

# Beyond Spatial Enablement: Engaging Government, Industry and Citizens

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## Abstract

In response to challenges at all scales, there is an increasing use of geographic information technologies and spatial data infrastructures to underpin location-based information for better decision-making. Spatial enablement uses the concept of place and location to organise information and processes and is now a ubiquitous part of e-Government and broader government ICT strategies. But for spatial enablement to occur, it needs to be regarded as a concept that permeates all levels of society – government, industry and citizens.

The spatial community needs to make **location, innovation and collaboration** its key priorities to not only realise the vision of spatial enablement, but to move beyond it. Collaboration across levels drives spatial innovation to make better use of the available geo-spatial information and to create new, smart applications to harness, integrate and interpret this data. An enabling platform is key to facilitating delivery of spatial data and services. Establishing new partnerships will bring together communities of practice and enable knowledge sharing to overcome both technical and non-technical issues that still persist in realising spatial enablement.

**Key words:** spatial enablement, spatial data infrastructure, collaboration, government, industry, citizens

## 1. Introduction and Background

As a global community, we continue to witness amazing technological advancements and progress. At the same time, we continue to face unprecedented challenges at multiple scales – the recent earthquake and tsunami in Japan; the widespread flooding in Australia; the ongoing ramifications of the 2009 Global Financial Crisis. These are just some examples of large-scale disasters that have had persistent and long-term consequences on communities.

These challenges will continue to exist and potentially be exacerbated as a result of urbanisation, population growth, the growth of coastal cities, climate change and the increasing interconnectedness of economies. These events underscore the demand for a spatially enabled society. Around the world, the use of geographic information technologies and spatial data infrastructure is becoming increasingly vital in enabling governments, local communities, non-government organisations, the commercial sector, the academic community and ordinary citizens to make progress in addressing many these challenges.

With advancing maturity in the use of spatial information resources, location is emerging as a key facilitator in decision-making and is now commonly regarded as the fourth driver in the decision-making process, complementing the more traditional triple bottom line approach (social, economic and environmental drivers). I note the pressing demands for further innovations, to make better use of the available spatial information, and the drive to create new, smart applications to harness, integrate and interpret spatial data. Effective and efficient geo-information as well as spatial information

infrastructures plays a key role in supporting evidence-based decision-making to facilitate our response to the global agenda and achieving sustainable development. To move forward, there is a need for greater collaboration – forging new partnerships, bringing together communities of practice, sharing knowledge and working together to better prepare for and respond to global challenges.

The notion of spatial enablement, and a spatially enabled society, is a reference to the use of spatial information and technology across all levels of society – government, industry and citizens, to improve decision-making, transparency and increase efficiency. This paper will address the movement of societies to support the increasing use of location-based information in the delivery of services and processes. The paper discusses the concept of spatial enablement and provides examples of different initiatives around the world. Some of these will provide context for the benefits of engaging government, industry and citizens to leverage location information, facilitate collaboration and drive innovation to overcome current challenges in realising spatial enablement. The paper will conclude with some propositions on future trends and directions for moving beyond spatial enablement.

## 2. Spatial Enablement

Spatial enablement is a concept that adds location to existing information and thereby unlocks the wealth of existing knowledge about the land, its legal and economic status, its resources, potential use and hazards. Spatial enablement uses the concept of place and location to organise information and processes and is now a ubiquitous part of e-Government and broader government ICT strategies. It addresses the importance of an enabling platform to facilitate delivery of spatial enablement in government and society. It also highlights the need for connected technologies and connected organisations in order to realise spatial enablement (see Figure 1).

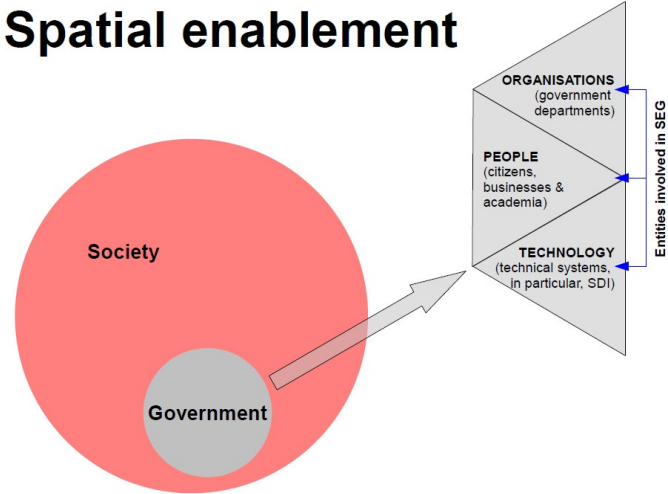


Fig 1: Spatially enabled government (Holland, Rajabifard and Williamson, 2009)

### 2.2 Spatially Enabled Society and Government

A Spatially Enabled Society (SES) is one where location and spatial information are commonly available to citizens and businesses to support innovation by encouraging creativity and product development (Wallace et al., 2006) but also to support and promote e-Democracy.

Spatial enablement contributes to the expansion of consultative and participative government services to the society 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.

For example, spatial enabling mortgage and foreclosure information by linking it with large-scale and more people-relevant information such as the cadastre, which arguably could have played a key role in reducing some of the information asymmetries that contributed to the global financial crisis of 2008 (Bennett et al, 2010). The aggregation of such information at different levels would have facilitated the detection of patterns or clustering phenomena that would otherwise be missed. The spatial representation of such phenomena as an example, can serve important political decision-making processes (see Figure 2).

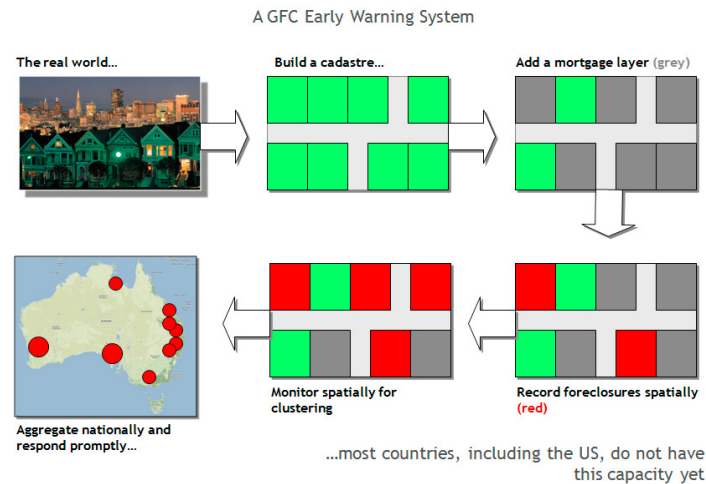


Fig 2. Example of spatial enablement in action.

The concept of SES and inherently, the concept of Spatially Enabled Government (SEG), has gained momentum internationally as jurisdictions begin to recognise the benefits it delivers. SEG is now part of the objectives of governments in many countries, highlighting the importance of spatial information and strategies in policy development and decision-making in the public sector. SEG increasingly operates in a virtual world, but SEG initiatives need to be coupled with real world institutional and structural reforms in the use of spatial information and spatial data infrastructures as an enabling platform.

In this context, Steudler and Rajabifard (2012) provided the following definition to encompass the broad applications of this concept:

*A **spatially enabled society** – including its government – is one that makes use and benefits from a wide array of spatial data, information, and services as a means to organise its land and water related activities. Spatial enablement is a concept that adds location to existing information and thereby unlocks the wealth of existing knowledge about land and water, its legal and economical status, its resources, potential use and hazards. Information on the ownership of land and water is thereby a basic and crucial component to allow for correct decision-making. Such data and information must be available in a free, efficient, and comprehensive way in order to support the sustainable development of society. It therefore needs to be organised in such a way that it can easily be shared, integrated, and analysed to provide the basis for value-added services.*

## 2.3 Key Components

To support this concept, a joint initiative between the International Federation of Surveyors (FIG) and the Global Spatial Data Infrastructure Association (GSDI) identified six core elements, which are

critical for the implementation SES and ensure its successful progression (Stuedler and Rajabifard, 2012). These are:

- a. **Legal framework:** to provide a stable basis for the acquisition, management, and distribution of spatial data and information. SES needs to be based on a legal framework, which takes a whole-of-government approach to spatial data and information, and which enables and supports the broad use of geo-information.
- b. **Common data integration concept:** to facilitate that existing spatial data – from government as well as other sources – respect the common standards in order to ensure interoperability for the benefit of all. It is crucial for SES to have a common data integration concept, which ensures interoperability of data and information and which respects the institutional independence of the different actors.
- c. **Positioning infrastructure:** to provide a common geodetic reference framework in order to enable the integration of spatial data and information. The concept of SES is built upon a set of several infrastructures: the development of those needs to be based on business cases, demonstrating their – mostly long-term – benefits and contributions to the overall goal of sustainable development
- d. **Spatial data infrastructure:** to provide the physical and technical infrastructure for spatial data and information to be shared and distributed. SES needs a spatial data infrastructure that provides the platform for interoperability.
- e. **Landownership information:** to provide the updated and correct documentation on the ownership and tenure of the land, fisheries, and forests, without which spatial planning, monitoring, and sound land development and management cannot take place. SES needs complete information about ownership of land and water resources in order to guarantee their sustainable management and development
- f. **Data and information concepts:** to respect and accommodate the different developments in the acquisition and use of spatial data and information. Crowd-sourced data carry a high potential for impact, which public sector institutions need to learn how to deal with.

Spatial enablement is an evolving concept and there are different views on what constitutes spatial enablement. What we do know is that spatial enablement is not just about developing and using geographic information system (GIS) technologies; we know that the vast majority of the public are users, either knowingly or unknowingly, of spatial information; and we know that a spatially enabled society will demand accurate and timely information about land. Therefore, it essentially requires data, and in particular, services, to be accessible and accurate, well-maintained and sufficiently reliable for use by the majority of society which is not spatially aware. Finally, for spatial enablement to occur, it needs to be regarded as a concept that permeates all levels of society – government, industry and citizens, and its ability to flow through all levels of society will depend primarily on the spatial data infrastructure (SDI) and the land administration system available in the jurisdiction (Williamson et al, 2010a; Williamson et al, 2010b).

### 3. Engaging Government, Industry and Citizens

Collaboration is central to spatial enablement – especially across government, industry and citizens. Such collaboration drives spatial innovation – to make better use of the available spatial information, and the drive to create new, smart applications to harness, integrate and interpret spatial data. Establishing new partnerships will bring together communities of practice, enable knowledge sharing and working together to better prepare for and respond to global challenges.

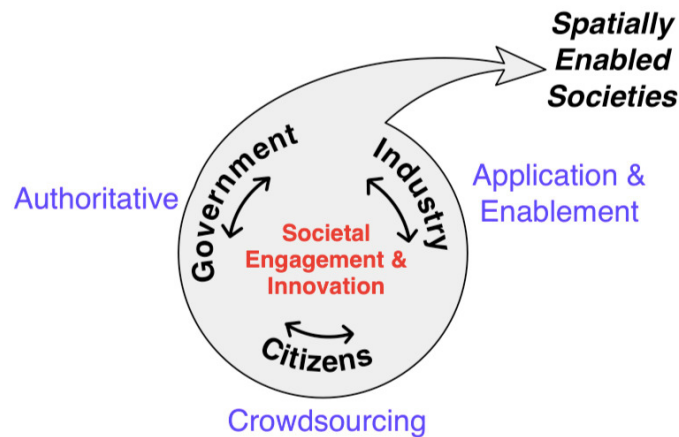


Figure 3. Spatially enabled societies require collaboration between government, industry and citizens.

### 3.1 Engaging Government

The aim to develop spatially enabled governments was a key outcome of the 17th United Nations Cartographic Conference for Asia and the Pacific (UNRCC-AP) and the 12th meeting of the United Nations supported Permanent Committee for GIS Infrastructure for Asia and the Pacific (PCGIAP) in September 2006 in Bangkok, Thailand. Subsequent activities resulted in the definition of Spatially Enabled Government (SEG) as a scenario where “*data, information and related business services with spatial content become ubiquitous in the daily conduct of government agency business and in the efficient and effective delivery of government services*”.

Governments around the world are increasingly acknowledging the benefits of spatial enablement, particularly as this is necessary for achieving e-government. This has resulted in spatial enablement being adopted as a cornerstone for key policy initiatives. Within Australia, this can be seen in the inclusion of the concept of spatial enablement in our national information technology strategy since 2008. Spatial enablement of public information is also a way to improve transparency in government and a way to facilitate public participation – integral to any democratic system.

Governments play a crucial role in spearheading spatial enablement initiatives as these are intrinsically linked to cadastres and land administration (typically government responsibilities). The importance of these two elements reflects the importance of land as a key issue for socio-economic development and sustainable development and the reason that many governments are stimulating growth in the spatial information sector. A prime example here is the governments of Europe and the formation and development of the INSPIRE directive. INSPIRE now legislates policy regarding spatial information management in support of the wider digital agenda for Europe: to deliver sustainable economic and social benefits from a single digital market using fast internet and interoperable objectives. Some examples of implementation of this agenda are the development of the European Land Information Service (EULIS), which is a trans-border portal for purchasing land across Europe, and a move towards developing collaborative relationships. An indication of trends in spatially enabled governments, a recent agreement between Eurogeographics and PSMA in Australia breaks new ground in the conflation and delivery of continental datasets.

Within the Asia Pacific region, the Malaysian government’s vision for spatial enablement is inherent in the development of a broad national strategy to move towards a knowledge-based society. There have been many new initiatives – both spatial and non-spatial – to support access, discovery and use of information. In particular, initiatives are increasingly focused on improving service delivery and strengthening the public sector. From a spatial perspective, a proposed national geospatial act aims to advance policies, clarify responsibilities of the various levels of government and define policies for the dissemination of geospatial information. This is in support of a vision to realise a digital Malaysia for spatial enablement, where all levels of geospatial data and common geocentric datum/framework serves as the basis for all information enabling all levels of government data to be connected.

These various initiatives underscore the growing importance placed by governments on facilitating the availability of accurate and timely data, especially from remote sensing and geospatial sources, to facilitate evidence-based decision-making as well as policy design.

### **3.2 Engaging Industry**

Spatial enablement is a holistic endeavour that requires a multi-sectoral approach. While governments may have led efforts in the past, it is necessary that achieving spatial enablement move beyond being the sole responsibility of government. To deliver benefits to the whole of society, it is necessary to engage industry, who performs important roles as enablers, producers and consumers of spatial information and technology.

In the current fiscal climate, economic limitations drive a desire to maximise returns on investment. Issues of duplication of products and services between spatial data producers within government and solution providers within industry, needs to be addressed through greater collaborative efforts. In Australia, PSMA – an industry organisation, has done so by playing a leading role in the assembly and delivery of national fundamental datasets. PSMA has been crucial in streamlining the interactions and transactions between organisations by providing an essential service as an aggregator and developer of national spatial datasets.

Engagement with industry can also facilitate the adoption of best practices and service delivery. This is especially important in the pursuit of spatially enabled data that is ubiquitous and seamless, and where success in other industries such as the adoption of cloud technology can prove beneficial to current practices.

### **3.3 Engaging Citizens**

The public are now used to spatial information being available on-line and on-demand, a need satisfied by the large, private systems such as Google Earth and Maps, Microsoft Virtual Earth and other applications. Additionally, recent technological developments such as Web 2.0 and ubiquitous location-based services have made it easier for ordinary citizens to become spatially enabled. Just as importantly, these developments have also provided them with tools to contribute to the flow of spatial information through all levels of society.

We have seen the effectiveness of engaging citizens in the contribution of spatial information, most notably in their ability to respond immediately to support information needs in times of disasters. The example of the production of crowd-sourced maps of different jurisdictions, e.g. the construction of a map of Haiti in the wake of the earthquakes in 2010 is notable for its role in facilitating relief efforts – since no coherent map of Haiti existed before the earthquake. The social media, communication and contribution of people in response to different disasters, and extending to include other types of local or global events, showcases the trend and value in engaging citizens.

However, trends in embracing and utilising volunteered information necessarily imply a need to differentiate between authoritative (or the new concept of concept of ‘AAA’ information – Accurate, Authoritative and Assured, to reflect high accuracy data), and volunteered (including crowd-sourced) information sources. Both types of information are important in their own right and provide value towards spatial enablement and the enrichment of societies.

It is exciting to see more instances of collaboration across government, industry and citizens to support the use of location in responding to challenges. For example, in the 2011 floods and tropical cyclone that devastated the state of Queensland in Australia, the Queensland Fire and Rescue Service who were mapping damage and assessment inspections, received technical support from Esri in the United States, who were able view the mapped data in real time through web-based synchronisations over a server hosted with cloud technology (Esri, 2011). It is clear that it is only through the effective engagement of government, industry and citizens that we can hope to overcome some of our current obstacles to realising true spatial enablement.

#### **4. Issues and Challenges**

Currently, the realisation of spatial enablement is still limited and challenged by technical and non-technical issues. Of primary concern, significant institutional issues, both across different organisations and/or jurisdictions and between different levels of government, still prevail. Institutional failure poses a key risk to implementation of spatial enablement as it underpins all other issues. The existence and perpetuation of data silos both within and between organisations poses a real and continuing challenge to spatial enablement. This has downstream effects on the discovery, access, use and sharing of spatial data. Additionally, legal issues often challenge the availability and accessibility of information. In response, there is a growing awareness in many countries of the need to articulate specific access and licensing initiatives to facilitate free or low cost information such as the adoption of Creative Commons.

In terms of technical issues, a lack of clear standards limits the ability of organisations to collaborate and facilitate multi-source data and information. The issue of metadata is also common, as it is often not systematically addressed. Terrestrial and non-terrestrial information continues to remain disconnected – there is a real need to develop a seamless SDI model to bridge the gap between the terrestrial and marine environments: improved connectivity between these datasets will facilitate better decisions regarding sustainable development.

There is also a growing concern that in trying to achieve spatial enablement, we are creating a dependency on spatial data, where other forms of information may otherwise suffice. Investment in geospatial information could be ill spent if the information is not calibrated to meet specific needs, that is, fit-for-purpose, instead of applying template solutions.

#### **5. Conclusion and Future Directions**

The future of spatial enablement, and therefore the realisation of a spatially enabled society incorporating government, industry and citizens, lies in it being a holistic endeavour where spatial and non-spatial data are integrated according to evolving standards and with the SDI providing the enabling platform. Spatial enablement, and the concept of spatially enabled societies, is offering new opportunities for governments and wider society in the use and development of spatial information, but it needs to move beyond the current tendency for the responsibility to achieve spatially enabled societies to lie solely with governments. Spatial enablement that benefits the whole of society will be more readily achieved by increasing involvement from the private sector, and in the same vein, if the surveying and spatial industries start to look toward other industries for best practices in service delivery.

There are some emerging trends in geospatial information, which presents new opportunities for the application of spatial technologies and geographic information. These trends include (but are not limited to):

- location as the fourth element of decision-making;
- differentiating between authoritative and volunteered (including crowdsourced) information, yet recognising the importance and value of both types of information towards spatial enablement and the enrichment of societies;
- changing directions: simple to complex, autonomous to interdependent, spatial ubiquity;
- growing awareness for openness of data e.g. licensing, and resultant improvements in data quality;
- move towards service provision; and
- recognising the difference between spatial enablement and spatial dependency.

In light of these trends, future activities will need to be fit-for-purpose, ubiquitous, transparent and seamless to the user.

There is also a need to consider the developing challenges that are arising from having differing levels of maturity in use and management of geospatial information, and perhaps a need to increase the focus on critical areas that are proving to be challenging. These include:



- improving the appeal of spatial information to attract a broader audience;
- institutional processes to facilitate spatial enablement particularly around information policies, access, and risk management;
- capacity building e.g. research and education, bandwidth;
- standards and licensing as a means to enable and facilitate partnerships; and
- creating a seamless platform.

Even as we begin to think about what the future of spatial enablement may look like, at its heart, the realisation of spatial enablement and spatially enabled societies will always be predicated on six key components: legal framework, data integration abilities, positioning and network infrastructures, and the various data and information principles. These key elements need to be embraced by the established professional communities or face the threat of being taken over by those that better understand the messages of change. As spatial information specialists, it is imperative that we understand the technological changes, developments and possibilities, so that we can convey these messages and requirements to our partners, to political decision-makers, and to society at large.

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## Bio-Professor Abbas Rajabifard

Prof. Rajabifard is Head of the Department of Infrastructure Engineering and Director of the Centre for Spatial Data Infrastructures and Land Administration, both at the University of Melbourne. He is immediate Past-President of Global Spatial Data Infrastructure (GSDI) Association and is an Executive Board member of this Association and was Vice Chair, Spatially Enabled Government Working Group of the UN supported Permanent Committee on GIS Infrastructure for Asia and the Pacific (PCGIAP). Prof Rajabifard has spent his career researching, developing, applying and teaching spatial information management and strategies and also SDIs to deliver benefits to both governments and wider society and is acknowledged as a pioneer in the concept of spatial enablement – using location to facilitate decision making. He has authored/co-authored over 240 publications including 6 books. He has been also consulted widely on spatial data management, SDI, land administration and spatial enablement, to many national government agencies and ministries. He is a frequent keynote speaker at international geospatial conferences, forums and organisations and through his academic and professional activities, tirelessly promotes the surveying and spatial science professions driven in his belief that these professions play an integral role in delivering the vision of a sustainable future.





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