CROSS-AGENCY ALIGNMENT OF GEOSPATIAL INVESTMENTS FOR SPATIAL DATA INFRASTRUCTURE DEVELOPMENT

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ABSTRACT:

Geospatial data and services are core elements of a Spatial Data Infrastructure (SDI). Their development requires cross-agency alignment of geospatial investments to minimize duplication and to improve resource allocation according to community priorities. With government agencies being the predominant producers of a country's overall geospatial data assets, the national budget could be an instrument for cross-agency coordination. The budget serves as a tool for financial management and control; it is the central component of oversight processes of public operations. However, government geospatial investments seldom are documented or tracked in a systematic manner, and there are political disincentives for better investment coordination. A 'disconnect' currently exists in most countries between geospatial efforts and public 'control instruments' that could streamline SDI activities. SDI implementers have tended to focus on technical aspects of SDI development, whereas the technical aspects must be coupled with a resolve by government to improve the public administration of information systems across all agencies. This paper draws upon current literature in governance and budget reform to assess mechanisms for tracking geospatial investments and implementing a national geospatial investment strategy. Geospatial investment tracking is put forth as an initial control step to (i) inform SDI program managers and service providers of opportunities, (ii) identify duplications, (iii) focus geospatial investments more tightly on SDI priorities, and (iv) facilitate cross-agency working. Investment tracking is part of a broader politico-administrative approach to SDI implementation, which takes into account the significant public sector role in SDI development.

1. INTRODUCTION

Geospatial data and services are basic elements of a Spatial Data Infrastructure (SDI). SDI implementation can be deconstructed into a number of technical and institutional concerns, but an overriding requirement is "*cross-agency alignment of geospatial investments*." Sporadic success stories in investment coordination have been reported in the literature. For example, the national government and 17 regional communities of Spain agreed in 2004 on a plan to co-finance ortho-photo production for the entire nation; this is a major departure from the status quo of duplicative and uncoordinated data collection of the same areas (Gould, 2004). In 2001, Jamaica implemented a similar strategic base-mapping coup with each member agency of the country's Land Information Council agreeing to contribute to the cost of acquiring IKONOS imagery of the country (Space Imaging, 2001). Unfortunately, such cross-agency coordination is more the exception than the norm. *Comprehensive and systematic, inter-agency coordination* of geospatial investments still eludes most countries, either because of the diversity of contributors, the broad scope and definition of SDI, or the complexity of inter-governmental interactions. Another factor may be the voluntary nature of cross-agency coordination, as is the case in the U.S. NSDI, an initiative that has spawned a number of imitations around the world since its establishment in 1994 by President Clinton's Executive Order 12906.

The predicament in the U.S. is highlighted in a 2004 General Accounting Office report and a congressional hearing, entitled *"Geospatial Information: Are we really headed in the right direction or are we lost?"* (GAO, 2004). "A complete and up-to-date strategic plan [to coordinate geospatial investments] is missing… federal agencies are not consistently complying with OMB [Office of Management and Budget] direction to coordinate their investments… and OMB's oversight methods have not identified or eliminated specific instances of duplication." According to Karen Evans, OMB administrator for e-government and IT, "We need to get to the issue of accountability and managing information strategically…. Integrating geospatial requirements into the budget process is a key step in promoting effective use of geospatial resources (Committee on Government Reform, 2004)."

Before SDI implementers can pursue an investment strategy, an analysis of existing government resources and allocations is warranted across all sectors and agencies. *Are we sure that existing funds are being directed at SDI priorities? Could existing investments be utilized more efficiently? Can we even track existing investments?* A significant amount of investment in geospatial technologies already is being made in many countries, both from central governments and international development partners (donors). However, national mechanisms to keep tabs on and align these investments are missing.

The uptake of GIS in the public sector must be coupled with a resolve by government to improve public administration. A 'disconnect' currently exists in most countries between geospatial efforts and public 'control instruments' that could streamline budgetary processes for SDI. Instead, as Fountain (2004) points out, "There is a tendency for technical issues such as bandwidth, computing power, processing speeds and the like, to substitute for examination of more difficult questions regarding the organizational structures within which information technologies and their potential can be

leveraged and the implications of newer, networked organizational arrangements for governance."

SDI literature has given some attention to financial management issues, but the focus has been on economic aspects of data delivery (Tveitdal, 1999; Groot, 2001; Bernhardsen and Jespersen, 2001) and on SDI funding models (Urban Logic, 2000; Giff and Coleman, 2003), not on actual budgeting processes. The budget serves as a key tool for financial management and control; it is the central component of government oversight of public operations (IFAC, 2004). Specialists in public administration view budgets as one of the most significant policy documents in the public domain. In their organizational contexts, budgets are tools for organizational development and change (Alexander, 2004).

Case studies mentioned in the SDI funding literature generally have been theoretical in nature, without giving actual concrete figures or actual budgetary examples. Rhind (2000) provides one of the few examples in which an attempt was made to identify costs of SDI development, using the United States as an example; he recognized that a country ought to have an understanding of the costs before embarking on a funding strategy (p.53):

> "We know very little about how much money and other resources are actually being spent on maintaining the existing national GDIs, let along on creation of enhanced versions of them, or who is providing these resources. In broad terms, we do not know whether these resources are being applied wisely. It would seem helpful, therefore, to carry out some sound accounting of this expenditure: arguments for adding to it or for using it more effectively or efficiently are unconvincing if we do not know the current practice."

A few other attempts at providing estimates of costs can be found in several national cost-benefit or data policy studies (Price Waterhouse, 1995; OXERA, 1999; KPMG, 2001). The Infrastructure for Spatial Information in Europe (INSPIRE) project endeavored to estimate costs for planned SDI activities, but the assessment of costs, as well as benefits, was found to be a difficult exercise. The result was a relatively high level of generality (INSPIRE, 2004; INSPIRE, 2002). The Geo-Informatics and Space Technology Development Agency of Thailand was more successful in generating detailed cost estimates. However, when an investment analysis for Thailand's national SDI implementation plan was conducted, "cash flow" projections were not based on existing and anticipated investments, rather the cash value of benefits that would accrue by virtue of cost savings were used (ESRI, 2004). Again, a constraint for doing such an investment analysis is the difficulty in obtaining actual financial information.

Strictly speaking, there is a distinction between geospatial investments and expenditures. Investments represent the sum that agencies yearly spend on geospatial assets intended for permanent use. Expenditures are costs for consumables, training, wages, licenses, and leasing. However, broadly, everything that is spent towards spatial data infrastructure development is an investment. The expectation is that benefits from the spending will exceed the value of the resources expended.

This paper, in the next section, discusses the need for cross-agency budgetary planning for SDI. The primary constraint, departmentalism, is described, which can be addressed by improved accountability. The third section suggests that subsuming SDI into a reformed politico-administrative framework would provide the 'control instruments' for accountability, in particular performance measurement. However, countries with 'fragile' financial systems must begin with more basic control measures such as investment tracking. The conclusion highlights the fact that administrative reforms are underway worldwide to improve accountability, so the extension of such reforms to geospatial services is not an unreasonable proposal. Questions of who is accountable, to whom, on what terms, and how are a crucial dimension of SDI development, and therefore deserve critical analysis.

2. CROSS-AGENCY IMPLEMENTATION

Individual government agencies in many countries, such as national mapping agencies or national remote sensing agencies, currently cannot afford on their own annual budget allocations to develop and maintain digital base maps or acquire earth observation data. As a result, data development and maintenance typically occurs on an 'as needed' basis, as projects come and go. Generally no single use or application can justify the cost of base map development. However, base maps, which are a core component of spatial data infrastructure, support a wide variety of applications at national and local scales. Collectively, the applications warrant investment, but without a strong 'collective voice' by potential users through line ministries, the justification cannot be made.

SDI implementation also is evolving from a focus on data discovery and retrieval to a more complex array of web services for cataloging, processing, and interacting with spatial data online. Agencies must ensure that their initiatives complement each other. Many governments are seeking to deliver integrated, public services through 'single-window' or 'one-stop' approaches which draw upon spatial data services. This requires that government agencies work across administrative boundaries, sharing administrative costs to focus on a particular business need.

The importance of having a national, cross-agency geospatial investment strategy was articulated by Mothibi Ramusi, CSIR Satellite Application Centre Manager. He explained, "We are putting together a plan for the infrastructure that we will need at SAC to give efficient and effective support to all branches of the government… This is to find out what we need and how much it will cost… We should be supported by the whole government, not just a couple of departments, because we serve the whole government, for example the Departments of Agriculture, Defense, Environment Affairs and Tourism, Safety and Security, and Water Affairs and Forestry (Campbell, 2005)."

Cross agency approaches have been coined in the literature in a number of ways: 'inter-agency coordination' (Serrano, 2003), 'whole of government' (Australian Public Service Commission, 2004), 'joined up government' (Ling, 2002), 'horizontal government' (Bakvis and Juillet, 2004), 'managing for shared outcomes' (State Services Commission, New Zealand, 2004). All refer to the situation in which public service agencies work across boundaries to achieve a shared goal and an integrated government response to particular issues.

A metaphor used by Backus (2001) to explain e-governance deployment is well suited to explaining cross-agency SDI implementation. In the situation of constructing a house, the needs of the future house owners determine aspects such as the

size, cost, number of windows, and location of the house. A series of activities can be defined, with each activity contributing to the final goal of constructing and maintaining the house. Each activity may be planned and budgeted by a different contractor (agency), but a strategy is devised to synthesize and synchronize the work and to ensure that is it done to quality standards. A SDI committee pieces together all the individual work items to build the house (Figure 1). SDI is an amalgam of activities conducted by individual agencies under their programs.

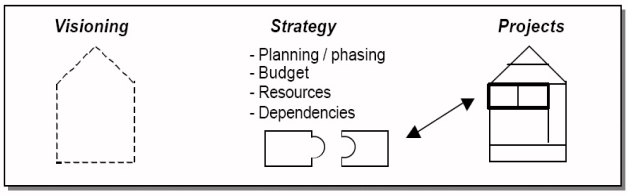


Figure 1. Metaphor of SDI implementation: building a house (Backus, 2001)

One example in which countries have made a cross-agency commitment to funding data development has been the national population census. Census activities extend beyond the routine operations of a single unit of government; operations involve numerous government agencies at various administrative levels, as well as the private sector, academic institutions and NGOs. More government resources go into a national population census than into any other public data generation activity (Alam, 2001). There is a collective recognition of the need for census data for evidence-based population and development planning. Many countries organize donors' meetings specifically to address the financing of this dataset. Donors are conscious of the need for census data and of the consequences of not having such data (UNFPA, 2000). Technical cooperation and assistance from donors have played a major role in the success of past censuses. If SDI framework datasets were similarly seen as vital for the economic well-being and assessment of the country, then it would follow that governments would source funds for those datasets as well.

2.1. Departmentalism

While a joined-up approach is the conceptual vision of SDI, it is problematic from an administrative standpoint. Government, by design, is constructed around boundaries. "Boundaries between programs fuel political debate. Boundaries between administrative agencies shape clarity of purpose. Boundaries within agencies, through hierarchy and authority, promote efficiency. These boundaries are essential for defining administrative responsibility and, ultimately, democratic accountability (Kettl, 2001, p.8)." These ingrained boundaries, by design, are 'part and parcel' of government. In theory, the boundaries should be beneficial, but civil servants often concentrate on protecting their 'turf' or departments rather than thinking holistically about the overall strategy and goals of the government. Public choice theory argues that turf protection is 'rational' behavior for bureaucrats. Departmentalism is a reflection of the structure within which ministries operate (Richards and Kavanagh, 2000), and ministries seek to claim the largest possible amount they can of the national budget. So, a fundamental dilemma exists when it comes to SDI between the need to "join-up" to achieve cross-agency aims and the institutional drivers that maintain departmentalism. Richards and Kavanagh ask, "Does 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, "Are the incentives strong enough for individuals to shift away from their customary competitive and departmental behaviors (Pollitt, 2003, p.47)?"

A cross-agency endeavor such as SDI may be further thwarted by the behavior of individuals, negotiating not on behalf of their departments, but for themselves. In Africa, for instance, governments have been characterized as having pervasive personalistic patron/client relations rather than impersonal and universalistic state/citizen relations (Berman and Tettey, 2001). Meanwhile, disinterested, apolitical conduct is what is needed. A 'predatory attitude' towards state resources is explained as being a result of meager incomes of employees; as a result, officials are compelled to use their positions to engage in activities that maintain their networks of political support and ensure personal economic security for the future, when they no longer have control over state resources (Theobald, 1994).

Seidman (1998, p.179) encapsulates the sheer idealism that surrounds the pursuit of coordination. "The notion of coordination is the twentieth century equivalent of the medieval search for the philosopher's stone…. If only we can find the right formula for coordination, we can reconcile the irreconcilable, harmonize competing and wholly divergent interests, overcome irrationalities in our government structures, and make hard policy choices to which none will dissent." Israel (1997, p.26) is even more pessimistic, saying, "Nothing is more difficult in management than achieving coordination among different agents and agencies. If institutional capacity is weak, coordination is practically impossible, or perverse."

2.2. Accountability

The previous section paints a bleak picture for the future of cross-agency initiatives. The hope is that interventions can be devised that steer departments and individuals to work together. Richards and Kavanagh (2000) quote a senior civil servant in the U.K. who suggests that 'shared accountability' is needed, so that officials are judged upon cross-agency outcomes and not individual outputs:

> "At the moment, we have tried to join government up with sellotape and bandages and I think it is going to take a lot more in cultural terms to really join up government. It will take serious incentives, and I do not mean just threats, something is going to have to happen to make officials and ministers working in different departments realize that they are being judged upon the outcome of overall policy and not just on their individual role or that of their department."

Accountability is the recurring theme in the literature on cross-agency initiatives to address departmentalism. Public sector agencies in New South Wales, Australia similarly were questioning how to attain accountability when they initiated horizontal reforms in 1996. They asked, "At what level do we integrate service planning and budgeting?… How can we pool funds while ensuring accountability back through each agency's hierarchy (Department of Housing, NSW, 1996)?" The difficulty is that cross-agency initiatives have 'horizontal objectives,' but the government agencies involved follow traditional 'vertical' government structures with respect to securing resources and accountability. The need to reconcile a collective sense of purpose and responsibility with individual accountability is one of the most significant tensions to be resolved in the management of a horizontal initiative (Hopkins et al., 2001, p.vii).

3. POLITICO-ADMINISTRATIVE SDI FRAMEWORK

The solution, according to Kettl (2001) is that central governments "enhance their steering capacity" (p.11), in part by retooling their budgeting and evaluation systems "so that they have the capacity to ask – and answer – the central questions (p.12)." Cope et. al. (2003) investigated how regulation is being used in the U.K. to increase accountability within government where self-control (or trust) has not proven adequate. Regulation has often been viewed as something that "government does to business." However, government itself also is subject to regulation. Within-government regulation is an old but increasingly necessary mode of social coordination and political intervention (Hood et. al. 1999). Traditional or Weberian bureaucracies relied on rules to govern or prevent opportunistic behavior. 'Principals' specified in detail what 'agents' must do (or must not do), carefully monitored their actions, and sanctioned all deviations accordingly. The notion of regulation has evolved and transformed over time to encompass more generic concepts of control that capture the diverse ways in which public sector behavior is influenced. Regulation is seen as "an art and craft of governance, as an institutional reality, as a field of study, and as a public discourse (Jordana and Levi-Faur, 2005)." Innovative regulation today does not emphasize the creation of more rules to control opportunistic behavior, rather to improve principals' abilities to *monitor* agents. This is improving *transparency*. Transparency can be based on diagnostic control or 'control by the numbers;' it can also be enhanced by debate and dialogue, referred to as interactive control. Interactive control is 'a help-the-manager-manage' strategy. It is a learning process, proceeding from strategic vision through choices and their consequences to better understanding, clearer vision, improved choices, and higher valued consequences (Thompson and Jones, 2000)."

Regulation involves a combination of information gathering (diagnostic control), standard-setting, and attempts at behavior modification (interactive control). From an institutional standpoint, regulation requires three elements (Hood et al., 1999), all of which must be present:

1. The regulator has a degree of authority over regulated bodies and sets standards for them. Standards can relate to resource inputs, procedures, outputs or outcomes and can reflect a range of aims including economy, efficiency, effectiveness, quality, and equality;
2. The regulator monitors performance and uses persuasion or direction of regulated bodies to change their behavior; and
3. There is organizational separation of regulator and regulated bodies, so that regulation is distinct from internal management within an organization.

The thought of instituting some form of regulation over geospatial investments is not unreasonable. However, it may not be so straightforward. In order to consider the possibility, one must first understand how SDI fits into the political and administrative setting.

Many of the principal SDI stakeholders are public managers who are in the business of managing government programs, human resources, budgets and finance, and the delivery of services. SDI implementation is not an amorphous cloud of activities independent of the government; SDI implementation

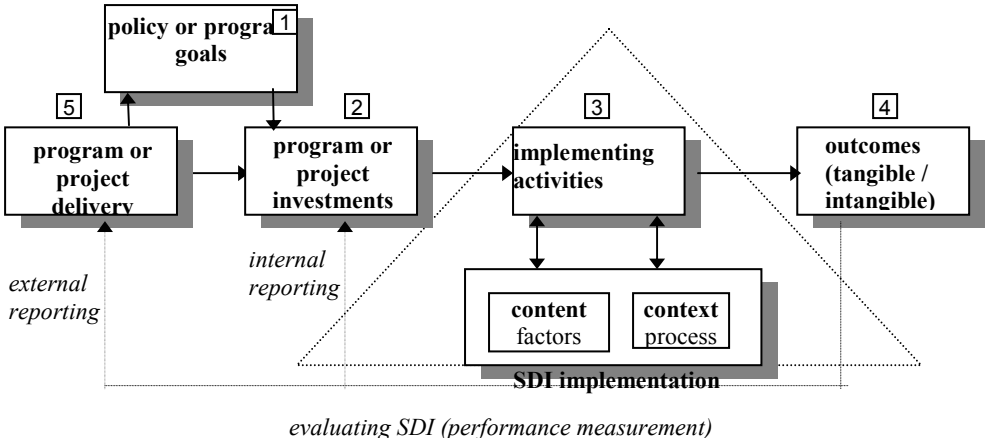


Figure 2. Framework for SDI implementation, adapted from Ramasubramanian (1999)

occurs as a series of administrative decisions within government. The decisions are embedded in programs, which reflect the political agenda. Ramasubramanian (1999), drawing upon work from Grindle (1980), described a politico-administrative framework for GIS implementation, which can also be used for SDI. Figure 2 depicts how SDI is subsumed within the political and administrative processes of individual countries. A 'mature' SDI is contingent on the presence of clear national policy or programmatic goals that provide the motivation for SDI (policy base) [1]. These goals are translated into project or program investments [2], which means that resources (budget, people) are allocated to appropriate agencies (ministries). Agencies design and implement activities to fulfill program goals. A SDI committee typically identifies and coordinates those activities that are geospatial in nature [3] to best serve SDI development, taking into account a range of influencing factors. The activities are designed to achieve results [4] that can be measured and reported on internally or externally, to an oversight or regulatory body (and to citizens) [5].

In the absence of an effective SDI committee that aligns multiple agency budget requests, or a regulatory body that monitors inputs, procedures, outputs or outcomes, activities are likely to be fragmented and poorly aligned. Attempts at SDI implementation are dominated by departmentalism, and there are no mechanisms for cross-agency accountability.

International aid organizations may further complicate SDI investment coordination, by introducing funding for specific geospatial activities, but conditions of the funding may 'pre-define' site selection, data collection and management requirements, managerial structures, and resource allocation as

well as the scope of transformation envisaged (Ramasubramanian, 1999). In these cases, the activities may not be in line with the strategy developed by the SDI committee. For instance, an SDI committee may have determined that a geospatial portal is the current SDI priority, but the available funding calls for equipment and satellite imagery procurement to conduct a land cover study. In addition, internationally supported projects typically have their own reporting structures. Governments must devote scarce resources to deal with a diverse set of donor instruments and modalities so that they can administer projects and respond to donor requirements (Asian Development Bank, 2004). Studies of country-donor relations in Cambodia and Vietnam found that these countries received mission visits from donors more than there were days in the year. These countries had to produce countless quarterly reports primarily for donors' benefit (Banerjee, 2005). The challenge for a SDI committee, in an aid-dependent environment, is to ensure that international support for geospatial activities contributes to a reasoned and transparent approach to activity selection and does not over-burden agencies with additional reporting obligations.

Most SDI initiatives at the moment see SDI only as a set of activities under the area shown in the triangle [3] (Figure 2), which is an indication of an immature SDI strategy. Countries may have established SDI committees and outlined individual SDI components to be implemented (e.g., framework data, metadata, standards, clearinghouse, portal), but the overall SDI vision has not been subsumed within a politico-administrative framework. The existing dialogue focuses broadly on technical aspects, not on the political and administrative *details* of 'who is going to pay for what and how, what impact the activities will have and how the impact will be measured, and who will be accountable to whom'? The National Geoinformation Policy of Nigeria does suggest that "each National Geospatial Data Infrastructure (NGDI) node agency shall be supported with an annual budget and 60% of internally generated income from its GI activities for its support operations to NGDI;" The "NGDI lead agency and the NGDI Committee shall actively promote funding of all NGDI node agencies and work out further mechanism of obtaining fund for NGDI (Federal Ministry of Science and Technology, 2003, p.37)." This hints at a cross-agency funding model, which is promising, but the overall costs of developing SDI were not assessed, nor were they mapped against existing resources of individual agencies. Costs and available resources across agencies were not analyzed either in Botswana. The terms of reference for the Botswana National GIS Coordination Committee say, "It has not been possible to calculate the costs and to propose financing for the Coordination Committee and its activities. The main principle, which is used in most countries, is that each of the participating organizations seeks financing for its own costs (Sandgren, 2003, p.13)." The terms of reference do recognize the need to measure the success of the NSDI initiative, but detailed indicators remain an activity for the future, not something explored at the onset. The South African Spatial Information Bill specifies that the "Committee for Spatial Information must, within three months after the end of each financial year, submit a report to the Minister and the Director-General, stating the activities of the Committee and its sub-committees, and any recommendations from the Committee aimed at improving its functioning or the functioning of the South Africa SDI (NSIF, 2003, p.15)." Again, it is promising that the Committee is required to submit an annual report, since reporting is a mechanism for accountability, but the Committee is not required to synthesize financial information nor assess its outcomes according to agreed-upon performance measures. More mature SDI strategies spell out both funding and evaluation mechanisms and may include internal and external forms of control.

In the United States, one of the three recommendations recently made by the NSDI Future Directions Governance Action Team was to improve the management of federal geospatial programs by creating a geospatial investment analysis capability within Federal Geographic Data Committee (FGDC) and by re-establishing geospatial leadership functions within the Office of Management and Budget (OMB), an executive oversight agency (FGDC, 2005a). The FGDC Steering Committee Meeting minutes of June 23, 2005 echo these recommendations. The Committee recognizes that one of the challenges ahead is the monitoring of geospatial investments. To help the FGDC in its efforts, the Committee asked all members "to support an investment strategy; implement accountability measures; document geospatial activities; build NSDI/FGDC/A-16 performance measures into their staff performance plans, evaluations, and work plans; and to develop an internal strategy to track investments." The FGDC Annual Report to OMB also will be analyzed and revised so that it provides a better way to measure performance and outcomes of FGDC member activities (FGDC, 2005b).

3.1 Performance Measurement

In many advanced economies, public agencies have come under increasing pressure to improve the efficiency and effectiveness of the services they deliver. In the drive to achieve this, various 'private sector' management techniques have been introduced, often referred to as 'new public management.' The reforms place significant emphasis on agency performance.

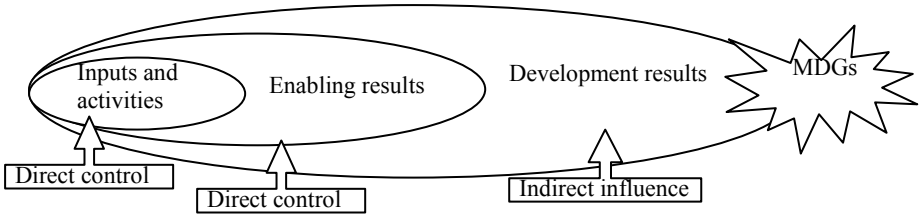
This approach was proven effective in Canada, as explained by the former Executive Director for Government on-Line.

"To give structure to government efforts we issued mandates. For example, in one year every department had to put all their information online. If this wasn't done, it would be publicly announced that they had not met their goal. Then we moved on to say that all agencies had to develop transactional activities online, and ultimately end-to-end, inter-jurisdictional activities. By developing very specific target dates and measures we ensured constant progress even when we were not sure in 1999 what the end results would look like in 2004. I believe that central policy steered through funding worked very well for us, proving to be a very good incentive and ensuring recognition for Deputy Ministers that made a difference. We would provide further recognition by slipping news of Deputy Ministers' successes into Prime Ministerial speeches, and this acknowledgement at the apex of government was a wonderful incentive for senior administrators (Furlong, 2005)."

Performance measures, however, for SDI are not so straightforward, and this is especially the case in many developing countries where SDI has been 'hyped' as a solution to poverty reduction, sustainable development, and the achievement of the Millennium Development Goals (MDGs). SDI does not have a direct influence on resolving a country's social and economic ills; rather SDI provides indirect support through data, information, and enabling services (Figure 3). It is difficult to track how data and information are used and to measure their value in decision-making and outcomes. "User transactions involving information - not to mention outcomes of such transactions - largely take place outside established accounting and measurement systems (Alexander, 2002)."

Before the geospatial community can begin to contemplate the relationship between SDI and development results, it must first have procedures in place to measure SDI enabling results. Moreover, cross-agency measures are needed, as the previous section of this paper pointed out, and these must be harmonized with the 'vertical' reporting requirements of individual agencies. That said, the geospatial community has yet to even develop the mechanisms to track inputs to outputs. Until inputs are organized and controlled, it is inappropriate for a country to consider performance measurement. The difficulty of applying 'new public management' techniques to developing countries is that the *preconditions of financial control* are absent (Peterson, 2001). Anthony developed a typology of administrative processes: operational control, management control, and strategic planning (Anthony, 1965, p.16-18 cited in Peterson, 2001). Schick (1966, 1998a, p.113) argued that these processes are sequential and that operational control must be established before management control, and management control before strategic planning. Operational control is brought about through external oversight. "Operating in an externally controlled environment is an essential phase in the development process for it (a) gives managers the skills to operate – that is, to manage on their own, (b) builds trust between central controllers and line managers and confidence between citizens and government, and (c) encourages managers to internalize a public ethic of proper behavior (Schick, 1998b, p.8)."

With respect to SDI, a country must first be able to control the inputs, and the first step in doing so, according to Peterson (2001) is to promote widespread *comprehension* of the existing system. Tracking of geospatial investments is a key means to do so.



Inputs	Activities (outputs)	SDI enabling results (outcomes)	Development results
• Personnel • Training • Hardware/software (licenses/maintenance) • Consulting support • Travel • Meetings/ communications • Leveraged resources (NGOs, private sector, etc) • Etc.	• Data development and maintenance • Elaboration and maintenance of metadata catalogs • Services development • Standards definition and implementation • Data policy articulation and implementation • Partnerships formation • Etc.	• Improved delivery of public services • Faster data discovery • Improved data quality • Increased accessibility and usability of data/services • Cost savings (from reduced duplication; co-financing of data) • Cost avoidance • Etc.	(Millennium Development Goals) • Economic well being • Social development • Environmental sustainability • Governance • Etc.

Figure 3. SDI results-based management and accountability framework, adapted from CIDA (2002)

Initiative	Implementing Agency	Date of Initiation	Source of Funding	Orientation
SINIA AOT - SIGIT	SERNA	August 1999	World Bank	National Environmental Information System & Land Administration System
Center for Geographic Information- CIGEO	UNITEC	May 2000	USAID	Spatial data documentation and exchange
National Network for Permanent Capacity in Risk Management	COPECO	June 2000	OFDA/USAID	Natural Disaster Network for disaster information exchange
National Forest Information System	COHDEFOR	In development (2001)	World Bank	Information management for sustainable forestry
National Statistical Information System	INE	January 2001	UNDP, ASDI	Census and statistics for development and democracy
National Systems for Evaluation and Management	Ministry of the President	August 1999	IDB	Monitoring of policies, programs, projects and activities related to Modernization of the State

Table 1. Information management initiatives in Honduras in 2001

3.2. Tracking of Geospatial Investments

As mentioned in the introduction, a significant amount of investment in geospatial technologies already is being made in many countries. However, government agencies and donors commonly develop projects in isolation from one another, leading to fragmented information systems and duplications. This was case in 2001 in Honduras, as summarized in Table 1. Millions of dollars flowed into the country after Hurricane Mitch to improve the availability and use of spatial data for development and disaster mitigation. Yet, without appropriate control measures, these inputs, rather than contributing to a coordinated, cross-agency SDI framework, resulted in 'stove-piped' installations and data-driven applications. Similarly, Table 2 demonstrates a considerable influx of resources into the geospatial realm in Egypt. Readily available information from government and donor websites reveals that projects have focused on data development, institutional capacity building, technical training, applications, and research. Nasr and Radwan (2004) estimate that the Government of Egypt and a number of international donors have invested more than US$50 million in the past 15 years for the technical modernization of the Egyptian Survey Authority. However, all this investment has not yet resulted in up-to-date and accessible base maps needed by the user community.

This sort of 'fiscal archaeology' can provide transparency as to how resources are flowing into a country for geospatial activities and how they are used over time. More detailed and continuous, institutionalized tracking of investments would enable SDI committees to oversee the full range of ongoing activities and critically evaluate their effectiveness for SDI. The resulting information would help (i) inform SDI program managers and service providers of opportunities, (ii) identify duplications, (iii) focus geospatial investments more tightly on SDI priorities, and (iv) facilitate cross-agency working. The inability to clearly track investments and negotiate adjustments between agencies and donors undermines the implementation and credibility of SDI as an initiative. A more studied approach would provide the means to improve the use of resources, as well as put SDI in focus of ministries of finance.

Tulloch et. al. (1998) emphasized another reason to track geospatial investments. "Research on the magnitude and rate of investment in GIS will provide a basis for monitoring and evaluating the economic contribution of the GIS industry to the overall GNP (gross national product), and to the Information Technology Gross National Product. It will help us track public expenditures in terms of capital and human investment. This research will form the economic basis for evaluating the impact of GIS upon society and its institutions."

Ministry / Agency	Project	Project Amount	Funding Source	Implementation Period
Egyptian Environmental Affairs Agency (EEAA)	Egyptian Environmental Information System	CIDA Contribution: $ 12,783,000 EEAA Contribution: $1,800,000 CDN in Egyptian L.E.	Government of Egypt and Canadian International Development Agency (CIDA)	1997 to 2004
Egyptian Environmental Affairs Agency (EEAA)	Environmental Information and Monitoring Program (Phase I & II)	(DKK 79,600,000 and LE 12,400,000 for air quality, coastal waters and reference labs). Total budget reached US $ 17,000,000 for phase I & II.	DANIDA	1996-2004
General Organization for Physical Planning (GOPP), part of the Ministry of Housing, Utilities and Urban Communities (MHUUC)	Support to GOPP in Planning and Geographic Information Systems		SIDA, Government of Sweden	Began in January 2005
General Organization for Physical Planning (GOPP)	Development of Regional Physical Planning Centers by the Establishment of a Network for a Geographical Information System	US $ 1,165,019	UNDP	1999-2004
Egyptian Survey Authority (ESA)	Training Programme for the Development of Managers and Supervisors for the National Cadastre	€ 1,256,053	Royal Netherlands Embassy	2001-2004
Egyptian Survey Authority (ESA)	Egyptian Cadastral Information Project (ECIM)	€ 7 million	Finnish government	2002 -
National Authority of Remote Sensing and Space Sciences (NARSS)	Development of an information system for operational monitoring and integrated management of the Nile Delta coastal Zone	US $ 361,000	FAO, Technical Cooperation Programme (TCP)	04/2002 – 12/2003

Egyptian Geological Survey and Mining Authority (EGSMA) & National Authority of Remote Sensing and Space Sciences (NARSS)	Capacity Building of the EGSMA and the NARSS for the Sustainable Development of the South Valley and Sinai	US $ 2,000,000	UNDP	1998-2004
National Water Research Center (NWRC) / Ministry of Water Resources and Irrigation (MWRI)	Decision Support System for Water Resources Planning Based on Environmental Balance – Phase II	€ 1,047,600 Government of Italy LE 2,693,370 - Italian Debt-for Development Swap.	Government of Egypt (Italian Debt for Development Swap)/ Italian Third Party Cost Sharing.	2004-2007
Ministry of Water Resources and Irrigation (MWRI)	National Water Quality and Availability Management (NAWQAM) (has a GIS component and a Central GIS Unit at the National Water Research Center)	CAN $ 20.5 million and L.E. 27.5 million	Canadian International Development Agency (CIDA) & Government of Egypt	1997-2004
General Authority for Educational Buildings (GAEB)	Primary Schools Construction Programme (PSCP) (has a GIS component)	€ 82.4 million	Kreditanstalt für Wiederaufbau (KfW), Frankfurt, Germany	1996-2006
Ministry of Planning	Participatory Urban Management Programme		GTZ	1998-2003
Fayoum Economic Authority for Drinking Water and Sanitation (FEGAWS)	FaDWaSP Base-map/Satellite Project			2002
Supreme Council of Antiquities, Egyptian Ministry of Culture / NARSS	Egyptian Antiquities Information System (EAIS), 1st phase	€ 685,000	Ministry for Foreign Affairs of Finland	2000-2002
Supreme Council of Antiquities, Egyptian Ministry of Culture / NARSS	Egyptian Antiquities Information System (EAIS), 1st phase	€ 745,000	Ministry for Foreign Affairs of Finland	2002-2004
Real Estate Transaction Authority, Egyptian Survey Authority	Financial Services and Real Estate Project (has a GIS component)	Total project US $35 million (budget for GIS component n/a)	USAID	Began in 2005

Table 2. Government and donor-assisted geospatial investments in Egypt (2000-2005)

In practice, cross-agency investment analysis will be an incremental process in which rough initial estimates of investments are replaced by more detailed and precise statements of current resource allocations and future requirements. The initial step of compiling information of existing investments in itself is difficult. The geospatial community will encounter a situation that is similar to what the statistical community encountered. In the 1980's, the United Nation Statistics Division conducted an inquiry to find out whether and how financial records for census taking were kept. Among those countries that responded to the inquiry (95 out of 138), a substantial number maintained records of census expenditure by type and the stage of census operation. However, there was no uniformity in record keeping, and in most instances countries were unable to classify their administrative records in ways that they could answer the specific details requested in the inquiry (Alam, 2001). Geospatial investments typically are part of program investments, and it is difficult to extract details relating to the geospatial component. This is the case with many of the projects listed in Table 2; only a fraction of the project budgets is assigned to geospatial activities. Geospatial investments also are difficult to separate from information technology (IT) investments. There is a broad understanding of geospatial technology and IT, but neither have specific descriptions and classifications for accounting/expenditure tracking purposes. Some IT investments are budgeted as capital investments, and these may be accounted for in a budget separate from recurring costs. Another potential obstacle is the lack of clarity of responsibility for tracking geospatial investments. Geospatial investment tracking could fall under the remit of IT managers, GIS managers, program managers, accounting departments, and ministries of finance.

Some tools do exist already that can facilitate geospatial investment tracking. FGDC is exploring the use of *searchable identifiers* to enable the discovery of geospatial investments from among all government grants. GAO has published guidelines for managing IT investments focusing on three aspects:

- the processes that agencies use to identify and evaluate their IT investments,
- the data (cost, benefit, and risk) that are being used to make IT decisions, and
- the IT decisions that are being made using defined processes and data.

The U.S. Commercial Remote Sensing Space Policy (CRSSP) Interagency Working Group is developing a web-based entry tool called CRSSP Imagery-Derived Requirements (CIDR) that is designed to capture civil agency remote sensing investments. It will facilitate partnerships among agencies, or even within

	Identify/Select	Control	Evaluate
Processes	Selection processes include: • screening new projects • analyzing and ranking all projects based on benefit, cost, and risk criteria • selecting a portfolio of projects • establishing project review schedules	Control processes include: • consistently monitoring projects • involving the right people • documenting all actions and decisions • feeding lessons learned back into the Selection phase	Evaluation processes include: • conducting post-implementation reviews using a standard methodology • feeding lessons learned back in to the Selection and Control phases
Data	Selection data include: • evidence that each project has met project submission requirements • analyses of each project's costs, benefits, and risks • data on the existing portfolio • scoring and prioritization outcomes • project review schedules	Control data include: • measures of interim results • updated analyses of each project's costs, benefits, schedule, and risks	Evaluation data include: • measurements of actual vs. projected performance • documented "track record" (project and process)
Decisions	Selection decisions include: • determining whether projects met process-stipulated requirements • deciding upon the mixture of projects in the overall IT investment portfolio	Control decisions include: • deciding whether to cancel, modify, continue, or accelerate a project • aggregating data and reviewing collective actions taken to date	Evaluation decisions include: • assessing project's impact on mission performance and determining future prospects for the project • revising the Selection and Control phases based on lessons learned

agencies, by enabling them to match up their funding and data requirements with known data sources or planned data

Table 3. The IT investment management process (GAO, 1997)

acquisitions of others. The commercial satellite industry also will have a snapshot of civil agency needs in order for them to provide better and more-tailored data and services. Entries will be updated as fulfilled, partially fulfilled, unfulfilled and forwarded, or unfulfilled. The CIDR development team plans to incorporate a map interface into the tool and add basic GIS capabilities. Users will then be able to find more easily regions of overlap. The goal is to have this interface in place by the end of 2005 and have it coordinated with Geospatial One-Stop (GOS). Such a "Partnership Marketplace" will facilitate collaboration and cross-agency alignment of investments. That is why advance information about geospatial investments is a key design element of the GOS portal.

While new cross-agency standards, guidelines, and tools, such as those just mentioned, are likely to facilitate investment tracking, some issues regarding tracking are particularly problematic. For instance, there are situations when investments are more "phantom" than "real." This has been documented with aid flows. Investments do not always represent a real resource transfer to the recipient, rather the bulk of the money is wasted, misdirected or recycled within donor countries (Watt and Greenhill, 2005).

To improve accountability of aid inflows, a number of countries are establishing development assistance databases to track and monitor all commitments. For example, the Sierra Leone Development Assistance Coordination Office (DACO), in collaboration with the Ministry of Finance, Ministry of Development and Economic Planning and the Bank of Sierra Leone, is meant to ensure that external assistance data are systematically incorporated into the annual budget. The Canadian International Development Agency (CIDA) supported a similar initiative under its Project for Economic Governance in collaboration with the Malawi Ministry of Finance. The cornerstone of the Malawi effort is an integrated database of information on funding agency and government expenditures. The Office of the Prime Minister of Fiji has set up a central information system to track government projects (Fiji GIS and RS User Forum, 2005). A global initiative called Accessible Information on Development Activities (AiDA) also has been established which lists ongoing and planned activities of major bilateral organizations, multilateral development banks and UN agencies. AiDA also is linked with Local Project Databases that are being developed. At the moment, though, none of these efforts provides a means to extract investments specifically for geospatial activities. Record keeping issues mentioned earlier in this section could preclude this from happening. Also, geospatial activities are not treated as a "sector," and most aid agencies are organized around sector (or geographic) boundaries.

There are, however, two initiatives underway that are designed to track geospatial projects: the Natural Resources Information Clearinghouse (NRIC), by U.S. Agency for International Development (USAID), and the Project and Spatial data Information System (PASTIS) by the Europe Aid Cooperation Office. While the long-term institutionalization of NRIC and PASTIS remains to be seen, these efforts do indicate that geospatial project tracking has become a concern of donors. Also, given that much of the geospatial activity in developing countries is funded through external assistance, control over geospatial investments could be supported in part through donor oversight and aid alignment.

4. CONCLUSION

Some may argue that geospatial investment tracking requires a degree of motivation and capability that may be lacking in many countries, particularly developing countries. However, budget reform efforts are underway worldwide to reduce the costs and refocus the activities of the public sector, to change the way it works, and to promote the role of the market and non-governmental actors both in service provision and in the economy at large (Therkilden, 2001; Fozzard and Foster, 2001).

Sector-wide approaches (SWAps), particularly in health and education, have introduced results-oriented management at national and local levels (Roberts, 2003). In June 2005, the African Development Bank (ADB) Group approved a loan to Benin of US$ 3.7 million to finance the Control Institutions Support Project (PAIC) to address the need for capacity building and modernization of public expenditure control instruments. Thus, there is evidence that existing politico-administrative frameworks already are embracing new control measures.

In a recent interview, Soumana Sako, Executive Director of the African Capacity Building Foundation, stressed, "If capacity (for coordination) is weak, this is one more reason to step in and strengthen it. If budgeting and financial accounting systems need to be developed to give donors - and the ultimate domestic beneficiaries – the degree of confidence that the money is going to be used for the intended purpose and that the money can be accounted for, then help the government fix the system, but don't circumvent the local system. Donors must accept the fact that, if they want successful programs, African governments must be able to coordinate development assistance (Development Gateway, 2005)."

With the introduction of new technologies, such as GIS, new administrative capabilities must be strengthened. SDI is the administrative framework for GIS, and SDI must be part of a broader politico-administrative framework, linked to policy and the national budget. Administrative reforms must precede or accompany introduction of GIS in the public sector. Officials in Sri Lanka understand this. "Reengineering government is the key issue here in Sri Lanka. You can't simply apply technology in isolation, because that will just automate the mess as it is," explains Manju Hathotuwa, Chief Executive Officer of the Information and Communication Technology Agency of Sri Lanka (ICTA). "So we're pursuing an integrated e-government model that reengineers government processes at the same time as we automate them. We refer to it as 'regov', and this Sri Lankan model of development is being closely followed by the World Bank and a number of other countries in the region (Smith, 2005)."

SDI implementers should be considering which administrative reforms might restrain departmentalism and support cross-agency accountability and transparency. Questions of who is accountable and transparent, to whom, and on what terms, and how, are a crucial dimension of SDI development, and therefore deserve critical analysis. The way in which regulation (control instruments) are applied in SDI fundamentally will affect the way in which agencies interact with each other.

Even if the feasibility of a geospatial investments tracking mechanism is questionable at the moment, it is possible that attempts alone at instituting such mechanisms could stimulate behavioral change. It could be like having a 'placebo' for the 'silo' malady. People might just focus on better aligning of resources, because they think that those around them are counting the beans.

A human resources study from several decades ago, at the Hawthorne plant of the Western Electric Company in Illinois, found that production at the plant increased not as a consequence of actual changes in working conditions introduced by the plant's management, but rather because staff perceived an interest their work (Mayo, 1933). Improved lighting resulted in improved worker productivity. But then one investigator decided to repeat the study with decreased lighting and found that this also improved productivity. The conclusion was that the productivity gains were not related to the brightness of the lights, but rather to the act of measuring. This phenomenon is referred to as the Hawthorne Effect – with individuals altering their behavior because they know they are being observed. So increased oversight of geospatial investments, at the very least, might lead to more cross-agency alignment.

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