Towards an assessment framework for spatially enabled government

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Abstract

Government today confronts challenging and complex issues – the global financial crisis, terrorism, climate change, an aging population, deteriorating public infrastructure, natural resource depletion, and increasing demands for welfare support. Many of these issues require coordinated action across governments. In nearly every case government responses require knowledge of location – where are the people, infrastructure and resources affected by these issues and where should the response be targeted. Although government has benefited from the use of spatial technology for many years, this use has been for the most part fragmented and uncoordinated. Relatively recent developments in the fields of ICT, the internet and spatial data infrastructure (SDI), now offer the real prospect of cost-effective deployment of knowledge of location in business systems across the whole of government. This is called the spatial enablement of government (SEG), part of a broader and all encompassing phenomenon, the spatial enablement of society. One of the key requirements of SEG is a means of assessing whether investments in enablement are achieving expected outcomes. This paper briefly reviews the state of global development on SEG and cases of SEG in Australia, North America and Europe; and then focuses on an assessment framework for SEG. The framework builds on assessment methods under development or in place for eGovernment, SDI and, public policy and program evaluation. The paper concludes with some views on future directions for research on SEG assessment frameworks.

Keywords

spatially enabled government (SEG), spatial data infrastructure (SDI), assessment framework

1 INTRODUCTION

In simple terms the purpose of government is to ensure the well-being and betterment of society and the protection of the sovereignty of the state. From a government perspective this purpose is achieved through implementation of government policy. Government policies, be they social, economic, environmental or security, are typically developed and administered by government ministers and their departments, and are implemented through actions like the delivery of services, imposition of regulations and collection of revenue. During this process government interacts with stakeholders, principally its citizens, businesses and other governments. This overall process, that is the process of government, depends variously upon human, financial and technical resources and systems.

Most of the tasks involved in the process of government, that is, consultation, analysis, decision-making, communication, design, implementation and review, in relation to policy, services, regulation and revenue collection requires knowledge of the location of people, infrastructure and resources. Spatial technology has been
used in parts of government for many years to help provide knowledge of location. Contemporary developments in technology, particularly information and communication technology (ICT) and spatial data infrastructure (SDI), now present government with the opportunity to integrate knowledge of location cost-effectively and seamlessly into business processes and systems across the whole of government. By taking this step government becomes spatially enabled. A growing number of governments around the world, at local, provincial and national level, are presently taking steps to become spatially enabled.

Spatial enablement of government (SEG) is part of larger phenomenon now impacting the world, the spatial enablement of societies.

A question presently being considered by those in involved in spatial enablement research and practice is, what are the requirements for, and indications of, spatial enablement and how might spatial enablement be assessed. In order to answer this question is helpful to first consider the global state of research and development on SEG, present cases of implementation of SEG, and to have conceptual view of SEG, particularly its purpose and its essential characteristics.

With this in mind this paper discusses some of the research on SEG and the closely related field of SDI follows by implementations of SEG in Australia, the USA, Canada and EUROPE. It focuses on a conceptual framework of SEG, particularly as it relates to assessment and present approaches to assessment in some key areas of relevance to SEG. Finally, a possible assessment framework for SEG taking account of issues raised in previous sections is proposed.

2 RESEARCH ON SEG

Rajabifard et al (2003), Rajabifard et al (2006) and Masser (2009) describe the changes of SDI over time and their influence on SEG. The 1st generation of SDIs were explicitly national in scope and their titles referred to ‘spatial data’ and included the term ‘infrastructure’. The 2nd generation of SDI’s were characterised by a shift from product to process and a shift from data producers to data users who emphasised data sharing and reusing data collected by a wide range of agencies for a great diversity of purposes; by a shift from centralised structures to the decentralised and distributed networks that are a basic feature of the WWW; and, by a shift from SDI formulation to implementation and from single level to multi level participation. In this generation of SDI coordination models are more complex and inclusive models of governance have emerged. In the last few years there are signs of a 3rd generation of SDIs emerging. The balance of power has shifted from the national to the sub national level, the source of most large-scale land related data. There is also a shift from government led approaches to whole of industry models where the private sector operates on the same terms as its government partners. The concept of SEG that is emerging as a result of these SDI trends presents important challenges. The vast majority of the public today are users, either knowingly or unknowingly, of spatial information. As a result SDIs must develop in such a way that they provide an enabling platform that will serve the wider needs of society in a transparent manner.

Rajabifard et al (2005) note that users now require precise spatial information in real-time about real-world objects and this requires governments and industry to work together to create such products and services. Although whole-of-government initiatives are underway to provide access to government data holdings, industry is not engaged in many of these initiatives The authors argue the need for the creation
of an infrastructure or enabling platform linking government and private industry from which applications and services can be leveraged and value added, and providing the ability to grow the private sector and spatial information industry as a whole.

Wallace et al (2006) consider the topic of SEG from the perspective of land administration. They argue that land administration systems can become important sources of spatial information for use by government if these systems are re-engineered accordingly; and the spatial enablement of information in these systems will permit more equitable administration of land and resources. They view the cadastre as the vital information layer of an integrated land management system, and suggest that in future it will underpin information systems of modern governments. They conclude that a whole of government approach is needed to ensure that the spatial enablement of interoperable networked systems goes beyond the existing core businesses of land administration system organisation.

Holland et al (2009b) argue the importance of referencing and geocoding any elements involved in SEG and e-Government from both a national and regional perspective in particular the geocodes for address files. In many instances geocodes are derived from digital cadastral databases.

In Williamson et al (2006) start to see a vision for SEG - establishing an enabling infrastructure to facilitate use of place or location to organise information about activities of people and businesses, and about government actions, decisions and policies. The authors suggest that the present infrastructure used to administer land needs to be integrated and operate in an Internet enabled e-Government environment. In this regime, information policy becomes crucial. SEG in this environment involves the whole of government. Williamson et al (2007) go on to present the SEG research problem: that governments are not using transformational spatial technologies to improve business processes, thereby limiting their effectiveness, efficiency and international competitiveness; and, the SEG research aim, to develop an internationally applicable, whole of government path to use transformational spatial technologies, particularly land information, to manage national activities, provide services and deliver local, national and regional information.

Rajabifard (2007) introduces the idea of spatial enablement of society. The authors argue that the creation of economic wealth, social stability and environmental protection can be achieved through developing products and services that are based on spatial information collected by all levels of government. These objectives can be facilitated by developing a spatially enabled government and society where spatial information is regarded as a common good made available to citizens and businesses to encourage creativity and product development. To do so requires data to be accessible and accurate, well-maintained and sufficiently reliable for use by the majority of society who are not spatially aware. There needs to be a mechanism of assessment that uses a set of agreed indicators to measure the progress of its development and delivery of its services.

Another effort in assessing SEG which has been done recently is the work by Ezigbaliike and Rajabifard (2009) where the authors have proposed two methods for selecting indicators and they tried to identify indicators for assessing spatially enabled government services. In particular, they addressed various challenges and issues associated in the new vision of SEG. They also discussed the importance, role and value of benchmarking government services and the level of their spatial enablement and proposed methods for selecting indicators for measuring and comparing different aspects.
It has been highlighted that, one of the key features of government services, and the associated choices in e-government is the location of the services centres, vis-à-vis the service takers, be they citizens, businesses or government agencies. This has led to the concept of SEG, which is now part of the objectives of countries in the Asia Pacific region, Europe and North America. The combination of strategies in the spatial enablement of government and mainstream e-government are now emerging trends in many parts of the world.

The discussion on spatially enabled government and society is continued in Rajabifard (2010) and Williamson et al (2010).

3 IMPLEMENTATIONS OF SEG

- Australia

National level, Paull and Bower (2003) identify collaboration and innovation as important requirements for spatial enablement in at the national level in Australia. Location-based information relating to people, activities, and resources is critical to informed decision making within both private and public sectors. A readily available consistent seamless national geospatial framework for location-based information is essential. Collaboration by the national governments through PSMA Australia Limited has seen the development of seamless national framework datasets, including a geocoded national address file called G-NAF, and a supply chain infrastructure. These elements are crucial to SEG in Australia. In a political context SEG was discussed for the first time by national ministers at the Online and Communications Council in 2006 (OCC, 2006). Ministers noted that SEG used place or location to manage and integrate government services and enhance business opportunities. It required a mix of both research and implementation and a partnership between public and private sectors; re-use of existing spatial data; and, spatially enabled addresses. Ministers agreed to develop a national address management framework. Subsequently Ministers further agreed to develop a national government information sharing strategy. ANZLIC, Australia’s spatial council, is presently looking at new and contemporary ways of creating the Australia New Zealand spatial infrastructure (ANZsi). The ANZsi is conceived to take the form of a spatial resource marketplace and would build on public and private capabilities and Web 2.0 methodologies. The Cooperative Research Centre for Spatial Information has recently received government funding to develop ANZsi (CRCSI, 2009).

State Government of Victoria. VSC (2008), Thomas et al (2009) and Hedberg and Thomas (2010) present the concept of spatially enabled Victoria. Spatial enablement contributes to the expansion of consultative and participative government services such as e-government, policy and administration through cost reduction, public safety through more efficient emergency services, improved utilities infrastructure, better management of health services, and environmental sustainability. A strong institutional environment helps to build spatial capacity. A spatially enabled Victoria will be supported by land administration systems, and by the new uses and markets for spatial data created by technology convergence. The present state spatial information management framework is the foundation on which spatially enabled Victoria will be developed.

State Government of Western Australia. Fitzgerald (2008) describes the Western Australia Shared Land Information Platform (SLIP). SLIP is the infrastructure supporting SEG in the state. SLIP is a delivery system that provides efficient access to government spatial information and is based on an enabling framework of connected servers, delivering real time spatial data. SLIP aims to transform how
government spatial information is used and shared. SLIP users have access to over 350 datasets from over 20 agencies (Armstrong, 2009). SLIP development is characterised by a strong public-private partnership.

**State Government of New South Wales**

The New South Wales government has implemented a number of SEG initiatives. These initiatives reflect international approaches and are being developed strategically within a unified architecture of location intelligence (Watkins and Harris, 2010).

**Federal Government**

Several SEG initiatives are being taken at federal government level. Of most interest is the Commonwealth spatial data initiative (CSDI). CSDI aims to support the government policy on social inclusion by facilitating the integration and sharing of authoritative spatially enabled social information. CSDI is being implemented by a lead department in partnership with other departments. A geospatial analytical capability is being deployed during the first stage of a CSDI pilot program. A focus for CSDI at present is building an evidence base of administrative data to strengthen government ability to deliver social policy through informed decision making, and on identifying and developing options for whole-of-government information sharing (DHS, 2009).

- **United States of America**

A Presidential initiative on a Geospatial Line of Business (GLOB) commenced in 2004. This has led to the establishment of the National Geospatial Advisory Committee in 2008. This diverse committee is comprised of 28 experts from all levels of government, academia and the private sector, including a representative from the Office of Management and Budget (OMB), and reports to the Secretary of the Interior. The committee has developed a white paper to describe the changes and advancements the community has witnessed in the geospatial landscape over the past three-plus decades to set a context for its future deliberations NGAC (2009). The NGAC has urged the new Presidential Administration to make a strategic investment in geospatial programs and technologies to underpin and support the health, welfare, and safety of U.S. Citizens. A decision on this recommendation is pending. A view on a performance framework for the GLOB is shown in Figure 1 which illustrates the importance of information and governance in delivering capabilities to the society.
Canada

Canada is well advanced in its spatial enablement initiatives. It has a well developed SDI, the Canadian Geospatial Data Infrastructure (CGDI), a funded and comprehensive SDI partnership program, and a strong and inclusive SDI governance framework over-sighted by the Inter-Agency Committee on Geomatics (McLaren et al., 2006).

European Parliament

A European Union Directive lays down a general framework for a SDI for Europe (INSPIRE). INSPIRE aims to improve the interoperability of, and access to, spatial information across the European Union at a local, regional, national and international level, facilitate improvements in the sharing of spatial information between public authorities and provide improved public access to spatial information. INSPIRE builds upon the infrastructures established and operated within countries (European Commission, 2007). INSPIRE is probably the most significant multi-country SDI implementation in the world at present and is an important case study on SEG is a case to see how it would help to facilitate and realize SEG in Europe.

4 A CONCEPTUAL VIEW OF SPATIALLY ENABLED GOVERNMENT

It is necessary to have a conceptual view on SEG, particularly its purpose and its elements, before considering approaches to assessment. A conceptual view of SEG is discussed in Holland et al., (2009a). This discussion suggests that SEG involves the interaction of organisations (government departments and agencies), technology (technical systems, particularly spatial data infrastructure) and people (citizens,
businesses and academia). These entities are shown in Figure 2. SEG can be conceptually framed in the following way:

- The vision or purpose of SEG
- Its drivers, benefits and business case;
- Definitions, principles and objectives of SEG;
- Its characteristics and elements;
- Its theoretical bases and research needs;
- SEG implementation requirements; and, finally
- SEG assessment methods.

A vision for SEG might be *government actions informed by knowledge of location*. The USA Presidential vision that accompanied the establishment of a GLOB, that is, the nation's interests are served through the effective and efficient development, provision, and interoperability of geospatial data and services, is consistent with this more concise phrase. The purpose of SEG might be to facilitate better outcomes by government. These outcomes are both external to government, that is, more effective policy, service delivery, regulation and revenue collection; and, internal to government, that is, more efficient and effective people and systems.

The interacting elements of SEG include:

- Citizens and businesses communicating with government, affected by government policy and regulation, utilising government services, and providing government revenue;

Figure 2: Entities involved in spatially enabled government

- Government ministers and departmental employees developing, implementing and reviewing policy, process and structure;
- Government departments and their operating policies, accountability and governance arrangements (including cross-departmental, and inter-governmental operating policies, accountability and governance arrangements);
- Government technology and systems (particularly ICT and spatial information and technology operating within and between departments, and between governments; and, common business systems operating across departments and between governments);
- National and international ICT, internet and SDI technical infrastructures; and, private sector product and service providers; and
- National and international institutions (for example, national coordinating bodies, academic and research institutions, and, standards and professional bodies).

These complex interactions are shown in Figure 3.

Figure 3: Interactions by a spatially enabled government

5 HOW SOME ELEMENTS OF SEG ARE PRESENTLY ASSESSED

There is no research literature at present on assessment frameworks for SEG, the methods that might be used to undertake such an assessment, or the elements of SEG that might be assessed. There are, however, existing assessment methods, and views on future assessment methods for processes and infrastructure required, or closely linked to, SEG. These include assessment frameworks for SDI, ICT and e-Government, and, government policies and programs.

5.1 Assessment of SDI

SDI assessment is comprehensively addressed in Crompvoets et al (2008). In particular, the idea of a multi-view framework to assess SDIs is described in this publication (Grus et al, 2008). A multi-view framework is appropriate given that SDIs can be treated as complex adaptive systems. The strength of the approach lies in its flexibility, its ability to provide a multi-disciplinary view of SDI, and the reduced bias in
assessment results from using the approach. The approach also deepens knowledge of SDI, and may assist in SDI development. The multi-view assessment approach is shown in Figure 4.

**Figure 4: Multi-view SDI assessment framework (from Grus et al, 2008)**

In the concluding chapter of Crompvoets et al (2008), Future Directions for Spatial Data Infrastructure Assessment, the editors of the publication suggest that three critical questions need to be asked before starting the actual assessment:

- The first question concerns the user of the SDI assessment. A policy-maker is interested, and requires, different information from a politician responsible for a SDI. A distinction needs to be made between those operating at the strategic, management or operational level;
- The second question is about what is going to be assessed; and
- Closely related to this is the third question which concerns the level of SDI being assessed.

5.2 **Assessment of ICT and e-Government**


Evaluation methods for eGovernment projects identify strengths, weaknesses, and best practices, for both local and international implementations. Both Hong Kong and Australia have implemented techniques to measure the success of eGovernment
projects. In Hong Kong the eGovernment coordinating office commissioned an opinion survey to obtain user feedback on the design of government Web sites and the provision of eServices. In Australia, the Australian Bureau of Statistics used surveys to measure adoption of ICT in society as a whole. Some of the questions in the surveys were directed at measuring use of government online services, to better understand the demand-side for government. The European Union offers the eEurope Awards which includes three valuation criteria: innovativeness and effective management; practical results; and relevance and transferability. The implications of such awards highlight the importance of setting standards and defining measurable targets for efficient assessment. Effective assessment can determine success or failure of eGovernment projects. The United Nations Global eGovernment survey states that eGovernment measurements should track national progress, identify disparities in access to ICT, move toward an inclusive information society, and support international comparisons. The U.N. global survey also examines governments’ willingness to use eGovernment to improve services to citizens. The survey contributes to the development efforts of the member states by focusing on whether eGovernment impacts the socioeconomic uplift of the people. The survey provides a benchmark of a country’s state of e-readiness (Esteves and Joseph, 2007).

5.3 Assessment of government policies and programs

Evaluation is a well-established practice in the public sector. There is a wealth of literature on evaluation methods and results. Evaluation methods include policy and program evaluation and performance review and audit. Evaluation seeks to determine how well a particular policy, program, structure, project or process is performing against expected outcomes. Evaluation results lead in many cases to modifications and improvements in government activity. Evaluation of public sector activities assists in ensuring accountability of government actions. The process of spatially enabling government, given its necessary use of public sector capacity, is a likely candidate for evaluation. In addition, the process of spatially enabling government may require additional public sector capacity than that presently available, particularly funding. It is now a common requirement in government for a business case, or cost benefit analysis, to accompany submissions for new government funding. Given that some implementations of SEG operate as a public-private partnership, commercial-style business cases may also be a requirement.

6 A POSSIBLE ASSESSMENT FRAMEWORK FOR SEG

Several possible assessment methods might be used to assess a spatially enabled government. They include public sector methods, like policy and program evaluation, and performance review and audit; and non sector-specific methods to assess technology (for example, ICT and e-Government assessment methods, and SDI assessment methods. Some of these methods may need to be modified to accommodate particular elements of spatial enablement (for example, public sector methods do not as a general rule consider questions relating to location knowledge). Given the early stage of implementation of spatial enablement by governments assessment methods are likely to need refinement, particularly refinement based on experience from particular cases of implementation. Formal assessment methods might need to be supplemented with less formal approaches.

Drawing on the linkages shown in Figure 3, it is possible to begin to describe the stakeholders of a government that is spatially enabled, their expectations (as a result of government becoming spatially enabled, and the assessment methods that might be appropriate to test whether these expectations have been met:
• Citizens and businesses. These stakeholders might expect better services from, and better communication with government. An appropriate assessment method in this case might be program evaluation.
• Government politicians might expect that their constituents and the country are better off. Assessment methods in this case might include policy evaluation and less formal approaches;
• Government Ministers accountable for specific policies, or for spatial enablement within their government. These stakeholders might expect improved policy outcomes and an accountable spatial enablement environment. An appropriate assessment method might be policy evaluation in the former case, and performance review and audit in the latter case;
• Government employees. These stakeholders operate at different levels of responsibility and expectations are likely to vary between these levels. Lower level employees might expect improved business processes, and relevant skills in order to be able to perform in a spatially enabled environment; higher level employees might expect effective structural arrangements (including governance); effective linkages between departments within government; effective linkages between their government and sub-national and international governments; and, effective technical systems (including ICT, SDI, and spatial applications. Appropriate assessment methods here include program evaluation, performance review and audit, and technology assessment;
• Sub-national and international governments. These stakeholders might expect improved policy outcomes by the national government, effective links between governments, and, to the extent appropriate, effective technical systems for which they might be responsible. Assessment methods here might include policy evaluation and less formal assessment methods;
• Providers of technology and technical infrastructure. Expectations by government of this group might include effective relationships, and effective service delivery. Assessment methods here include performance review and audit and less formal methods; and, to the extent that it is relevant
• Partners with government in creating a spatially enabled government (for example, academic and research institutions, and specific businesses). These stakeholders might expect effective relationships with government. Performance review and audit, and informal assessment methods might be appropriate in this case.

The stakeholders of a spatially enabled government, in this case a national government, the possible expectations of these stakeholders, and possible assessment methods to test these expectations, are shown in Figure 5.

The above discussion suggests that a framework to assess SEG is likely to involve assessment methods drawn from the public sector, and broader technology assessment methods. A framework to assess SEG is likely to require both formal and informal assessment methods. This suggests a multi-view and multi-discipline approach might need to be taken.

7 FUTURE DIRECTION

This paper suggests that a multi-view framework of assessment be taken for SEG, drawing on public sector and technology sector methods of assessment, and taking formal and informal approaches to assessment.
Further development is required on this multi-view framework of assessment, in particular:

- The conceptual framework of SEG needs to be more completely described and tested;
- The technology assessment frameworks related to SEG, particularly the methods for assessing SDI, needs to be described in a more holistic and integrated way;
- The assessment framework for SEG itself needs to be more completely described, described in a more holistic way, and tested; and
- A toolbox for SEG assessment is needed to facilitate assessment for both high level (strategic) and low level (operational) purposes, and able to be used in both developed and developing countries (for example, the toolbox might be used to answer the questions how well is my government presently spatially, what options are available for me to improve my governments state of enablement, and how would I assess actions I might take to improve enablement).

The growing number of cases of SEG around the world provides a wealth of knowledge to test and improve any assessment framework on SEG.

Finally, developments in assessment frameworks for SEG need to take account of relevant developments in the spatial sciences, informatics and management science; and particularly developments in thinking on the issue of a spatially enabled society.
Figure 5: Stakeholders of a spatially enabled national government, their expectations and assessment methods.

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<thead>
<tr>
<th>Stakeholder</th>
<th>Expectation</th>
<th>Assessment method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Citizens</td>
<td>Better services</td>
<td>Program evaluation</td>
</tr>
<tr>
<td>Businesses</td>
<td>Better communication with government</td>
<td>Program evaluation</td>
</tr>
<tr>
<td>Government parliamentarians</td>
<td>Constituents and the country are better off</td>
<td>Policy evaluation</td>
</tr>
<tr>
<td>Accountable Government Ministers</td>
<td>Better policy outcomes</td>
<td>Policy evaluation</td>
</tr>
<tr>
<td>Government employees</td>
<td>Effective operations</td>
<td>Audit</td>
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<tr>
<td></td>
<td>Better business processes</td>
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<td></td>
<td>Effective structures (including linkages between departments)</td>
<td>Audit</td>
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<td></td>
<td>Effective skills (e.g. competency in the use of location knowledge)</td>
<td>Audit</td>
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<tr>
<td></td>
<td>Effective systems (e.g. ICT, SDI, business systems)</td>
<td>Audit</td>
</tr>
<tr>
<td>Other governments</td>
<td>Better policy outcomes</td>
<td>Policy evaluations</td>
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<td></td>
<td>Effective links between governments</td>
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<td></td>
<td>Effective systems (e.g. ICT, SDI, business systems)</td>
<td>Audit</td>
</tr>
<tr>
<td>Suppliers of products and services</td>
<td>Effective product and service delivery</td>
<td></td>
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<tr>
<td>Partners</td>
<td>Effective relationships</td>
<td>Audit</td>
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<tr>
<td></td>
<td>Effective systems (e.g. ICT, SDI, business systems)</td>
<td>Audit</td>
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