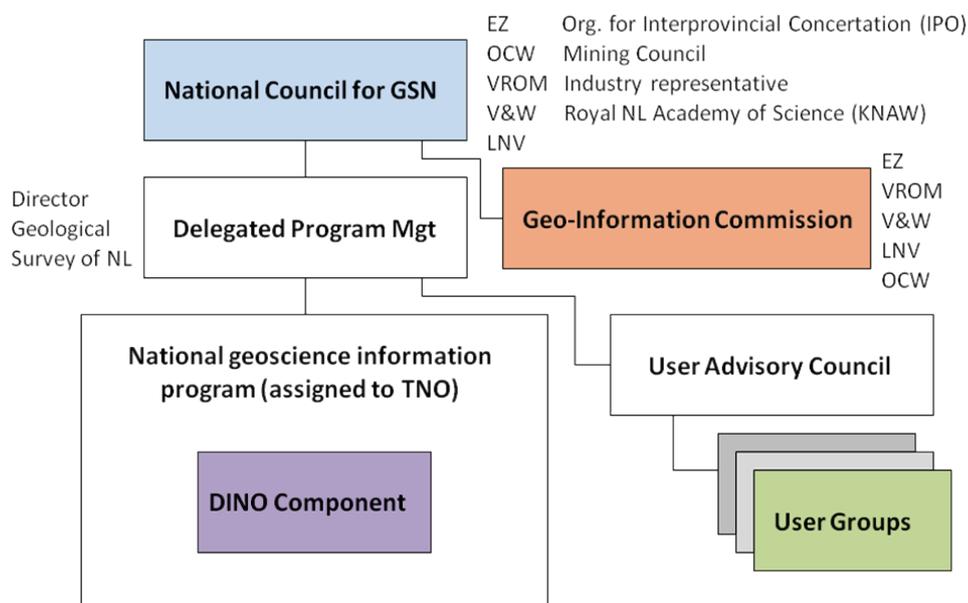


Figure 4.2: DINO Governance arrangements/framework

As part of its steering, in 2004, the GIC asked that DINO satisfy the demands of non-governmental users such as oil and gas operators, water boards, engineering companies, and educational organizations. “*This was partly driven by e-government policy that the user demands should be made the center of focus, instead of a push from governmental agencies. It should be more demand driven. Providing better services to the general Public and Private Companies was the policy [5].*” In effect, this GIC request influenced the subsurface network constitution. An advisory council and four user sub-councils were established for the shallow subsurface, oil and gas, geochemical, and soil.

Once per year, a users' day is organized by, and for, the users. This is a real network day for all users. The GIC agreed that the inputs and advice from the Chairman of the User Council should feed into the formulation of the annual work program. *"The GIC heavily weighs the advice from the user advisory councils into their decision processes and allocation of budget. So, the influence of the user councils is significant to the planning process of DINO [5]."* Users provide feedback once a year at the user meeting. A user board meets twice per year and steers development, content, and priorities.

4.5.1.2 DINO shaping governing structure

While GIC steers the process, DINO has opportunities to also shape the relationship. In part, this is because of frequent interaction and an established rapport with GIC. The shaping also occurs because DINO has expert knowledge and because they proactively seek to fortify how they are governed. Although GIC has responsibility for the work program, DINO staff suggests what they think is important and what they perceive users to want. One interviewee explained that "[T]he ministries ultimately choose, but normally they turn around and ask DINO staff, 'What do you suggest [1]?'". GIC members are supposed to be scientific experts, but as another interviewee explained, "More and more, there has been turnover in the ministries; more and more they started separating their domain knowledge. You get more business types [in the Committee] who don't have domain knowledge. [...] Ministries get reorganized, and you get new people to the meetings, which can be very frustrating to us. We noticed that some of our commission members have become attractive to other jobs, because they were trained in how to monitor DINO [5]." To the extent possible, when replacements are needed, DINO takes an active role in "sourcing" new GIC members. "I go to the ministries, I scout. I try to find the network. If there is a farewell party, I'm there, I give a flower, and I talk to all the people. And I find a new person—this is the one I need. And I ask my director to visit and request that this new person be brought in to the Committee [5]."

4.5.2 Autonomization

4.5.2.1 Operations shaped by GIC

GIC does not have direct influence on day-to-day DINO operations; rather, the market governance logic of steering through contracting gives (by design) greater autonomy to agencies for budgeting and personnel systems. In this sense, GIC has given DINO considerable discretion in establishing standard operating procedures.

4.5.2.2 DINO shaping operations

Though DINO is publicly funded, it follows private sector-type management.

DINO decides the number and types of staff employed and its own capital expenditure. No ex ante authorizations are necessary from GIC. DINO's managers come from the private sector, which as one interview explained, "Working in private sector absolutely has had an influence on management practices at DINO [1]." Another interviewee concurred that using procedures according to TNO standards increases DINO's capability "These procedures make business formal-business reporting, financial reporting, content reporting, external audits commission, peer reviews. The whole part of being more and more privatized, business-wise, commercial orientation, makes us think in terms of strategy plan, business plan, road maps, external consultancies, peer review [5]." As part of routine TNO quality management procedures, DINO undergoes three types of audits: Kennispositieaudit (KPA, Knowledge Position Audit), Klanttevredenheidsaudit (KTA, Customer Satisfaction Audit), plus an annual Employee Satisfaction Audit (MTA, Medewerkerstevredenheidsaudit). "The fact that DINO was being put under TNO, and that the TNO way of reporting was enforced on DINO, is part of the success of DINO; it's part of the success with politicians, ministries, and also the industry -- giving them the feeling that it's really managed very professionally. And it's managed the way we manage our engineering company."... "Before [as a government body], we only had an annual report, which didn't include specific targets, no key performance indicators, no budget responsibility on this or that [5]."

Furthermore, after the formation phase of DINO, TNO conducted a rigorous internal evaluation (termed Agenda 2003). DINO felt obligated to prove that it was delivering according to the terms in the contract between TNO and the State. It also was time to write up a new strategy plan (Mid Long Term Plan 2004-2008). "After the formation period, we anticipated a possible challenge, a need to justify ourselves [5]." "We foresaw in 2003, with Agenda 2003, that we needed to change and rearrange ourselves because there was more pressure on achieving results. TNO realized this itself, in time, before the ministries said, 'You're not performing well'. We forced ourselves to get these hard targets, and give the ministries these targets. It's more driven from within, knowing that if we wouldn't have done it, the consequences would have been dramatic [1]."

Several incidents in the country at the time contributed to the demand for greater efficiency in government. Such incidents include the IT market crash in 2002 (Statistics Netherlands, 2002), a scandal over the Ministry of Water Works' handling of the construction of Schiphol airport (Royal Commission, 2002) whereby civil servants were personally profiting, and the Enschede fireworks incident (Ministry of Interior and Kingdom Relations, 2001), which made it painfully apparent that government agencies (from central to provincial to municipality) needed to collaborate better. "There was a lot of

criticism on government agencies -- the economy was bad, unemployment rate was up, corruption, size of the civil service should be reduced. In this context, ministries asked for greater justification. There was a strong drive for efficiency and effectiveness [5].” TNO management was intensely worried by the uncertainty of DINO’s future existence. In order to solidify its base at TNO and to ensure its continuance, one interviewee said, “I was called in by the Board and they said that although we’re in a big reorganization and there’s a lot of political turmoil around it, you’ve got to safeguard DINO, make sure that TNO keeps the DINO task. And then basically I got carte-blanche to organize whatever I needed to ensure that I lived up to the agreement that TNO had with the State [5].”

Based on the internal self-assessment, TNO concluded that it needed to revamp its organizational divisions. DINO’s tasks were divided over seven research-focused divisions, which was problematic. “Their priority was doing research – projects – and not data management – process. Also their key performance indicators were research focused – number of publications, patents, sponsored research project, etc). This was one of the reasons to separate out the DINO task and staff from the research divisions and concentrate them into one data management division, DINO [5].” Once DINO had its own management division, it developed a number of new management information systems (Table 3). A scorecard is now used as a human resources management tool to motivate and enable staff to improve operations. A poster with graphics hangs on the wall is visible to everyone, and it is regularly updated. It gives targets for each data type and shows progress. “The process is very valuable. We know what we’re doing, and we know why we haven’t reached a goal or overreached another goal. Before 2004, there was none of this. With the scorecard, I know exactly what our targets are and who is working it and what it costs to reach the targets [1].” DINO also trained the handpicked staff in running production processes and started to listen much better to users. They set up a mechanism for complaint and bug tracking and also put in place an issues-tracking database (Table 4).

DINO continues to have the flexibility to reorganize internally. Initially, data and the service side of DINO were managed as two different sub-divisions (e.g. the back office and the front office), but in 2006, DINO realized that the front office should not be separate from the back office. Instead, the front office should be at the end of the line from the back office. Therefore, appropriate internal shifts were made so that now the back office gets the data and works on the data. Then, the last part is the service desk, which sends the data out to the users.

Table 4.4: Management information systems instituted by DINO to support implementation

Management information system	Description & use
Scorecard	Used as a human resources management tool to motivate and enable staff to improve operations. A poster with graphics hangs on the wall which everyone can see and is regularly updated. It gives targets for each data type and shows progress.
Complaints/bugs tracking	Facilitates reporting of user complaints (e.g., regarding response time, data, level of service) and user's requests; a button was added to the oil and gas portal menu. Complaints are sent to a designated person by email, and then DINO addresses each complaint.
DINO issues database (DID)	Tracks all issues that come from users and people who have data that could contribute to DINO. A DINO staff member is responsible for handling these issues and contacting network members to ensure follow up.

4.5.3 Result control

4.5.3.1 Result control shaped by GIC

Another basic element of the market governance regime is result control. *"Performance measurement was part of the original design from the start, because we got government money for doing this. And the GIC, well it does not enforce the program, but there was some kind of negotiation about what we are going to do for the amount of money that we get, and it is very normal that we report on how we spent the money... [The] first version of one-stop was in 2001, and from that moment on, we logged our users' activities. We only recorded the orders placed and deliveries made. Part of the logging was to try to get a hold on how much of the deliveries went wrong... which didn't happen often... which was good. We had to create some kind of raison d' être for getting this amount of money for the year, and it was a very long funding program, so we wanted to be intertwined in the society – so that a lot of people would feel hurt if we did not exist anymore. The logging became a tool to illustrate this [3]."*

For DINO, the main point of producing the performance information is to report back to the Commission. Also, *"it's handy to know... we can state things in our talks. It's used for promotional function. Users probably don't look at performance information. Why should they? If targets have not been reached, GIC typically is not heavy handed; no sanctions are applied. We have a good idea of what we can get done in a year. Yet you always want more than you can do. DINO has targets for each year. You can see that several things you cannot achieve in the year. So you just report that this was not executed during the year according to the plan, because there were some drawbacks. You have to explain. It does happen. The money is the*

same every year, regardless of outputs. Though in principle they could cut the budget if they wanted... or they could say that part of the budget will be used in a specific way. They have the power to do that [1]."

4.5.3.2 DINO shaping result control

Indicators are set in the annual work plan that DINO is required to deliver to the principals. However, it is DINO who proposes the indicators and the targets to be reported to the principals. *"I talked to the Ministries and asked them what they wanted... They said they wanted to see who was using DINO, show how much data is now in, how much data in archives, volume of data coming in. I asked the members of the GIC one by one what they meant... and I formulated the indicators from that [5]."*

The annual report, documenting the activities and progress of the past year, is a compulsory deliverable. The annual report includes both financial information and information concerning specific performance targets. Initially, DINO produced a substantial report, but it was extremely onerous to compile. "We spent an enormous amount of time on the annual report. The work was split in 120 separate projects... each project leader had to prepare something that takes 1-3 hours. [One staff member] was employed full time on it. At the end, we found that no one was reading it. We tested it. We put in a proposal to do data management on the bra usage cup C and D in The Netherlands, with a budget assigned to it. And nobody noticed. Then we showed it to them and said, 'Do you know what you approved? We're going to do the statistics on this! [5]' " After discussions on how to improve the process, the annual report is now electronic and searchable. The Commission asked for this format instead of the thick book, which had been time consuming to study. They wanted it organized so that they could quickly identify what is important to them. DINO has made it easier for the GIC to steer by making it easier for the ministries to extract information that they can then use in their own reporting.

4.6 Discussion

This case provides a detailed description of how DINO's politico-administrative environment shaped its performance management regime, and in so doing, it explains why DINO began evaluating early on, when few others in the geospatial sector did. DINO's initial evaluation was tied to the principal-agent relationship established through structural disaggregation and a performance contract which defined objectives and accountabilities. This relationship resulted in the pooling of financial resources from the principals as well as budget stability for DINO. After 2003, heightened political pressure and accountability mandates drove further changes to the performance measurement practices used by DINO. In the subsections below, we discuss

how this case relates to earlier work on the subject of geoportal evaluation. We also highlight the implications of the case findings to researchers and managers.

Comparison with previous case studies

The findings support earlier research on how and why evaluation is taking place (Lance et al., 2009; Lance, 2008; Lance et al., 2006). We do not see geoportal managers, on their own accord, evaluating their performance. Rather, they conduct evaluation when an external party requires it. This reinforces our understanding that evaluation within the geospatial community is a mechanism of accountability, rather than a process to improve or learn. Also, previously, based on the US and Canadian cases, we had suggested that the central budget agency was instrumental in controlling geospatial activity through a hierarchical relationship. However, with this case, given that the market-type of governance by DINO's principals' exhibits similar characteristics of control, we can refine our model to encompass broader types of 'external control'. The hierarchical managerial control has been removed through disaggregation and has been replaced by external rule imposition. This suggests that a hierarchical relationship still remains, but it is packaged into a quasi-contract, "where the 'agent' ('subordinate' in old-fashioned hierarchical terms) agrees to supply the 'principal' (superior, boss) with a defined set of outputs within a fixed period and at a predetermined cost (Pollitt & Bouckaert, 2004, p. 84)." The results are intriguing, when one considers that much of the rhetoric of geoportal development is on 'sharing,' 'collaboration,' and 'harmonization.' Meanwhile, forces that control and constrain behavior may be beneficial to achieving these network type goals.

Implication for researchers

In both hierarchical and market governance types, accountability is a critical component. This is not to say, though, that we support the normative assumption that more accountability is necessarily better. In fact, scholars have shown that increased use of performance assessment instruments in the public sector have had unintended consequences (also referred to as "perverse effects") which can reduce the quality of the knowledge about actual levels of performance or even negatively affect performance (van Thiel, 2002; de Bruijn, 2002). Instead, we are suggesting that SDI researchers embrace greater empirical scrutiny and conduct in-depth case studies of the political and structural context in which evaluation actually is taking place (Flybjerg, 2006). From where are the evaluation requirements coming? How are evaluation requirements being defined? What are the effects of reporting requirements on SDI implementers? Is there a difference between how accountability is imagined and how it actually operates? Without answers to such questions, without a better understanding of how public management reforms and accountability directives affect SDI

implementers, it is impossible to know whether any newly proposed measures will be meaningful (e.g., INSPIRE reporting requirements).

As researchers, intrigued by the paucity of geoportal evaluation practices, and given that we see evaluation as inherently associated with the success of information systems (Beynon-Davies et al., 2000), we want to understand what has caused existing evaluation practice to emerge and stabilize over time in the cases in which it has. Once we have an array of case studies, or sufficient exemplars (Flyvbjerg, 2006), we may be able to see that some contextual variables persistently shape the evaluation practices of actors and vice versa, and therefore can be productively deployed by practitioners interested in evaluating or 'forced' by external parties to evaluate.

Implication for managers

For managers who are faced with performance contracts, we point out that external control need not be perceived negatively. In fact, "control is both restricting and enabling: an apparent paradox. It restricts by preventing unwanted events, and enables by providing the authority and resources to make something happen (Thomas, 2004, p. 6)." The contract mechanism clarified the task function, put focus on results, and instituted a well-articulated annual work plan and a set of performance targets. DINO made its operations more transparent by tracking the progress of database development and routinely reporting on services to the user community. This governance approach also created the "space" for structured meetings and dialogue between ministries, for continuous reporting, and for consultation.

While apparently successful for DINO, we are not prescriptively suggesting that this approach is a solution for all managers. A key component of performance-based control is task specificity (Pollitt & Talbot, 2004). Performance-based control is more applicable to well-defined processes, such as geodata collection and geoportal development, and less so to activities with ambiguous objectives.

The case also suggests that managers can have a role in shaping their evaluation regime. Contrary to the thrust of agency theory, we found the GIC-DINO relationship to be one of complex dependency and cooperation. Even though the performance contract is a hard, legal document, the focus is on dialogue between the parties rather than on control. The contract became a soft coordination instrument that brings ministries together in an interdependent, co-management relationship. Strictly adhering to objectives that can be quantitatively monitored is of less importance than the overarching purpose of securing a dialogue between those who manage and those who are being managed. Rather than looking at contract management as a zero-sum game of autonomy and control, it can be viewed as a shared

process of learning and adjusting (Jann & Reichard, 2003).

Ultimately, an emerging factor for DINO's performance-enhancing behavior seems to be the pursuit of legitimacy. Although we previously highlighted 'accountability' as the key driver, the legitimacy-seeking behavior of public managers is likely the overriding motivation for evaluation (Pollitt & Bouckaert, 2004). Performance measurement gives visibility to DINO's work and demonstrates how DINO is anchored in society. From the onset, DINO management sought to be seen as a coherent, essential initiative. Management did this to ensure that Parliament would make DINO a Dutch authentic registry. Approximately a decade after initiation, DINO apparently was successful in making its case, and in December 2008, the decision was taken to formalize base registration of subsurface assets through the DINO repository and geoportal. This move can be seen as a "feather in DINO's cap." Future research could explore whether DINO was thus rewarded for complying with principals and for maximizing efficiency, or instead for pursuing legitimacy and eventually gaining it.

Also, an interesting postscript to this case study is that with DINO having reached its "legitimacy goal" at the end of 2008, DINO's governance model changed in 2009. The GIC was dismantled, and the Minister of VROM, with a legal foundation, is now politically responsible for the base registry of subsurface assets. Funding is directly coordinated through VROM and is no longer coordinated by OCW or other ministries. The user advisory council remains; however, the Minister of VROM decides on the priorities.

4.7 Conclusion

Few government ministries or agencies have instituted basic processes of evaluation to assess public effort in the geospatial sector. Is the explanation that managers do not think that performance information is necessary for accomplishing objectives? Is it that initiatives have ambiguous objectives? Is it that funders do not provide incentives for better accountability? Is it that community members' pressure through reputational sanctioning is negligible? Each could be valid, but as yet, little empirical research has been done to decipher the deterrents or identify elements that are conducive to evaluation in different contexts. This paper makes a dent using qualitative research methods to understand how structure, autonomy, and accountability interrelate and influence the behavior of geoportal managers. We mobilized analytical concepts from public management literature to explore connections, not only between actors, but between actors and the politico-administrative environment. In so doing, we refined our concept of hierarchical control being a significant factor in the initiation of geoportal evaluation to more broadly encompass other forms of 'external control'; we showed how external control can actually be an enabling mechanism, rather than a negative or confining requirement; we found that, contrary to the

thrust of agency-theory, performance-based contracts can actually act as 'soft' rather than 'hard' coordination instruments; we revealed that 'mutual shaping' can take place, thus enabling the agent to influence how it is 'controlled' by the principal; and finally, perhaps most importantly, we unearthed the fundamental drive for legitimacy which may be the most significant reason why managers should be aware of all the levers available to them, including evaluation. In using a "governance lens," we show how researchers can begin to understand actual practices and begin to generalize analytical findings to other settings. The evaluation question, rather than being "Is geoportal X successful?" is instead "How do the conditions and mechanisms beneath geoportal X explain why the geoportal is being evaluated?"

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CHAPTER 5: Opening the black box of donor influence on Digital Earth in Africa

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Opening the black box of donor influence on Digital Earth in Africa

Abstract

Africa's participation in Digital Earth is uneven. There is a tendency to ascribe this state to prevailing governance and cultural challenges in Africa. However, foreign actors such as donors have an apparent role in shaping geospatial policies and outcomes. Thus far, the complex linkages between external aid and improved social and environmental monitoring and decision-making have been handled as a kind of "black box." To better understand the situation, we open the box and focus on the interaction between donors and policy makers. We use a heuristic from political science, as well as empirical evidence, to describe the policy-influencing tools that donors employ based on four basic resources donors possess: organization, authority, treasure, and nodality. We show an evolution of tool usage as donors shift from 'old aid' to 'new aid' modalities. The new tools include: technical assistance for geospatial curriculum development, inscription of standards and data access requirements in contracts and grants, cross-agency project design, best-practice analysis, portfolio management, and the use of language to promote participation and accountability. Though these tools reflect donor intent to partner in the realization of Digital Earth, the tools stem from a persisting asymmetric power dynamic between donors and policy makers.

Keywords: foreign aid, donors, policy, outcomes, tools, geospatial technologies

5.1 Introduction

With a good portion of the planet's resources falling under the jurisdiction of African countries, the realization of the Digital Earth vision depends upon the open flow of geospatial data covering Africa. While striking advances have been made in the past decade—satellite imagery archives of African space agencies have been opening up, real-time sensor feeds are more prevalent, and crowd-sourced data are becoming a viable option—many potential sources of geographic data remain inaccessible. Efforts of African policy makers to implement policies that enable the discovery of distributed geospatial content have stalled (Makanga and Smit 2010, United Nations Economic Commission for Africa 2009, Ayanlade et al. 2008), and geospatial technologies are under-utilized (Schwabe and Govender 2009, U.S. Department of State 2008).

In 2010, scientists and policy makers at the 8th International Conference of the African Association of Remote Sensing of the Environment (AARSE)

attributed failures in producing tangible outcomes in the geospatial sector to domestic weaknesses—lack of a mandate or policy for data sharing, lack of dedicated champions to serve as catalysts, control of information for political power, and lack of resources. These are all predictable responses, raised repeatedly over the past decade in similar venues and reports (Schwabe and Govender 2009, Abiodun 2000). In a different vein, a senior GIS Officer at the United Nations Economic Commission for Africa (UNECA), in the same conference, pointed to African civic culture as the culprit when he stated, “We Africans don’t have a culture of planning and vision. We’re always acting on emergencies (pers. comm., Andre Nonguierma, 26 October 2010).” A similar sentiment is echoed by other scholars arguing that proactive or strategic planning in African societies is less a concern than maintaining the status quo: “Without a dynamic perception of the future, there is no planning, no foresight, no scenario building; in other words, no policy to affect the course of events (Etounga-Manguelle 2000, p.69).” A Botswana GIS specialist expressed dismay to a listserv group discussing data sharing in Botswana: “What is wrong with us Africans? I mean we grew up sharing meals from the same plate, sharing beds, blankets with our siblings. The idea of sharing was instilled in us at a tender age, and yet when we grow up it seems like we lose that aspect of our culture/tradition. What is happening here? Is the idea of sharing [data] too much to ask anyone (Sewelo 2006)?”

While governance and cultural-deterministic assessments may provide some insight to data sharing attitudes, it is disconcerting to hear Africans attribute the lack of tangible outcomes to domestic political and cultural disposition. The uneven participation of Africa in Digital Earth may well stem from a chain of factors, spanning domestic political capacity and policy making processes (Homburg and Georgiadou 2009), the means with which knowledge of policy impacts is gained (Georgiadou et al. 2006, Bassole et al. 2001), and the influence of donors and international financial institutions (IFIs) in policy making. Donors and IFIs, in particular, are a considerable force shaping practices of the African geospatial community. Geospatial governance in Africa heavily relies upon funds channeled through bilateral aid agreements, foundation grants, lending by multi-lateral financial institutions, and technical assistance from international organizations, including the United Nations (Lance 2005). Yet, the promised outcomes of geospatial governance, such as better planning, informed decision making, more equitable distribution of public services, and improved natural resources management and early warning remain elusive (Homburg and Georgiadou 2009).

In this paper, we contend that in order to adequately understand the current state of Digital Earth in Africa, the full chain of factors—donors/IFIs to policy makers, policymakers to policies, policies to outcomes—needs to be critically examined. If we do not unpack and study these factors individually and

collectively, we run the risk of misidentifying causes and effects, as well as levers or opportunities for change. The aim of the paper thus is to pry open the 'black box' between donor financial inflows and development outcomes (Bourguignon and Sundberg 2007). We focus on what arguably is the most neglected yet influential link, the interaction between donors/IFIs and geospatial policymakers in African countries, and how it is changing over time with new aid architecture.

In section 2, we summarize the history of the geospatial sector in Africa and its relation to the foreign aid landscape. We then present the conceptual framework for the analysis. In section 3, we summarize the methods and present data from policy documents, literature, and interviews. In section 4, we discuss how the practices of donors/IFIs have changed over time and the implications in terms of aid effectiveness. We conclude by evaluating this line of inquiry and pointing to further research. For the purpose of the paper, we use the term donor to collectively refer to aid agencies, international financial institutions, philanthropic foundations, and other organizations that provide funding and/or technical assistance, directly or via contractors, to recipient, local entities who in turn serve local beneficiaries.

5.2 History of geospatial sector in Africa and conceptual framework

5.2.1 Historical background

Remote sensing and GIS trade journals often showcase the African geospatial sector, but comprehensive surveys or serial industry reports on investment in, uptake, and usage of geospatial technologies in Africa are lacking (Lance 2010). Remote sensing and GIS activities began in Africa in the 1970s (Hastings 1991), most notably with the establishment of regional remote sensing and GIS training centers. In May 1976, then Secretary of State Henry Kissinger, speaking at the United Nations Conference on Trade and Development in Nairobi, Kenya, told African leaders that "satellite technology offers enormous promise as an instrument for development (Conitz 2000, p.673)." At the time, the limited application of science and the low level of technology were considered the root causes of Africa's economic backwardness (Adedeji 1988). Geospatial technologies were viewed as 'good practice' to close the information and data gap required for rational planning and development.

Initially, a regional rather than national approach was employed, for economy of scale, owing to the large number of countries in Africa. However, the establishment of regional remote sensing centers shifted attention and resources away from national universities, and weakened them as a result

(Conitz 2000, p.672). In the 1970s and much of the 1980s, a supply-driven approach to geospatial technologies resulted in a clear imbalance between the information produced and the national capacity to absorb it (Woldai 2002). In the mid-1980s, efforts were launched to strengthen the capacity of national users. For instance, the UNEP GRID program, established in 1985, focused on the production of spatial databases and the development and application of GIS/environmental information systems in several African Ministries of Environment. During the 1990s, the theme of environmental conservation was gradually replaced by sustainable land management and poverty alleviation, and the community of RS/GIS users broadened. The thematic emphasis further shifted in the late 1990s to land administration and good governance. In the 2000s, the geospatial user community continued to expand, even fragmenting into many non-traditional sectors as diverse as public health, economic development, business intelligence, and the humanities. Currently, considerable attention is placed on climate change adaptation and disaster management. National governments still make up the bulk of the users (ESRI East Africa 2009), although municipal planning and community mapping are up and coming (Baud et al. 2011).

With the advent of web-based technologies, countries began pursuing initiatives aimed at increasing the availability and accessibility of geographic information (Ayanlade et al. 2008, Lance 2003). Developing national spatial data infrastructure (SDI) in Africa was one of the approaches to improve the handling of geographic information. To this end, African policy makers attempted to develop and implement geospatial policies to enable increased access to and use of government geospatial data in the public and private sectors, promote service integration and cross-agency geospatial data-sharing arrangements, and enhance government efficiencies in collecting, maintaining and distributing geospatial data.

Virtually all government ministries using geospatial technologies in Africa received the initial thrust for GIS usage from projects funded by foreign donors and IFIs (Conitz 2000, p.673). Before 2005, the investment of donors/IFIs in geospatial technologies in Africa was typically ad hoc and fragmented (Lance 2005). Aid agencies spread their resources across many countries, sectors, and projects, with 'stove-piped' or 'silo' installations. To complicate matters further, aid agencies shifted their focus over time, from government in the 1980s, to private sector in 1990s, to non-governmental organizations (NGOs) and civil society organizations (CSOs) in the 2000s (Akbar Zaidi 1999, Edwards and Hulme 1996, Meyer 1992). While it is impossible to put a number on the amount of foreign aid invested in Africa in the geospatial sector, for land administration alone at least US\$715 million was invested for the period of 2002 to 2012 (Johnson 2011). A fiscal archeology of sorts done across the web (Lance 2005) further illustrates a

sizeable investment in other sectors: environmental management (Central Africa Regional Program for the Environment (CARPE), US\$53 million; Africa Environmental Information Network (AEIN), US\$1 million), land cover (Africover, €4 million), climate change adaptation (Climate for Development in Africa (ClimDev), US\$136 million; West African Science Service Center on Climate Change and Adapted Land Use (WASCAL), €100 million), health data (Monitoring and Evaluation to Assess and Use Results Demographic and Health Surveys (MEASURE DHS), US\$8.9 million), earth observation (African Monitoring of Environment for Sustainable Development, €21 million; Monitoring of Environment and Security in Africa (MESA), €37 million; Regional Visualization and Monitoring System (SERVIR), US\$2 million), geological resources (African-European Georesources Observation System (AEGOS), €1.9 million); soil mapping (AfricaSoils.net, US\$30 million); and capacity building (GMES and Africa: Regional Network for Information Exchange and Training in Emergencies (GARNET-E), €1 million; GEO Network for Capacity Building (GEO-Net-CaB), €1 million). This influx of resources inevitably shapes the relationship between donors and aid recipients and needs to be explored to understand how geospatial policies and practices in Africa are established.

5.2.2 Conceptual framework

Despite the substantial foreign financial inflows to African ministries, many of the lauded outcomes of geospatial technologies have not materialized (United Nations Economic Commission for Africa 2009, Schwabe and Govender 2009). Trying to relate donor inputs directly to development outcomes “as through some kind of black box, will most often lead nowhere (Bourguignon and Sundberg 2007, p.317).” Instead, Bourguignon and Sundberg put forth a framework to open the black box and bring intermediate links to the fore. The first intermediate link is between donors and policy makers, the second between policymakers and policies, and the third between policies and country outcomes (Figure 1). Donors influence African policy makers by providing financial aid and technical assistance. Donors may try to impose policies through aid conditionality—projects made conditional upon the recipient’s adoption of practices or standards identified as good practice. Policy makers are responsible for policy formulation and implementation which largely depend on governance: political systems, bureaucratic and institutional capability, and checks and balances mechanisms, including civil society. Country outcomes are determined by the content and quality of the policies pursued and whether they are effectively implemented. Knowledge of local circumstances and continual learning through impact evaluation are critical to realizing outcomes.

These three links, if assessed and monitored, can paint a clearer picture of the geospatial sector in Africa. This generic framework linking foreign aid, the

policy process, and country outcomes is applicable to the geospatial sector given the aforementioned dominance of aid to geospatial activity in Africa. Each link of the framework merits its own empirical examination. A few researchers have begun to look at the governance link between African geospatial policy makers and policy. Geospatial policymaking appears to be a process of importing and editing foreign policies and not a deliberative process capable of producing appropriate domestic policies (Georgiadou and Homburg 2008). In recent years, in light of perceived policy failures, donors and African civil society have begun to experiment (Figure 1) to potentially improve the capacity of civil society with the aid of mobile phones and web mapping to participate in policy making and to directly demand the delivery of public services from their governments (Georgiadou et al. 2011). Researchers also have started questioning specific geospatial policies in relation to outcomes (Kalande and Ondulo 2006; Bassole et al. 2001), though rigorous or systematic evaluation of impacts of geospatial policies is lacking. No theoretically and empirically grounded study yet exists on the link between donors and geospatial policymakers, the first two grey bubbles in Figure 1 and hence the focus of this study.

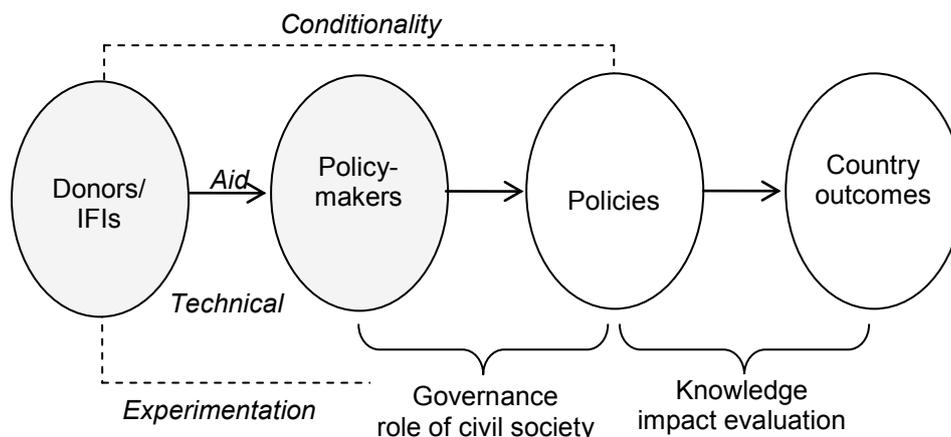


Figure 5.1: Aid, policy, and outcomes (adapted from Bourguignon and Sundberg 2007).

To examine the donors-policymakers link in detail, we draw upon a seminal political science heuristic developed by Hood (1983) in *The Tools of Government*. Hood's classification of policy tools distinguishes types of interventions that are analytically and empirically separable, and thus useful for comparison and analysis. Hood identifies four basic resources that any government has at its disposal to achieve its policy goals within its own society: organization, authority, treasure, and nodality (Table 1). Each resource enables a government to devise distinct tools to detect or effect

change, thus making policies operational. With organization, a government relies upon civil servants (e.g., in the army, police, executive agencies etc) to coordinate social groups and deliver services. With authority, a government defines rules in a legal or official sense to which subjects must comply. With treasure, a government influences policy through the direct purchase of goods and services, provision of incentives, or instituting user charges. With nodality, a government draws upon its central position to collect and distribute information (e.g. national census, national development indicators).

Although Hood conceived of the tools of government as a way to study how a national government achieves its policy goals within a country, the toolkit is equally useful for studying how foreign agencies (such as donors) achieve their policy goals in another country when they provide aid to that country's government. Foreign aid allows African governments to abdicate their responsibility to finance public goods, and donors end up substituting government in development planning. As Dambisa Moyo (2009a) described, "In Africa, public goods such as education, healthcare, infrastructure and yes, even security, are provided by donors. That is completely unacceptable." She reported a fellow African asking "[W]hy do we even bother going to stand in the hot sun to vote for these leaders? We should actually be voting between CIDA and USAID, because ultimately they are the ones who are providing us with the public goods (ibid)."

5.2.3 New aid architecture

The external injection of foreign aid into national affairs has been severely criticized (Moyo 2009b; Easterly 2006). From 2005 to-date, stakeholders across the development sector have argued for significant changes to aid architecture. 'New aid' practices have been devised to replace 'old aid', with a refreshed pledge to strengthen African governments (African Development Bank 2005). 'New aid' refers to commitments and instruments designed in accordance with the 2005 Paris Declaration on Aid Effectiveness, endorsed by over 100 donors and partner countries (ibid). The Paris Declaration is an international framework sponsored by Organization for Economic Cooperation and Development's Development Assistance Committee (OECD/DAC) that focuses on the quality of aid. It is yet another step in a history of efforts to improve the delivery and use of foreign aid. Like World Bank/IMF-led Poverty Reduction Strategy Papers (PRSPs) in the 1990s, the Paris Declaration of 2005 promises increased ownership and better coordination. The Paris Declaration can be viewed as a counterpart to agreements that focus on UN-led commitments to development goals (e.g., Millennium Development Goals) and to UN/G8-led commitments on development finance (e.g., Monterrey Consensus, Doha Declaration on Financing for Development).

Donors and policy makers in developing countries in partnership agreed to push for change in key areas relevant to this paper. For instance, policy makers are meant to identify development goals and formulate a national development strategy. Ownership of a national development strategy should include systematic, broad-based stakeholder participation, including civil society, the private sector, and local governments. Donors should align aid to the national development strategy, rather than impose their own priorities. Donors should rely on partner countries' own mechanisms for implementing projects, rather than putting parallel systems in place. Donors and policy makers jointly should manage for results, which includes establishing results-oriented reporting and assessment frameworks that monitor progress against key dimensions of the national development strategy and that improve evidence-based decision-making. National capacity development is the responsibility of partner countries, with donors playing a support role. Donors should strive to reduce duplication of efforts and harmonize their activities to make them as cost-effective as possible. Prior to the Paris Declaration, the onus for change repeatedly was placed on the recipient. Now, donors are called upon to change practices, as well.

Using Hood's heuristic, and in light of the 'old aid' and 'new aid' eras, we can compare how donors use organization, authority, treasure and nodality and how donor tools have changed over time. In the geospatial sector, donors use 'organization' in the form of expert human capacity to influence policymakers in a beneficiary country. Although donors lack direct legal 'authority' to define rules of behavior within beneficiary countries, they can make contracts conditional upon the recipients' behavioral change. With 'treasure', donors steer policy change by providing financial incentives to development sectors or initiatives which they deem worthy of development in the beneficiary country. With 'nodality', donors draw upon their strategic position to collect and dispense information (Table 1). These four resources (and combinations thereof) form the basis of the toolkit available to donors when seeking policy solutions in beneficiary countries. The resources can be seen as involving an increasing level of constraint. Roughly, the level of constraint inflicted on the recipient rises as we move from nodality, to treasure, to authority, and finally to organization-based tools (Hood 1983).

Table 5.1: Resources of donors to achieve policy goals (adapted from Hood 1983)

Resource	Constraint	Donor/IFIs-policymakers link
Organization	high  low	Ability of donors to use their own or <i>experts'</i> human capacity to influence policy change
Authority		Power to make <i>contracts</i> conditional upon the beneficiary's behavioral change
Treasure		Ability to select sectors worthy of <i>financial incentives</i> for development in the beneficiary country
Nodality		Ability to use <i>strategic position</i> from which to collect and dispense information in beneficiary country and amongst other donors

5.3 The changing aid game in Africa

Data for this study were collected through interviews, participant observation, analysis of documents, and review of literature. Both semi-structured and conversational interviews were conducted with aid agency officers, geospatial policy makers, project implementers, and international consultants, covering the dynamics of foreign aid and geospatial policy development. In addition, questions were posed and answered through electronic mail. The lead author participated in 15 Africa-wide conferences and 5 regional workshops focusing on geospatial policy and cross-agency coordination between 2001 and 2010; she organized and/or led 12 national workshops which addressed one or more of the following aspects: geospatial data discovery and visualization, geospatial data policy, cross-agency data sharing, and data standards. The lead author has extensive prior familiarity with the geospatial sector in Africa, including knowledge of aid practices through her employment as a contactor in aid-supported projects for over fifteen years. Secondary data sources included aid agency reports, project documents, scholarly papers, conference proceedings, and internal documents such as feasibility studies. Most of the sources are publicly available, though a few documents are not. In addition, the lead author regularly followed the continuous stream of communication on aid project planning and evaluation at listservs and blogs. We group the data according to the resource (organization, authority, treasure, nodality) the donors used and identify the specific tools donors deployed in the eras of 'old aid' (prior to 2005) and 'new aid' (after 2005).

5.3.1 Organization

Donors use the 'organization' resource when providing technical assistance, either via their own consultants or via local contractors. 'Old aid' relied heavily upon technical assistance by 'fly-in, fly-out' consultants, rather than

by local expertise. As a result, although many remote sensing projects have been conducted, many of the projects were contracted out to foreign consultants and local expertise in the use of GIS/RS technologies remained low (Adegoke 2003). Across sub-Saharan Africa, institutions of higher formal learning (polytechnics and universities) were generally by-passed in the development of capacity for the management of environmental information (Nkambwe 2002). Even today, many projects applying satellite data to African problems still do not include Africans working directly with the satellite data, but instead, work is done by external partners (Wood and Weigel 2009). Further, technical assistance is problematic because it legitimizes the expertise of foreign contractors over local expertise. Recipients often accept norms of foreign experts without questioning or challenging them, because these norms are seen as the standardized or 'correct' way to do development work (Wallace et al. 2006). Thus, consultants have a significant influence over how a project is implemented – the practices, the software used, the standards applied (Skok and Legge 2002). Often, contractors or consultants copy procedures from their country of origin with the assumption that what worked in the North, should serve as best practice in the South. Choices regarding open-source versus proprietary approaches (see Jackson and Schell 2008) may be decided upon by contractors, rather than through a deliberative process of consultation with local recipients, leaving the direction of a project heavily dependent on whoever is given the project reigns. As an example, in Kenya, Japanese consultants had a major role in steering framework data development and defining geospatial standardization profiles, procedures, and practices; this work largely was based on the consultants' experience and methods acquired during standardization activities in Japan (JICA and SOK 2008).

'New aid' has retained technical assistance as a principal instrument, but a shift in the type of technical assistance provided is taking place. In recent years, we see an increase in aid agency support to curriculum development and the development of human capacity at African universities, e.g., UK's Developing Partnerships in Higher Education (DePHE), Africa-U.S. Higher Education Initiative, China's new international partnership plan to assist 20 of its elite universities to foster partnerships with 20 African universities (University World News 2009). African universities can be viewed as "islands of stability" for cooperation because they offer a means for sustaining analytical efforts beyond the limited time frames of project funding, and they educate the next generation of scientists, engineers, and public policy leaders (U.S. Department of State 2008, p.8). The project *Development of a Geographic Information Sciences based Education and Research Program at the National University of Rwanda*, funded by The Netherlands Organization for International Cooperation in Higher Education (NUFFIC) is an example of technical assistance under 'new aid.' It is designed to build a multi-

disciplinary team of local specialists at the University who will have the knowledge and skills to develop and conduct high quality training and research, as well as offer professional services. A 2007 survey of research collaboration with African universities documented the rise in North-South research linkages (Harle 2007). However, the increase in linkages is not being matched by increased financial support for research by African institutions (ibid).

5.3.2 Authority

Donors use 'authority' when they inscribe conditionality in project contracts. In 'old aid', conditionality was a dominant feature. It referred to projects being made conditional upon the recipient's adoption of universal 'good practices.' Geospatial technologies were introduced in Africa mainly by means of conditionality. GIS adoption was a condition for obtaining loans for development from donors, tied to the financing of environmental development programs in the subcontinent in the 1990s (Kyem 1999). Aid agencies often bypassed recipient governments all together with respect to technology adoption, as highlighted in a South Africa case studied by Noongo (2007): "*The development of GIS at the CBS [Central Bureau of Statistics] started in 1999 with the preparations of the 2001 census. During the early preparation stage, SIDA (one of the main funding bodies of the census) commissioned GeoSpace (a South African based GIS consulting company) to investigate the feasibility of using GIS during the 2001 census.[...] All agreements and lines of communications in this feasibility study were directly between GeoSpace and SIDA, while the CBS did not play any role or got involved in anyway. As a matter of fact, the CBS was not even aware that there was a feasibility study being carried out (p.139).*"

In 'old-aid', donors also inscribed control practices—through the prescription of accounting techniques, financial statements, and input safeguards—in loan agreements and grants, as a means to exercise authority (Neu and Ocampo 2007). Many African governments face more organized and effective pressures for accountability and transparency from donors than from their own citizens and parliaments (Brautigam and Botchwey 1999). Inevitably, projects are "profoundly shaped by the [project's] managerial regime and its organizational systems and procedures — budget categories, sanctioning time-frames, procedures for approval or targets [...] An operational logic locks the project into certain design choices (Mosse 2004, p.14)." The dominant logical framework (logframe) tool for planning and reporting, with its clear hierarchy, rooted in engineering management, reinforces well-specified time frames and control of financial flows. It also impedes the ability of local organizations to operate with the kind of flexibility and adaptability that complex development problems generally require (Gibson *et al.* 2005, Wallace *et al.* 2006).

In 'new aid', geospatial technologies are sufficiently mainstreamed that they no longer need to be conditionally imposed. But, inscription of control practices into contracts continues, with interesting twists. While financial accountability and transparency still are required, donors are putting greater emphasis on performance accountability and managing for results. This includes ex-ante identification of output indicators and performance monitoring over the course of projects against the defined indicators. Some aid agencies also have begun to inscribe explicit data management practices into contracts and grants to ensure that grantees follow pre-set data collection standards, create metadata, archive data, and establish data access conditions, and unambiguously document them. For instance, because USAID is required to make non-proprietary geospatial data available to the public, USAID partners that create geospatial data with funding from USAID *"will be required to electronically submit these geospatial data layers to USAID within 30 days of the end of each fiscal year during the life of their Awards [...] To maximize USAID's investment and ensure effective re-use, geospatial data created with USAID funds must be compliant with ISO 19115 Geospatial Metadata Standards (USAID 2010, p.1)."* Similarly, the Gordon and Betty Moore Foundation has established a data sharing policy that specifies that *"[a]ll data used in or developed in whole or in part by GBMF funded projects (and that can be shared in a manner consistent with applicable laws) will be made widely available and freely shared as soon as possible (GBMF 2008, p.1) [...] As part of the GBMF grant development process, potential grantees are required to develop a Data Management and Sharing Plan (the Plan) with their GBMF program officer (GBMF 2008, p.2)."*

Inscribing data management practices into contracts is not yet standard operating procedure across aid agencies, but it is a noteworthy development, a type of imposition of a practice that aid agencies are pursuing. Inscription of data access conditions into grants and contracts by donors is meant to ensure that there is open access to data for all (African end users, as well as donors). This is an example of donors having learned from past projects which neglected end-users' data needs. Inscription is only part of the process; the more challenging aspect is enforcement. According to a USAID officer (pers. comm., 11 April 2008): "Most aid officers are not geospatial-oriented per se; they won't know if the grantee is following the best practice, because the aid officers don't know geospatial." Also, aid agencies often enter into cooperative agreements or grants rather than legally binding contracts. This minimizes the legal obligation. However, "If [recipients] don't deliver what was mutually agreed upon, then the trust is gone, and it's very unlikely that they will get another grant. We cannot stop payment [if data are not managed according to agreement], but the organization cannot expect to get funding again (ibid)."

5.3.3 Treasure

Donors use 'treasure' to privilege a certain sector by deeming it worthier of financial incentives than another. As Volvo Research and Educational Foundations stated in a report, under the heading *Influencing development*, "We have an opportunity to influence development by steering calls for proposals toward the areas that we have identified as of critical importance for future development (Volvo Research and Educational Foundations 2008, p.6-7)."

'Old aid' is characterized by the financing of single-agency, fragmented, thematic projects, aligned to donor priorities. Many projects reflect "an excessive data focus implying a preoccupation with aspects of data standards, interoperability, metadata, etc., which marginalizes the influence of the social, political, historical conditions within which the design and use of the end products takes place (Georgiadou *et al.* 2005, p. 114)." Donors have a history of focusing on technology and data acquisition to accomplish a pilot or initial application, with insufficient consideration of documenting the work performed and establishing how the system will be maintained once the project is completed. Also, end-users typically are not central to the design process, so there is lack of clarity of how end users will embed the results into their decision making. Noogo (2007) came to this conclusion when she reflected on GIS projects in Namibia: "*Although it seemed easy to implement computer information systems, I realized that we lack the full understanding of their nature and their potential. In addition, there tends to be confusion about how processes like decision-making might be improved by a computer technology like GIS. When information systems do fail, more often than not, our immediate, almost instinctive reaction is to look for technical explanations. We ask what went wrong with the software, is the network infrastructure or protocols inadequate. It shows how we regard information systems as technical projects, thus looking for technical reasons for failure. We appear to create one technical innovation after another as we move farther away from questions regarding implementation aspects and implications of these innovations (p.11).*"

In the 'new aid' era, donors support cross-agency efforts that are more structural in nature, focusing specifically on coordination and data sharing across organizations and sectors (Table 2). These cross-agency initiatives come with the promise of helping to reduce duplication, increase efficiency, and improve decision making. Similarities in these projects in different countries reflect a degree of convergence and learning within aid agencies with respect to the need for greater focus on institutional arrangements and creating an information foundation to support broader societal goals. Also, there is more dialogue and opportunity for consultation on national geospatial strategies, as evidenced by conferences organized by project implementers

and supported by donors. Projects that support cross-agency coordination and data sharing increasingly stem from a country's own specialists, though the line as to whether these projects are country-defined, selected and owned or donor-advanced is difficult to pinpoint.

Table 5.2: Examples of aid-supported cross-agency geospatial coordination projects

Year	Country	Aid agency	Project
1993–2002	Burkina Faso	World Bank	National Program for Environment Information Management (PNGIM)
1995–1997	Ghana	World Bank, GEF, DANIDA, DFID	Country at a glance (G-CAG) / National Framework for Geospatial Information Management (NAFGIM) - Ghana Environmental Resource Management Project
1997–2000	Zambia	World Bank & Nordic Development Fund	Environmental Information Network and Monitoring System (EINMS) / Environment Support Program
1998–2001	Namibia	Finaid	Information and Communication Services for Sustainable Development (Infocom)
2000–2005	Tunisia	CIDA	National Geomatics Project
2000–2006	Uganda	Italian Cooperation	Karamoja Data Centre; Northern Uganda Data Centre (NUDC)
2002–2004	Botswana	SIDA	Project for the Establishment of National GIS
2002–2007	Somalia	UNDP, Italian Cooperation, European Comm., UNICEF	Somalia Water & Land Information Management Project (SWALIM)
2005–2008	Kenya	JICA	Project for Strengthening Survey of Kenya for GIS promotion in the Republic of Kenya
2005–2013	Tanzania	Finaid	Sustainable Management of Land and Environment in Zanzibar (SMOLE)
2007–2010	Swaziland	JICA	Swaziland Integrated Geospatial Information System; National Development Data Center (NDDC)
2009–2010	Lesotho	World Bank	Lesotho Integrated Transport Program - Institutional Capacity for Database and GIS
2009–2013	Senegal	CIDA	Geospatial Strategy for Senegal
2009–2014	Rwanda	DFID	National Land Center

Although aid practice shows signs of more consultation for project selection and design, the alignment of projects to country priorities still can be problematic. For instance, the European Commission, at the request of African nations, has been implementing a Joint Africa-EU Strategy, agreed upon in Lisbon in 2007, under which African institutions would drive rather than be steered by the developed European states (Council of the European

Union 2007). Several of the eight partnerships in the Joint Africa-EU Strategy involve geospatial data--in many cases directly--in their operational plans or proposed projects. Yet, the European Commission (2009, p.5) reported a lack of participation on the part of the African nations and institutions in implementing the Joint Africa-EU Strategy, at the operational level, a divergence from the *modus operandi* endorsed in the Strategy.

5.3.4 Nodality

Donors started using the 'nodality' resource in the 'new aid' era for the first time in the form of the catchword 'donor coordination:' a strategic position from which to collect and dispense information in the beneficiary country and amongst other donors. Donor coordination under the 'new aid' architecture has influenced the ways in which aid agencies see themselves and the ways in which they work. Donors are becoming more reflective, questioning their approaches, and grappling with how to improve effectiveness. They are developing 'best practice' documents and protocols for data management within aid-supported projects (e.g. Wehrmann 2011, infoDev 2010, Wehrmann and Glavina 2009). They are using their nodal position to collect and distribute 'best practice' and innovative examples of collaborative approaches. This nodality-based tool usually is exercised in an advisory rather than a prescriptive manner. For instance, The World Bank explains: "Our client countries are starting to come to us for advice on how to organize their own SDI systems, to manage the growing pool of GIS resources better. [...] On the matter of supporting SDI development in client countries, there is always the risk that we influence more than we should. We are exploring how to offer an open set of options, instead of passing a judgment (pers. comm. with World Bank representative, 25 April 2009)."

Another nodality-based tool is manifest in the mapping of aid flows to improve the transparency of aid and access to aid information to recipient organizations, researchers, development practitioners, and beneficiaries in developing countries. An aid transparency standard has been developed so that donors can publish their content to the web (IATI 2011). In the past, aid agencies were subject neither to intense competitive pressure nor to scrutiny from analysts and rating agencies. Now, aid agencies are embracing competitive pressures by providing better information about where aid is being spent and publishing independent evaluations of projects. This competitive environment should improve the governance of aid agencies and the quality of the aid they deliver (Harford and Klein 2005). However, progress is slow, because the intended users of this data – CSOs, parliaments, researchers – have yet to apply this data to question donors' actions and effectiveness (Mulley 2011). Donors are gathering 'evidence' and using geospatial technologies to have a more holistic view of the spatial dimension of aid to support future allocation of resources. For instance, the

Sahel and West Africa Club/OECD (SWAC) mapped aid flows to local communities within Mali to analyze the overall spatial coherence of aid from a national, spatial perspective (SWAC 2009). JICA took a similar approach, new to the agency, in the mapping of medical facilities in Zambia and incorporating the overall spatial dimensions of aid in the health sector into future planning (Ministry of Foreign Affairs of Japan 2007, p.23). Similarly, the World Bank mapped its active projects in Kenya to get a better understanding of where its funding is allocated (AidData.org 2011).

A third nodality-based tool is exercised in the use of language. Language can be used to shape action and ways of thinking – serving as persuasive doctrine or myth (Homburg and Georgiadou 2009). As Hood (1983 p.140) pointed out “there is no such thing as an intrinsically ‘innocent’ instrument of government.” Aid agencies have modulated their language from ‘technical assistance’ to ‘technical cooperation,’ insinuating a shift of emphasis from the transfer from a knowledge-rich North to a knowledge-poor South, to a more co-operative and dialogic North-South relationship (Wilson 2007). The language of cooperation with recipients affirms the new architecture of aid, which is meant to reduce donor interference in recipient country policy making and improve local participation in planning processes and decision-making. Donors now refer to themselves as development partners, and commonly speak of ‘mutual responsibility’, ‘partnerships’ and ‘dialogue’. However, many discount this language turn as just rhetoric, and remark that “[p]ower imbalances between donors and aid-dependent countries are still very real (Agulhas 2006, p.2).” The words ‘assistance’ and ‘cooperation’ enable donors to appear as ‘technocratically neutral’ and ‘imply a non-existent parity of power between the technical helpers and the helped (Cooke 2004, p.607).’ The World Bank masks the coercive character of its policy transfer using the apolitical-sounding language of ‘diffusion’ and ‘knowledge sharing,’ alongside the technical or neutral terms of ‘best practice’ and ‘benchmarking’ in its documents (Stone 2001).

5.4 Appraisal on the evolution in the donors - policymakers link

This section reflects on the evolution of tools used by donors to ‘govern’ policymakers in the geospatial sector in Africa (Table 3). We analyze this development in terms of changes in the constraints upon recipients, as a result of using different tools in the two aid regimes: old and new. Following the imperative of ‘new aid’, to minimize constraint, donors may put greater emphasis on treasure and nodality.

Table 5.3: Evolution of donors' tools: from old-aid to new-aid

Resource	Tools in 'old-aid'	Tools in 'new aid'
Organization	Technical assistance: "fly-in, fly-out" consultants	Technical assistance: strengthening human capacity (African universities/specialists)
Authority	Old conditionality: use of geospatial technologies attached to projects Financial accountability	New conditionality: mandatory data access conditions and standards Performance accountability (managing for results)
Treasure	Project selection: aligned to donor priorities Project focus: single-agency thematic projects	Project selection: aligned to country strategy; greater consultation between donors and policy makers Project focus: cross-agency frameworks & cross-sector coordination
Nodality	N/A	Development of best-practice documents Mapping of aid flows and spatial dimension of aid Use of language of participation

Nodality does feature prominently in the 'new aid' architecture and is a welcome sign of donor effort to decrease constraint on recipients in the geospatial sector. The emergence of nodality tools, for instance assembling 'best practices' to shape knowledge and attitudes, and conducting portfolio mapping to increase donor transparency and better targeting of aid, is not surprising given the rapid development of information technology which fosters nodality (Hood and Margetts 2007). Still, power imbalances between donors and recipients prevail, causing critics of aid to claim that the most prevalent nodality tool of donors has been their rhetoric.

'Treasure' is undergoing changes in the way it is used. The funding of cross-agency geospatial coordination programs can be seen as a positive step to correct for two decades of aid that resulted in substantial fragmentation of the geospatial sector. However, the degree of country ownership, as opposed to donor push for such projects, is questionable. While there may be greater consultation between donors and policy makers surrounding projects, the impetus of the project may still stem from donors. The act of supplying funds for such activity still is value-laden, particularly if the effort has been pre-selected and advanced by a donor. Foreign aid alters incentives for governments. If countries do not have to fund the work themselves, they do not really adopt the innovation (Teeffelen 2000). Woldai (2002) echoed this sentiment based on his 20 years of experience working in Africa: governments accept new initiatives without analyzing the consequences. Furthermore, the introduction of a coordinating body or committee is a form of manipulation of the local context. This happens when an organization, through its access to funding, assumes a position of authority and attempts

to regulate membership and action of other organizations. In effect, donor projects may be tampering with domestic organizational boundaries by over-using the treasure tool. Donors confer power and legitimacy on those organizations chosen to receive funding. A perceived unequal distribution of resources can define and position actors vis-a-vis each other. Similarly, the choices that aid agencies make in terms of channeling funds to government organizations or civil society – such as projects that are designed to empower civil society organizations to influence policy – reflects a political ideology that can have important, unanticipated consequences for the recipients (Wedel 2001).

Although authority tools come with higher constraints, authority is being used in the 'new aid' era to achieve a positive, community outcome. The new conditionality underpinning aid contracts could prove effective in improving data access and standards. Performance accountability, while principally still an ex-ante control measure, holds promise for greater accountability for results and could be used to identify recipients for future aid allocation. However, conditionality in any guise is often viewed as dysfunctional, because it undermines the domestic political process by imposing policy from afar. The inscription of financial mechanisms also have become more demanding in recent years (World Bank 2009, p.21), and while these mechanisms may increase accountability, they typically are influenced by public management reforms originating in developed countries and transferred to the developing world.

Finally, organization is undergoing changes in the way it is being used. In the 'old aid' era, when technical assistance reigned supreme, donors regularly required that experts be hired from the donor country (Easterly 2006). In effect, aid recipients were handing back aid to consultants from the donor country. Furthermore, the funding of foreign consultants undermined the development of local GIS firms, which invariably were passed over in favor of international ones. In the 'new aid' era, donors are beginning to strengthen and recruit human capacity from domestic universities. This is a positive development, though the bulk of technical assistance continues under 'old aid' practices. Even for the university-orientated projects, it is unclear just how much the projects are staffed by existing local experts in Africa, or whether the projects merely have shifted from foreign, private sector consultants to foreign, academic ones. Also, a potential imbalance remains in the allocation of resources, with the bulk of funding going to non-African institutions. In sum, the geospatial sector still continues to rely on technical assistance, a tool of the highest constraint, despite the shift to strengthening African academia and human capacity.

5.5 Conclusion and further research

This paper is the first ever 'broad brush stroke' of the donor-policymakers dynamics in an emerging Digital Earth. We used two lenses. With the first lens (Bourguignon and Sundberg 2007) we scoped the particular area of focus within the aid effectiveness chain. It pointed us to a particular concern to address, the link between donors and policy makers. By inserting the second lens (Hood 1983), we conceptualized and grounded empirically this particular link. Using wide-ranging data from primary and secondary sources, we discussed in a structured way how donors influence the actions of policy makers in recipient countries by changing over time the tools they use which are based on donor organization, authority, treasure, and nodality. The main conclusion is that ways in which donors/IFIs relate to African policymakers are a constitutive part of Digital Earth in Africa and warrant extensive consideration.

The vision of a Digital Earth in Africa will be more achievable if the 'new aid' architecture is applied more rigorously than currently is the case. Presently, the continuing reliance on high-constraint tools based on organization and authority contradicts the Paris Declaration principles of local ownership and participatory politics. However, the intention of this paper is not to advocate one tool over another. Rather, we would like to sharpen our ability to analyze the tools being used in practice and our awareness of how they are changing over time. We may be experiencing not a shift in donor practice per se, but an expansion of the tools used – leading to only 'new-ish aid', instead of 'new aid'. What results is a "clumsy" approach with donors combining elements of different policy paths. This clumsiness was found in other studies looking at geospatial coordination and external, funding bodies (Lance et al. 2009, Lance et al. 2011). Donors may use foreign consultants to maintain better control over outcomes, because new aid architecture puts heavy emphasis on 'managing for results.' Meanwhile, this contradicts the call for greater local ownership and understanding of local context. Similarly, inscription of open data access and archiving conditions in contracts and grants, has the potential to achieve broad community-wide benefits that otherwise would not be forthcoming, but this tool still is coercive.

The conceptual framework presented in this paper opens up a field of inquiry that could improve how donors craft their involvement in geospatial technology management and use in Africa. Pertinent questions still to be explored include: How do aspects of donor contracts (e.g., size, duration, performance monitoring, and renewal potential) shape the incentives for and responses of policy makers? In Bourguignon and Sundberg's model (Figure 1), the link between donors is represented by an arrow, but the relationship actually is shaped in both directions. Policy makers are not merely passive recipients; they can act as innovators, gatekeepers, and brokers. Armed with

the list of promises in the Paris Declaration, they are better positioned to demand that donors improve aid practices. The nature of partnership between donors and policy makers warrants further research; how partnerships are developed and maintained in a mutually serving and less power-asymmetric manner than in the past. What is the impact of new 'inscription in grants' on data standards and access, and does 'portfolio mapping' serve as a catalyst for critical assessment of donor investment in geospatial projects? How does donor-supported civil society engagement affect policy processes? Research also could be conducted comparing different aid agencies, including emerging, non-traditional donors such as China and Brazil, since there is considerable variation which we were not able to cover in this analysis (Angemi 2008). Most importantly, further work is needed along the full set of linkages to fully clarify the contribution of aid to geospatial outcomes: "policymakers – policies", "political systems and the role of civil society", and "policies – country outcomes". This includes greater knowledge of the policy processes in different countries, the governance characteristics of countries, and the capacity of civil society organizations.

Research also should extend beyond donors, since other external agents, such as corporations, vendors, international organizations, professional associations, and advocacy groups, may play a part in influencing policy makers. The Group on Earth Observations (GEO) specifically envisions activities in its work plan to engage donors in Earth observation capacity building priorities. Similarly, the recent Eye on Earth (EoE) effort has a Special Initiative to create a geospatial community of practices within aid agencies. GEO, EoE, and the International Society for Digital Earth (ISDE) each aim to raise awareness amongst policy makers on the utility of geospatial technologies, promote standards and open access policies, and transfer 'best practice' to national governments. GEO by design is more tightly coupled with political processes, but ultimately, policy adoption by member countries is voluntary, not obligatory. That said, if countries have a desire for international acceptance, they may conform to internationally endorsed practices.

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Appendix: Definitions

The policy process is usually considered to include the following components: agenda setting, policy formulation, decision-making, implementation, monitoring and evaluation.

Geospatial policies encompass those that enable increased access to, integration of, and use of government geospatial data and models about the virtual Earth in the public and private sectors. Geospatial policies also include those that determine government funding and efficiency in collecting, maintaining and distributing geospatial data.

Geospatial policy impacts include improved sharing of and access to digital data, models, and information about the virtual Earth in the public and private sectors; enhanced government efficiencies in collecting, maintaining and distributing geospatial data; an expanded role of Digital Earth in the fields of Earth science, including climate change, adaptation and health related issues, natural disasters, new energy sources, agricultural and food security, and urban planning.

Geospatial governance is the policy, organization, management, and delivery processes associated with geographically referenced models that represent the planet.

Geospatial policy makers are not limited to parliamentarians (i.e., policy does not have to mean laws or directives to ministry or agency heads). An array of government agencies - heads of mapping agencies, environmental ministries, and statistical bureaus - determine whether a country has a framework which enables policies conducive to a "knowledge economy." Often policies at an institutional level determine data access and standards that shape data availability and reliability.

Geospatial sector spans organizations that acquire, integrate, manage, analyze, map, distribute, and use geographic, temporal, and spatial information and knowledge. The sector includes basic and applied research, technology development, education, and applications to address the planning, decision-making, and operational needs of people and organizations of all types.

CHAPTER 6: Synthesis and Outlook

Synthesis and Outlook

6.1 Introduction

The primary research goal of this thesis is to bring to the fore a neglected analytical component of cross-agency geospatial coordination – the influence of ‘external agents’. Literature to date on geospatial coordination largely has concentrated on the internal (endogenous) functioning of cross-agency coordination structures, such as committees and coordinating bodies, and on inter-organizational data sharing. In contrast, this research focuses on deliberate, external (exogenous) interventions by public authorities to regulate, steer, or influence geospatial governance elements that are defining aspects of cross-agency coordination. These public authorities operate in the ‘background’ and shape the politico-administrative ‘context’ which the foreground public sector agencies must navigate. To structure the research, four objectives were identified, each pursued and explained in the previous chapters. This chapter now reviews the main findings, reflects upon the contributions and limitations of the research, and proposes possible directions for future research.

6.2 Main findings

The thesis made operational the analytical concept of ‘external agents’ who have discretion over allocation and use of funding and ability to make rules or regulate public sector geospatial agencies. Their control over resource flows and regulatory capability is a source of power and influence in the dynamics of cross-agency geospatial coordination. Operational decisions of geospatial public managers may be influenced by the agents in the background in ways that SDI researchers thus far have not acknowledged. If we ignore the background and focus only on ‘context,’ we get what Kennedy (2005, p.9) says: "Focus on context - on the impersonal forces - blunts the responsibility of actors in the foreground, while affirming their centrality." We miss the dynamics of agents in the background affecting cross-agency coordination in the foreground, and we may have a distorted understanding of how change in cross-agency coordination occurs, since both external and internal change mechanism likely are at play.

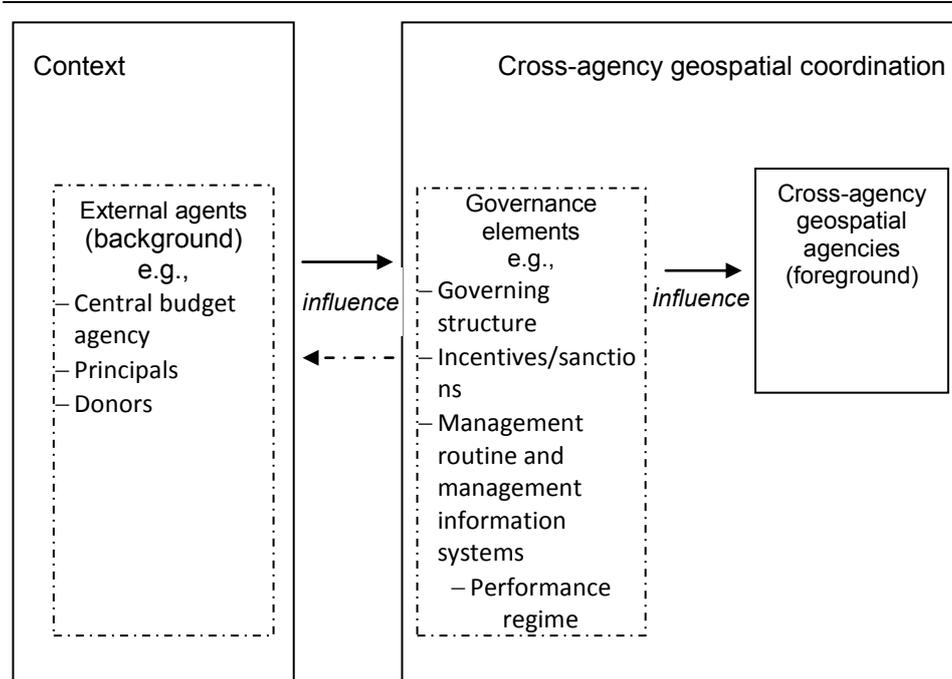


Figure 6.1: Conceptual framework

Figure 6.1 refines the initial conceptual framework as presented in Chapter 1. The dashed lines denote the alterations to the conceptual framework as a result of learning from the Chapters 2, 3, 4, and 5. The box depicting external agents now includes specific entities that influence geospatial coordination governance elements. These include central budget agencies, (ministerial) principles, and donors. Their influence, respectively, is associated with budgetary oversight, performance contract oversight, and foreign aid. This is not an exhaustive list. Rather these were examples relevant to cross-agency geospatial coordination explored to operationalize the concept of external agents. External agents could include other core executives from cabinet-level agencies, politicians or ministers responsible for specific programs, legislators, ombudsmen, and representatives of regulatory agencies, audit bodies, and inspections bodies (Talbot, 2008; Goodsell, 1994). 'Core executive' refers to central bodies of the state such as the Presidency and associated bodies or Prime Ministers/Cabinet offices, finance ministries, and other central ministries.

Figure 6.1 also now features an arrow in the reverse direction between geospatial coordination and external agents. This arrow was not present in the original conceptualization of the research (see Fig. 1.1). Chapter 4 in particular revealed that influence occurs in both directions. The shaping of coordination practices is far more complex than the original conceptual framework implied. Although external arrangements are inextricably linked to

coordination by virtue of being part of the system, external factors alone do not drive or shape coordination. While this research has shown that external agents exert influence, the influence is not necessarily in a uni-directional manner exerted on passive or compliant organizations. Rather, agencies employ a range of strategic responses—reactions that include acquiesce, but also, compromise, avoidance, defiance, and manipulation (Oliver, 1991).

External agents exert their influence through governance elements: governance structure, incentives/sanctions, management routines and management information systems, and performance regimes. These governance elements now have been included in the corresponding box. The arrow denoting influence, generally, could mean imposing, constraining, prescribing, and/or enabling aspects of governance. A continuum of influence styles exists, ranging from shaping, facilitating, approving, lending authority, providing positive and negative incentivization, as well as prescribing procedural rules and the structure for coordination (Heritier and Lehmkuhl, 2008, p.2).

Case-specific examples of the governance-influencing instruments used by external agents are summarized in Table 6.1. There is a bit of artifice in the summary, because different analytical frameworks were used in Chapters 3, 4, and 5, so the results from the Chapters do not completely align. Still, the instruments used by the external agents are comparable. In each case, the external agent has a hand in shaping governance structures, applying incentives and sanctions, promoting the uptake of management routines and information systems, and installing a performance regime.

Table 6.1: Summary of findings: governance-influencing instruments of external agents.

Instruments of influence	Canada (Anglo-American federation)	U.S. (Anglo-American federation)	Netherlands (Unitary, consensual state)	Africa (developing countries)
Shaping governing structures	Federal Geomatics Strategy and Policy Framework	Geospatial Line of Business	DINO management contract (structural disaggregation)	Selectivity; cross-agency geospatial coordination projects (treasure)
Applying incentives and sanctions	Multi-year funding for joint work	Potential budget cuts or increases	Pooled funding, multi-year	Conditionality in loan or grant agreements (authority)
Promoting uptake of management routines and information systems	Value Management Office	Federal Enterprise Architecture	Scorecard; issues database (autonomization, at practitioners' discretion)	Technical assistance (practices, the software used, the standards); portfolio mapping to track investments (organization, nodality)
Installing a performance regime	Results-based Management Accountability Framework	Circular A-11 business case & performance measurement	Annual report; customer satisfaction audit (result control)	Results-based management; logframe (authority)

Shaping governing structures involves the creation or strengthening of a steering and decision-making framework to support the cross-agency coordination. More than just defining oversight roles and accountabilities, the governing structure brings cross-agency geospatial investment planning to the forefront. There is an inherent difference between the SDI objective of sharing data and the need to share (or align) funding. Data, unlike funding, is a reusable resource. Mechanisms that encourage cross-agency data sharing cannot be assumed to be effective for cross-agency funding coordination. Thus, specific instruments are needed to align the geospatial investments of different agencies and minimize investment duplication and overlap.

Applying incentives and sanctions refers to economic inducements, rather than regulation, as a way of influencing the actions of agencies. Incentives may take the form of funding to defray the cost of coordination. Sanctions, could include tightened regulations or (the threat of) budget cuts to discourage actions that are considered undesirable. This tool was included as the research progressed, since public policy literature points to incentives and sanctions as policy instrument commonly applied to change behavior

(Salamon, 2002; Bemelmans-Vidéc, 1998).

Promoting uptake of management routines and information systems

amounts to increasing institutional capacity and fiscal discipline through technical means. Agencies are assumed to be rational actors who can be persuaded to change their behavior based on the acquisition and or use of new information, techniques, or tools.

Installing a performance regime involves monitoring and evaluation to scrutinize cross-agency activities and solidify accountabilities. Requirements for performance measurement and evaluation reinforce shared accountability and make clear the results for which agencies are responsible.

By identifying common instruments of the external agents, a classification system emerges that extends our knowledge base upon which to study the dynamic nature of government cross-agency coordination. By bringing external agents to the fore, it is possible to delineate more clearly the instruments that the external agents use that affect the governance elements of an SDI coordinating structure. For instance, if we wish to elevate the Geospatial One Stop (GOS) to a 'model' for global emulation, we need to recognize the role of OMB in GOS with respect to budgetary control and allocation; same with Geoconnections, and Treasury Board Secretariat's instituting a results-based management framework and sunset evaluation of the program; DINO, and its multi-year performance management contract; SDI policy makers in Africa, and donor's ability to select what gets funded, such as cross-agency SDI projects. These direct interventions occur against a backdrop of contextual factors such as social and environmental upheaval and political-administrative reform. The delineation and identification of external agents in the background-part of the context is a key first step in comparing SDI initiatives and ascertaining whether practices could be transferred and translated elsewhere. In each case, external agents use multiple instruments, and all the cases show that context in addition to harbouring the "background" is not static, but evolves over time.

6.2.1 Sub-objective 1 – External demand for 'control' evaluation

Research question: Are there institutions that hold public sector SDI implementers accountable, thereby steering public sector SDI coordination?

While SDI has been advanced on the grounds of improving performance (efficiency), in practice few SDI initiatives have taken steps to determine whether they are realizing the envisioned outputs or outcomes (however defined), not unless evaluation is required by institutions external to the implementers (Lance et al., 2006; Lance, 2008). Chapter 2 introduced the

concept of 'external demand' for evaluation through an inventory of SDI evaluation practices across multiple countries. Where performance measurement was found to occur, the external requirement for evaluation came from legislators or political appointees. The requirement often was an accountability measure, and a function of budgeting processes. In two cases, the supply of performance information by SDI managers preceded the demand for evaluation. However, in both cases, there was the potential for budget cuts, and the managers' impetus for carrying out the evaluation and supplying performance measures was to proactively ensure that funding would be continued. Thus, the uncertainty of budgetary decisions served as the demand.

These findings highlighted an element of geospatial coordination that seldom has been considered when SDI initiatives are compared – bureaucratic accountability. The essence of accountability is answerability; being accountable means having the obligation to respond to inquiries regarding decisions, actions, and performance. Given the accountability nature of the 'external demand' for evaluation, with agencies under pressure to improve the efficiency of the services they deliver, it is not surprising that 'control' evaluation is most used by SDI practitioners (Lance et al., 2006; Georgiadou et al., 2006). This finding was further reinforced by Bregt et al. (2008) in a more detailed case study of SDI evaluation in The Netherlands. 'Control' evaluation typically considers financial and technical issues using tangible, quantifiable measures. To assess outcomes and effectiveness, a different evaluation orientation would be needed, one that is sensitive to ambiguities and social transformation (e.g., learning or exploratory evaluation).

An element of control evaluation which challenges SDI practitioners is input specificity. Although public sector evaluation literature indicates that both outputs and inputs need to be specified, SDI practitioners have difficulty in obtaining financial information because the inputs typically are sunk, indirect, or concealed in program budgets. Meanwhile, better tracking of financial flows could enable cross-agency coordination by revealing vertical accountabilities which then could be mapped to horizontal objectives. Attention to agents responsible for flow of financial inputs is an aspect explored in subsequent chapters.

Originally, I had a different interpretation of internal and external pressure (or demand), in chapter 2. For instance, I indicated that demand from a management board of an autonomous agency was internal, since the management board has a role in steering operations (Lance et al., 2006). However, since there is a relational distance between a management board and public managers who are implementing activities, I have later understood a management board's demand for evaluation as external.

6.2.2 Sub-objective 2 – Core executive / central budget agencies

Research question: How does the central budget agency influence public sector coordination?

Chapter 3 used results from Chapter 2 as a point of departure. Two cases in particular, U.S. and Canada, were found to have the most 'comprehensive' evaluation practices in place, and were the basis for the initial conceptual framework to look at budgeting processes (central budget agency) as a source for imposed cross-agency geospatial coordination. The U.S. and Canadian cases show the willingness of agencies involved in a federal SDI program to engage in self-evaluation when prompted by a threat in government regulation. External, hierarchical steering was found to strengthen the focus of the agencies to jointly deliver results, as well as bolster the overall legitimacy of the SDI initiative.

The central budget agency used several hierarchical tools to influence network elements. With respect to *shaping governing structures*, the Canadian Federal Geomatics Strategy and Policy Framework and the US Geospatial Line of Business articulate respectively a new relationship between Inter-Agency Committee on Geomatics (IACG) and the Treasury Board Secretariat (TBS), and Federal Geographic Data Committee (FGDC) and the Office of Management and Budget (OMB), a relationship that brings cross-agency geospatial investment planning to the forefront. On the *management information systems* front, the GeoConnections' Value Management Office (VMO) and the USA Federal Enterprise Architecture (FEA) are meant to improve implementation by providing clarity in the links between financial resources, geospatial services, and citizen needs, as well as by tightening up accounting practices. The *evaluation* of GeoConnections Phase I and OMB's Circular A-11 annual requirement for business cases and performance measurement reinforce shared accountability and ensure that agencies achieve intended results. Although not identified in Chapter 3 – the funding for Geoconnections and threat of budget cuts by OMB can be viewed as incentive and sanction respectively.

The case results align with findings of authors from outside the geospatial research community who stressed that the budget process is a major mechanism for the coordination of public organizations (Volkery et al., 2006; Verhoest et al., 2005). Consideration of budget and accountability arrangements in SDI initiatives is conducive to cross-agency planning, resourcing, and management of priorities.

6.2.3 Sub-objective 3 – Public principals

Research question: How do public principals influence private (or quasi-private) agency coordination and practice?

Chapter 4 makes a significant contribution to the analysis of geoportal implementation by providing an analytical framework for exploring and understanding the context of implementation. Institutional structure, autonomy, and control are elements of geoportal governance and affect budgeting, planning, management information systems, and accountability. DINO is developed and maintained in a formal principal-agent relationship with clear objectives and accountability. DINO is managed by the Netherlands Institute of Applied Geoscience (the agent) through a performance-based management contract with the sponsoring Geo-Information Commission (the principals). The DINO program is characterized by the pooling of financial resources from five ministries, the internal tracking of activity progression, the routine reporting to the user community, and the regular monitoring and evaluation of DINO by the Geo-Information Commission.

The findings address the emerging concern of researchers and practitioners for greater monitoring and evaluation of geospatial initiatives (Crompvoets et al., 2008). The findings are relevant in both developed and developing countries, given continued interest in geospatial data portals and the transfer of technology from one country to another. External control can actually be an enabling mechanism, rather than a negative or confining requirement. Contrary to the thrust of agency theory, performance-based contracts can actually act as 'soft' rather than 'hard' coordination instruments; 'mutual shaping' can take place, thus enabling the agent to influence how it is 'controlled' by the principal. However, the management contract still relies on a power disparity and reinforces previous research findings that external parties can influence network/coordination conditions.

Control is a critical concept for understanding SDI coordination. Often, control has been negatively equated or reduced to being 'top-down' and then contrasted with more favorable 'bottom-up' cooperation. However, in organizational theory literature, control is used to indicate the process by which one entity influences the behavior or output of another entity (Ouchi, 1979). Control actually occurs along a continuum, ranging from formal, hierarchical control to informal, social control, and controls interact with each other. An important dimension of control is its origin. Control may originate within an agency, such as the expectation to meet managerial needs or carry out organizational directives (internal control) or it may originate outside of agencies, such as regulatory requirements and accountability to branches of the government and to citizens (external control).

Chapter 4 refined the concept of hierarchical control to more broadly encompass forms of 'external control' in politico-administrative regimes other than a federal system.

6.2.4 Sub-objective 4 – Donors/IFIs

Research question: How do donors influence recipient policies and practices, and how do the interventions shift or evolve over time?

Chapter 5 shows that the conceptual framework can be used at a supra-national level, opening yet another area of research. Donors constitute a type of external agent, exerting external control and influencing policy and practice. The Chapter begins to pry open the black box of donor influence on geospatial policy in Africa. Hood's (1983) analytical framework (organization, authority, treasure, nodality) was used to study how governments select and use tools to affect change within a country (i.e., state-centric). This Chapter shows that in the global context, donors act as supra-national agencies, exercising power across borders for the purpose of affecting policy.

Donors employ policy-influencing tools based on four basic resources they possess: organization, authority, treasure, and nodality. Donors' usage of each tool has evolved over time, as donors shift from 'old aid' to 'new aid' modalities. The new tools include: technical assistance for geospatial curriculum development, inscription of standards and data access requirements in contracts and grants, cross-agency project design, best-practice analysis, portfolio management, and the use of language to promote participation and accountability. Though these tools reflect donor intent to partner in the realization of Digital Earth, the tools stem from a persisting asymmetric power dynamic between donors and policy makers.

6.3 Reflections

6.3.1 Contribution to SDI practice

The primary objective of the thesis is to increase theoretical understanding of cross-agency geospatial coordination, by combining conceptual building blocks from public management & policy literature and case studies. The findings (and analytical approach) provide a richer picture of SDI, while providing a ground for systematic and theory-based comparisons between countries. Still, the thesis has practical aspirations, as well. At the heart of the matter, I want to better understand how to get past departmentalism or other obstacles to coordination. When I am not wearing my PhD student hat, I am employed to help design and implement SDI in developing countries. However, when I put myself in the practitioner's seat, it seems painfully obvious to call attention to the dynamics between external agents who

provide resources and internal professionals who implement activities – so obvious that it verges on being trivial. In the words of a fellow practitioner, “[v]irtually every aware public servant with some rank would know that ‘lower’ level agencies respond to what the higher level wants even without any explicit hint of coercion by the higher level. The lower ones know that the higher authority can use coercion if it wants to, and this could cause bigger problems.[...] This underlying understanding is fundamental to the way relations work. No one mentions it. No one has to. This ‘insight’ is no big deal (pers. comm., Bruce McCormack, Planning Inspector at Department of Environment, Heritage and Local Government, December 22, 2011).”

But then I think – this ‘taken for granted’ element has meant that the background seldom is discussed. I have participated in countless international conference sessions – where a geospatial public manager from one country tells another manager from another country about his SDI program or his newly launched geoportal – but there is rarely any mention about how the program or geoportal is funded, maintained, or evaluated. Public manager A does not explain the background or context to public manager B. Generally, SDI implementation choices are treated as ‘open’ – universally – as if informed SDI practitioners could pursue any avenue they so chose. This research makes evident that it is important for public managers to be explicit about their political and institutional context if they are going to act as policy entrepreneurs, promoting their ‘successful’ practices. If not, a seemingly impossible feat is implied: that an innovation, such as SDI (in general) or a geoportal (in particular), can be transferred from one context to the next regardless of the destination context (Rottenburg, 2002). The tendency is to prescribe and apply general courses of action in the implementation of technology innovation, without considering in a systematic way variations of the organizational and the broader context within which the innovation is embedded (Avgerou, 2001). The same holds when an SDI program in one developing country is presented to another, without any details about the involvement of donors and the pathologies associated with foreign aid.

Another lesson that can be taken away from this thesis is the importance of accountability for results. I do say this with caution, since performance regimes come with many pathologies and perversions (de Bruijn, 2002). The limitations of setting performance goals and then measuring and auditing them are well documented. However, the fact that geospatial public managers continue their Rodney Dangerfield stance of “[w]e don’t get no respect,” greater pro-active evaluation on their part could enable them to attain the legitimacy they seek. However, evaluation for accountability comes with potential trade-offs. Public managers may purposely ‘fly under the radar screen’ of external authorities, to avoid scrutiny, so that they can proceed without interference. This autonomy with respect to geospatial activities is

possible because geospatial activities typically are not explicit in programs (Lance et al., 2009). However, inviting evaluation, calling attention to one's outputs or outcomes, puts pressure on the organizations involved to perform – and accept consequences of not performing.

The 'rationality' of geospatial practitioners or professionals could present a new means for benchmarking an SDI program. Programs could be assessed and compared as to whether the program takes a 'rational' perspective, which means that agencies shift over time in order to pursue (internal) performance objectives (e.g., greater efficiency) or the primary objective of organizational change is 'isomorphic', which means agencies shift over time in order to achieve greater (external) legitimacy (DiMaggio and Powell, 1983). Geospatial professionals confront both drivers of change, to varying degree, hence a continuum exists (Ashworth et al., 2007). Cross-agency geospatial coordination structures that are more attuned to the latter – ensuring accountability, securing social or political fitness, and gaining legitimacy – than the former – improving the availability and quality of products and services – may prove to be more successful in the long run.

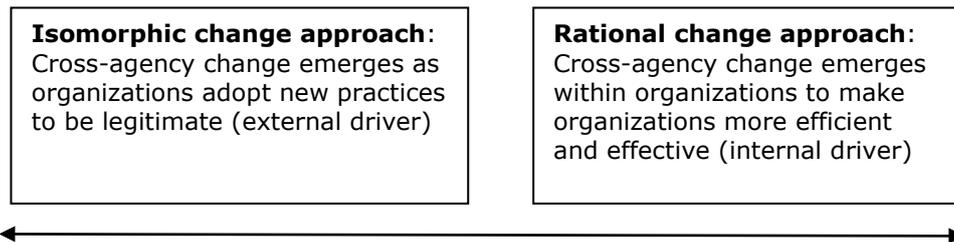


Figure 6.2: A continuum of isomorphic and rational change approaches.

6.3.2 Governance mixtures

Chapter 3 questioned whether network coordination was the main organizing principle in the federal geospatial programs of U.S. and Canada. Similarly, Chapter 4 questioned whether market coordination was the primary coordination mode present. In reality, SDI programs display a mixture of hierarchical, network and market coordination modes, rather than being 'ideal-types'. Similarly, the aid sector deploys a mixture of old and new tools. As new tools and approaches are introduced, old practices are not replaced. Rather, old practices are revised or supplemented. Meanwhile, researchers demonstrate a preference for seeing coordination according to 'ideal-types'—hierarchical, network or market. It is fashionable to juxtapose the old against the new, to jump on the 'reinvention' bandwagon and suggest that there is an inevitable, paradigmatic shift. Instead, the emphasis should be in recognizing that network organization, along with market and hierarchy, is part of a repertoire of overlapping, supplementary, and competing

coordination forms that coexist. Researchers need to understand how mixtures of these different coordination forms influence practice. This thesis opens up a new research avenue that allows for systematic analysis of the influence of individual coordination instruments, their mutual interactions, and (ultimately) theory-based comparisons of SDI initiatives within (and beyond) government.

6.3.3 Limitations

While the findings from this study have merit for the future examination of change in cross-agency geospatial coordination, it is important to note limitations in both the study design and analysis.

With respect to study design, emphasis was placed on the relationship between external agents and governance elements of influence. This scoping is a narrow view, pursued for this thesis to break new ground and hone in on a yet unexplored aspect of coordination. To properly understand the full nature of cross-agency geospatial coordination, a more balanced approach to the conceptual framework should be applied. Both external and internal spheres of influence in cross-agency geospatial coordination need to be explored, including the dynamics between the two spheres over time. The scoping of the PhD research to the sphere of external control provided a manageable, niche field of study and a basis for original contribution to the field.

This exploratory research is based on a few cases. It is necessary to be cautious about the generalizability of the findings. More comparative studies SDI governance in multiple politico-administrative settings (broader range of contexts) would give me greater confidence in the findings.

While I tried to look at the evolution of relationships in each of the cases, it would have been even better to study the cases over longer periods of time. There are many 'fashions' when it comes to public management, and practices shift. Also, due to the time passage while working on the PhD, SDI initiatives progressed or changed. The case findings, particularly interviews, reflect events which happened in a particular context at a given moment in time.

With respect to analysis, it is possible that I could have done more to discount or disprove conclusions about the data or explore alternative explanations for the data, but I also had the benefit of practitioner feedback on draft versions of papers, as well as anonymous peer reviewers who critically assessed the interpretation of the data in my publications. The advantage of qualitative research over quantitative research is that it can present a more accurate picture of a slice of reality as it is experienced or

perceived by the participants. The validity of qualitative research may be threatened by two sources: description and interpretation. I minimized threats to valid description by taping the interviews and transcribing them. I verified the data with the government officials with whom I spoke. I reduced threats to interpretation by checking the representativeness of the data and validating it with willing reviewers, academics and practitioners.

6.4 Outlook

On the basis of the findings contained in this thesis, I can suggest potential directions for future research.

6.4.1 Expand analysis of 'background' (external agents) / Policy transfer

The first suggestion is to expand the definition of 'external agent' and further refine the conceptual model. For the purpose of the thesis, I selected cases where the locus of authority stemmed from the control over resource flows. However, there are other external agents. In the broadest sense, these may be corporations, international organizations, professional associations, advocacy groups, and the media (Avant et al., 2010; Talbot, 2008) interacting with SDI constituencies and playing a part in shaping governance outcomes. Professional associations may have the power to lay down performance practices or criteria for their members, which then may have a specific effect on how government agencies collaborate. Advocacy groups may be given formal rights to be consulted over the goals of, and results expected from, government agencies and hence, sometimes directly and explicitly affect the coordination practices adopted by the agencies.

6.4.2 Recognize context (comparative public administration)

The second suggestion is to focus on how contexts differ and how outcomes depend on other variables and influences. We should be suspicious of comprehensive models and deceptively simple, cookie-cutter approaches to good government and governance (Jann and Reichard, 2003, p.51). Scholars of public management reforms have emphasized that countries translate ideas and adapt reform 'ingredients' in quite individual ways, thus producing distinctly national cuisines (Pollitt and Bouckaert, 2003, p.13). For this reason, a universal 'cookbook' approach or superficial view of the SDI implementation context is problematic and unconstructive. A country's politico-administrative system and administrative culture and controls therein, significantly influence the trajectory of administrative reform (ibid). Differences occur not only between countries, but within countries and between sectors (Herranz, 2006). These differences challenge the SDI community's ability to treat 'successes' in one country as a solution in another. To circumvent the risk of comparing apples and oranges, SDI

research requires a high level of specificity and detail, encompassing the instruments and processes of reform.

The challenge for a new generation of SDI researchers is to develop greater conceptual clarity and the methodological sophistication needed in order to sift through the complexity of new policy regimes, governance mixtures, alternative instruments for influencing governance elements, and changing cross-agency practices and link these to a deeper theory of implementation.

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Summary

The increasing complexity and 'wickedness' of public problems, such as climate change, sustainable development, and national security, increase the need for government agencies, to work across administrative boundaries to address the problems. A traditional single agency approach cannot resolve these modern environmental, social, and economic problems. Cross-agency coordination is required to ensure that the geographic information 'silos' of individual government agencies are integrated into a cost-effective, interoperable system to support the nation's spatial data infrastructure (SDI). This thesis focuses on the nature of coordination within government, and in particular, within central government, since central government agencies - ministries, departments, bureaus, and authorities, or parts thereof - have core responsibilities for the design and maintenance of social, economic, and environmental systems and policies. Government agencies are meant to jointly agree upon how they will exchange and share data, develop and maintain common databases and web portals (one-stop-shops), and deliver geospatial services to a wide community of users within and outside of government. Furthermore, agencies need to mobilize human and financial resources, make decisions about resource allocation between agencies, and share the responsibility for outputs and communication of societal benefits of SDI.

Though governments have formulated policies and coordinating bodies for cross-agency geospatial coordination, in many cases, researchers and practitioners alike have questioned the effectiveness of these coordination instruments. SDI, like most cross-agency endeavors, is perennially difficult to achieve. As challenging as cross-agency coordination is to effective SDI implementation, SDI research seldom has explicitly focused on the nature of coordination in the public sector. Often, cross-agency coordination has been scoped to a narrower question of coordination structure and participation or cross-agency data sharing. Also, the tendency is to look at change/coordination as a gradual endeavor, as a result of building of trust over time, rather than a result of deliberate intervention. SDI research thus far offers limited understanding of the interventions (change agents) to stimulate cross-agency coordination behavior in the public sector. How does change occur in an environment perceived to resist change? Are there circumstances through which purposeful action disrupts deterrents to coordination?

This thesis fills the gap in understanding through empirically-grounded explanatory research. The objective is to analyze the nature of geospatial cross-agency coordination, by drawing upon public management and public policy literature. A central aspect of this thesis is the distinction between

'foreground,' 'context,' and 'background.' Most researchers who have analyzed the cross-agency geospatial coordination challenge have focused on the interaction between geospatial practitioners or professionals, who can be viewed as the "foreground" of SDI, actively responsible for making joint decisions and implementing agreed upon actions. A few researchers also have considered the 'context' in which professionals are embedded. When considered, context typically is treated as an 'impersonal' concept. The implication is that no one is responsible for context; it just exists - a natural or inevitable state. This thesis unpacks context into 'background' and 'context,' so we can begin to consider that agents, in the background, influence or decide upon practices that ultimately shape context. The 'background' is that part of the 'context' that captures the direct, but often invisible, work of agents who influence context and ultimately the 'foreground' - the civil servants involved in cross-agency coordination. With this finer resolution of context, into background and the rest of the context, we take the focus off the internal coordination mechanisms of the foreground geospatial practitioners, and explore external agents and processes that otherwise would not be visible.

The following findings and conclusions emerge:

External agents: The thesis makes operational the analytical concept of 'external agents' who have discretion over allocation and use of funding and ability to make rules or regulate public sector geospatial agencies. These include central budget agencies, (ministerial) principles, and donors. Their influence, respectively, is associated with budgetary oversight, performance contract oversight, and foreign aid. This is not an exhaustive list, rather these are examples relevant to cross-agency geospatial coordination explored to operationalize the concept of external agents.

Governance elements: External agents exert their influence through a) shaping governance structures, b) applying incentives and sanctions, c) promoting uptake of management routines and information systems, and d) installing performance regimes. *Shaping governing structures* involves the creation or strengthening of a steering and decision-making framework to support the cross-agency coordination. More than just defining oversight roles and accountabilities, the governing structure brings cross-agency geospatial investment planning to the forefront. *Applying incentives and sanctions* refers to economic inducements, rather than regulation, as a way of influencing the actions of agencies. Incentives may take the form of funding to defray the cost of coordination. Sanctions, could include tightened regulations or (the threat of) budget cuts to discourage actions that are considered undesirable. *Promoting uptake of management routines and information systems* amounts to increasing institutional capacity and fiscal

discipline through technical means. Agencies are assumed to be rational actors who can be persuaded to change their behavior based on the acquisition and or use of new information, techniques, or tools. *Installing a performance regime* involves monitoring and evaluation to scrutinize cross-agency activities and solidify accountabilities. Requirements for performance measurement and evaluation reinforce shared accountability and make clear the results for which agencies are responsible.

Governance mixtures: SDI programs display a mixture of hierarchical, network and market coordination modes, rather than being 'ideal-types'. Similarly, the aid sector deploys a mixture of old and new tools. As new tools and approaches are introduced, old practices are not replaced. Rather, old practices are revised or supplemented. Meanwhile, researchers demonstrate a preference for seeing coordination according to 'ideal-types'—hierarchical, network or market. It is fashionable to juxtapose the old against the new, to jump on the 'reinvention' bandwagon and suggest that there is an inevitable, paradigmatic shift. Instead, the emphasis should be in recognizing that network organization, along with market and hierarchy, is part of a repertoire of overlapping, supplementary, and competing coordination forms that coexist. Researchers need to understand how mixtures of these different coordination forms influence practice. This thesis opens up a new research avenue that allows for systematic analysis of the influence of individual coordination instruments, their mutual interactions, and (ultimately) theory-based comparisons of SDI initiatives within (and beyond) government.

Samenvatting

De toenemende complexiteit van maatschappelijke problemen, zoals klimaat verandering, duurzame ontwikkeling en nationale veiligheid, vragen om een intensieve samenwerking tussen de verschillende overheidsorganisaties. Eén organisatie is niet in staat om de huidige problemen op deze gebieden op te lossen. Voor het ondersteunen van deze vraagstukken wordt intensief gebruik gemaakt van geografische informatie, veelal georganiseerd in de vorm van geo-informatie infrastructuur. Coördinatie tussen organisaties is noodzakelijk om geo-informatie van de individuele organisaties te integreren tot een kosteneffectieve en samenhangende geo-informatie infrastructuur (GII). Deze thesis richt zich op de coördinatie hiervan binnen overheden, in het bijzonder op centrale overheden, omdat deze overheden een centrale plaats innemen op het gebied van het ontwerpen en onderhouden van sociale, economische en milieu systemen en het formuleren van beleid. Overheidsorganisaties hebben een gemeenschappelijke verantwoordelijkheid op het vlak van het uitwisselen en delen van gegevens, het ontwikkelen en onderhouden van gemeenschappelijk databases en web portalen, en het leveren van geo-informatie diensten aan de gebruikers zowel binnen als buiten de overheid. Daarnaast hebben deze organisaties ook als taak het mobiliseren van menskracht en financiële middelen, het besluiten over een taakverdeling tussen organisaties en het communiceren over de ontwikkelingen van de geo-informatie infrastructuur.

Voor het uitvoeren van de coördinatie taak hebben overheden beleid geformuleerd en coördinerende instituten opgericht. Door zowel de praktijk als het onderzoek wordt er aan de effectiviteit van deze coördinatie instrumenten getwijfeld. Geo-informatie infrastructuur blijken in de praktijk lastig te organiseren. Ondanks het belang van coördinatie voor een effectieve GII implementatie heeft het GII onderzoek hier zich nog maar zeer beperkt mee bezig gehouden. Het uitgevoerde onderzoek op dit vlak richtte zich vooral op coördinatiestructuren voor het delen van gegevens en naar het opbouwen van vertrouwen tussen organisaties. Het GII onderzoek leverde tot nu toe nog maar weinig inzichten op over hoe coördinatie tussen organisaties vorm gegeven kan worden en op welke wijze veranderingen gerealiseerd kunnen worden binnen organisaties die van nature nogal behoudend zijn.

Deze thesis beoogd dit gat te vullen op basis van op de praktijk gebaseerd onderzoek. Het doel van het onderzoek is analyseren van de inter-organisatorische geo-informatie coördinatie op basis van inzichten uit de overheidsmanagement en beleidsliteratuur. Een centraal aspect in deze thesis is het onderscheid tussen "voorgond" (foreground), "context" (context), en "achtergrond" (background). De meeste onderzoekers die het onderwerp van de inter-organisatorische geo-informatie coördinatie hebben

geanalyseerd, hebben zich gericht op de relatie tussen de gebruikers en de professionals. De professionals zijn te beschouwen als de "foreground" van geo-informatie infrastructuur. Maar weinig onderzoekers hebben de "context" van de professionals in beschouwing genomen. En indien ze dit wel gedaan hebben, dan wordt context als een zeer onpersoonlijk concept behandeld. De context is een gegeven en niemand is er voor verantwoordelijk. Binnen deze thesis wordt context uiteengehaald in "background" en "context". Het voordeel van deze aanpak is dat we binnen de "background" actoren kunnen identificeren die door hun invloed en beslissingen de context van een geo-informatie infrastructuur kunnen beïnvloeden. Deze, vaak onzichtbare actoren hebben via veranderingen die ze in de context aanbrengen uiteindelijk ook een sterke invloed op de ontwikkeling van geo-informatie-infrastructuur (foreground). Door deze aanpak zijn we in staat om de invloed van externe actoren en processen te onderzoeken.

Het uitgevoerde onderzoek leverde de volgende inzichten op:

Externe actoren. Externe actoren oefenen invloed uit op de ontwikkeling van de GII door het toewijzen en bestemmen van budgetten en hun mogelijkheid voor het opstellen van regels en reguleren van overheids geo-informatie organisaties. Deze externe actoren omvatten centrale budgethouder organisaties, centrale ministeries en donoren. Hun invloed wenden ze veelal aan via respectievelijk budget controle, prestatiecontracten en buitenlandse hulp. Dit is geen uitputtende lijst, het zijn voorbeelden van de zichtbare en vaak ook onzichtbare invloed van externe actoren op de inter-organisatorische geo-informatie coördinatie.

Besturingselementen. Externe actoren oefenen hun invloed uit door a) vormgeven van overheidsstructuren, b) toepassen van stimulerende maatregelen en sancties, c) het promoten van bepaalde management praktijken en informatiesystemen, en d) toepassen van prestatie indicatoren.

Het vormgeven van overheidsstructuren behelst het opzetten of versterken van een besluitvormingsstructuren die de inter-organisatorische coördinatie ondersteunen. Stimulerende maatregelen richten zich op het stimuleren van samenwerking en coördinatie door gerichte investeringen. Vaak worden extra fondsen beschikbaar gesteld voor coördinatieactiviteiten. Sancties omvatten het aanscherpen van regels bij ongewenst gedrag of het (dreigen met) korten van budgetten. Het promoten van bepaalde management praktijken en informatiesystemen richt zich op afdwingen van gewenst gedrag via technische hulpmiddelen. Organisaties gedragen zich op dit punt vaak rationeel en bepaald gewenst gedrag kan worden afgedwongen door middel van informatie en de inzet van hulpmiddelen. Het toepassen van prestatie

indicatoren omvat het opzetten van een monitoring en evaluatie methodiek voor inter-organisatorische activiteiten. Prestatie indicatoren maken duidelijk wat er van de organisaties wordt verwacht en organisaties hebben neiging om zich op het behalen van deze indicatoren te richten.

Besturingsmix. Geo-informatie infrastructuur programma's laten in de praktijk vaak een mix van coördinatie- en besturingsstructuren zien. Hiërarchische-, netwerk- en markt-sturing worden vaak in combinatie met elkaar aangetroffen. In de hulpverleningssector treffen we een mix aan oude en nieuwe methoden aan. Als nieuwe methoden worden ingevoerd dan worden de oude methoden vaak niet vervangen. Veelal worden oude praktijken iets aangepast of aangevuld. Ondertussen blijken onderzoekers vaak een voorkeur te hebben voor het indelen in ideaaltypische structuren: hiërarchie, netwerk of markt. Het is in de mode om oud af te zetten tegen nieuw en vervolgens te spreken over een onvermijdelijke paradigma verschuiving. In plaats hiervan is het goed te realiseren dat netwerk organisatie, hiërarchie en markt organisatie naast elkaar voorkomen. Onderzoekers dienen te begrijpen hoe deze mix van verschillende coördinatie- en besturingsvormen de praktijk van geo-informatie infrastructuren beïnvloeden.

In deze thesis wordt een nieuwe onderzoekslijn beschreven gericht op het begrijpen van de invloed van coördinatie instrumenten op het functioneren van geo-informatie infrastructuren. Aan deze onderzoekslijn heb ik via praktijk gebaseerd onderzoek een bijdrage geleverd.

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