Spatially Enabled society

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The term 'spatially enabled society' describes the emerging cultural and governance revolution offered by pervasive spatial information technologies and spatially equipped citizens. Spatially enabled societies make possible, amongst many other things, sustainable cities, early warning systems e.g. in relation to the global financial crisis, smarter delivery of housing, improved risk management, and better macroeconomic decision making. This article introduces the current international discussion around the evolving concept of 'spatially enabled society'. The concept is not about managing spatial information - it is about managing information, or governing society, spatially.

Introduction

Spatially enabled societies represent the realization of the promises offered by building spatial data infrastructures (SDIs) and reforming land administration systems. These building blocks, established over decades, make possible spatially enabled societies. Without tools for managing metadata, building complete national cadastres, modelling and integrating the 3rd dimension, and much other foundational work, spatially enabled societies cannot emerge. (Williamson et al, 2011).

The term 'spatially enabled society' attempts to describe an emerging cultural and governance revolution: pervasive spatial information technologies and spatially equipped citizens are changing the way economies, people, and environments are managed and organized. Economic wealth, social stability and environmental protection can be facilitated through the development of spatial information products and services created by all levels of society including governments, the business sector, and citizens (Rajabifard et al, 2010).

The concept of the 'spatially enabled society' is still unformed. Emerging literature, practical examples, and international associations (such as the International Federation of Surveyors, FIG and the Global Spatial Data Infrastructures Association, GSDI) continue to provide hints as to key characteristics and features; however, a shared empirically tested view is still forming.

In an international context the evolution of the concept 'spatially enabled society' has been driven by the Centre of Spatial Data Infrastructures and Land Administration at the University of Melbourne. This article draws from a recent paper presented by the Centre at the FIG working Week in Marrakech, May 2011 (Williamson et al, 2011). Also, extracts from Rajabifard et al (2010), one of the most recent publications on spatially enabled societies, and Williamson et al (2010), one of most recent publications on land administration systems, are used throughout the article to inform the discussion.

Place matters

"Place matters! Everything happens somewhere. If we can understand more about the nature of "place" where things happen, and the impact on the people and assets on that location, we can plan better, manage risk better, and use our resources better." (Communities and Local Government, 2008). This statement can be seen as a justification of spatially enabled government that is achieved when governments use place as the key means of organising their activities in addition to information, and when location and spatial information are available to citizens and businesses to encourage creativity.

New web-based distribution concepts such as Google Earth provide user friendly information in a very accessible way. We should consider the option where spatial data from

such concepts are merged with "hard-core" built and natural environment data. This unleashes the power of both technologies in relation to emergency response, taxation assessment, environmental monitoring and conservation, economic planning and assessment, social services planning, infrastructure planning, etc. This also include design and implementation of a suitable service oriented IT-architecture for organising spatial information that can improve the communication between administrative systems and also establish more reliable data based on the use of the original data instead of copies (Enemark, 2010).

A spatially enabled government organises its business and processes around "place" based technologies, as distinct from using maps, visuals, and web-enablement. This relates to institutional challenges with a range of stakeholder interests including ministries, local authorities; utilities; and also civil society interests such as businesses and citizens. Creating awareness of the benefits of developing a shared platform for integrated land information management takes time.

National Mapping/Cadastral Agencies have a key role to play in this regard in terms of coordinating the interests and potential of various stakeholders.

National land administration systems should capitalize on technology development. Modern land administration systems can play a key role in e-government and e-democracy. Spatial technology can break down historic institutional silos through data sharing and interoperability within an SDI environment. Virtual jurisdictions, cities, and societies offer exciting options and challenges. The power of locati-
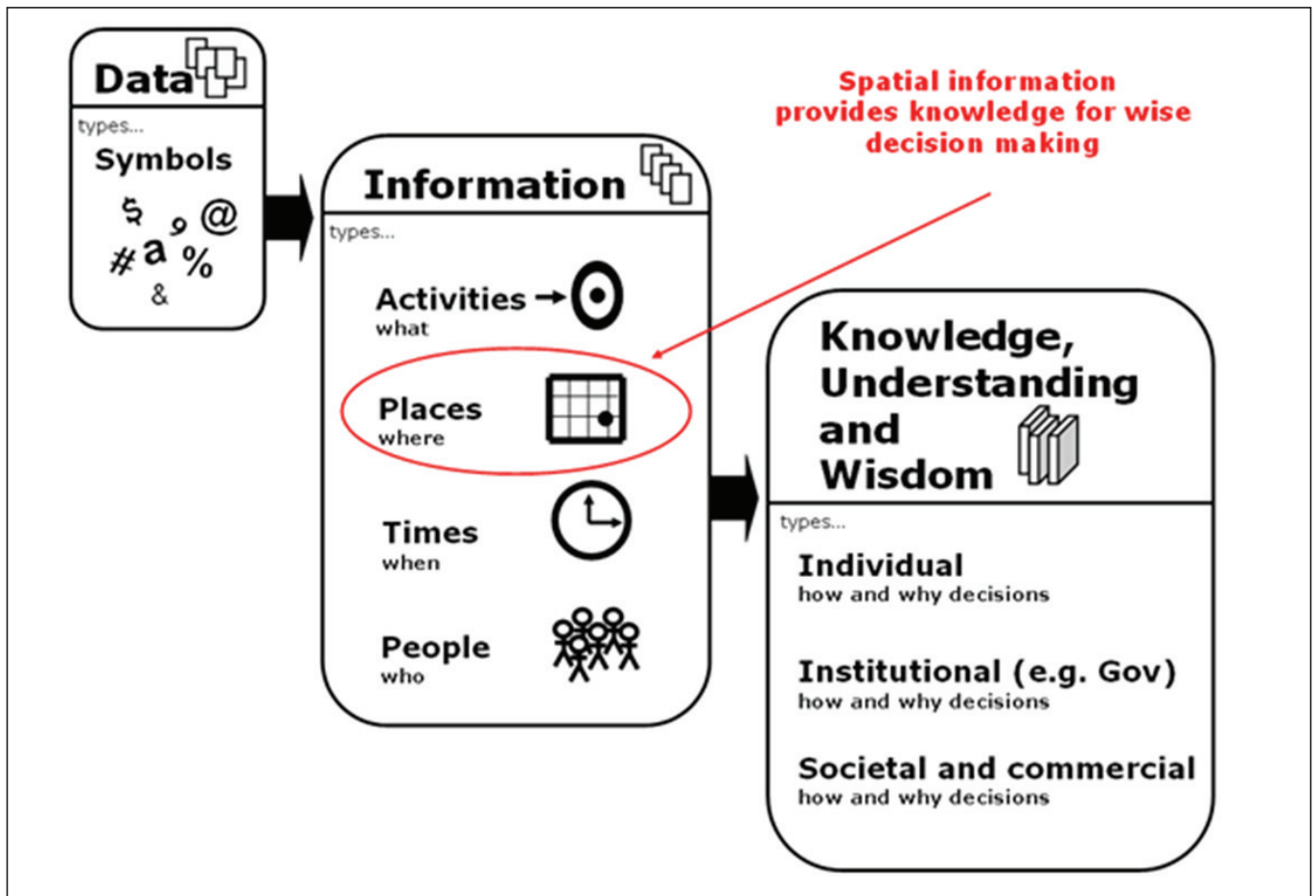

Figure 1. Place as a sorting system to improve manageability (Wallace, 2007).

on and place to revolutionize the way governments do business through spatial enablement is also opening up. Spatial technology is at the heart of this new land administration system evolution and the range of relevant land administration tools now being developed (Williamson et al, 2010).

The power of the visual over the verbal both reduces the amount of information and organises it into "brain-ready" material. For the spatially informed, this is not "a picture tells a thousand words", but a "map condenses thousands of spreadsheets". The result of the conversion chain of data into information and then into knowledge to deliver wise and informed decisions is a vast increase in manageability. It is the vast improvement in manageability of business processes that is the attraction of spatial enablement of the non-spatial government processes. These processes can then influence the capacity of business to perform commercial functions, and people in general to perform their activities. This story is told graphically and in simple terms in Figure 1.

SDI as a spatially enabling platform
Governments can be regarded as spatially enabled 'where location and spatial information are regarded as common goods made available to citizens and businesses to encourage creativity and product development'. (Wallace et al, 2006). Under such circumstances the vast majority of the public are users, either knowingly or unknowingly, of spatial information. They generally lack an awareness of spatial concepts and principles while many are willing to transparently embrace spatially enabled infrastructures such as Google Earth.

As a result spatially enabled governments present a number of important challenges for the small elite of spatially aware professionals who have so far dominated the development of the spatial related fields of geography, land administration and environmental science, and particularly those
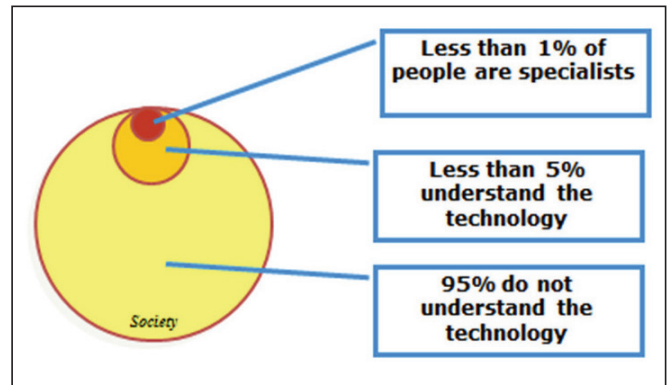

Figure 2. Level of spatial data user and expertise in society.

who have an in-depth scientific understanding of spatial concepts. The key challenge is how to develop a spatial data infrastructure (SDI) that will provide an enabling platform in a transparent manner that will serve the majority of society who are not spatially aware as visualized in Figure 2 (Masser et al, 2007).

The creation of economic wealth, social stability and environmental protection can be achieved through the development of products and services based on spatial information collected by all levels of government. These objectives can be facilitated through the development of a spatially enabled government and society, where location and spatial information are regarded as common goods made available to citizens and businesses to encourage creativity and product development. This requires data and services to be accessible and accurate, well-maintained and sufficiently reliable for use by the majority of society which is not spatially aware.

In this regard, in modern society, spatial information is an enabling technology or an infrastructure to facilitate decision making. Spatial information can be a unifying medium in which linking solutions to location and accommodating the user demand that has shifted to seeking improved services and delivery tools. This will be achieved by creating an environment so that we can locate, connect and deliver as illustrated in Figure 3.
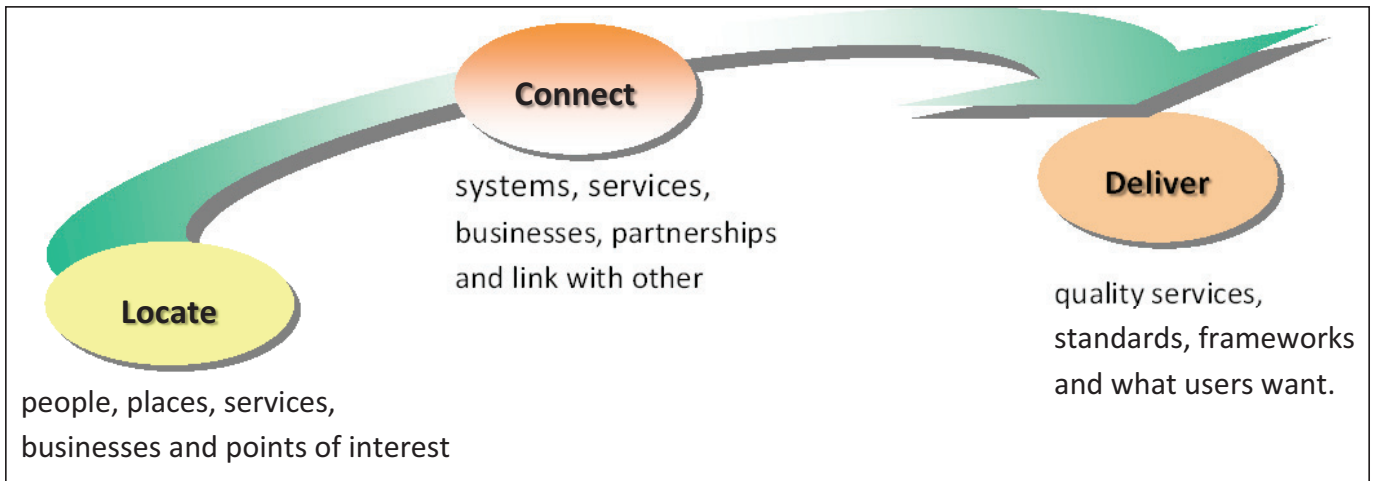
Figure 3. Locate, connect and deliver spatial information (Rajabifard, 2010).

With this in mind and in order to better manage and utilise spatial data assets, many countries around the world are developing SDI as a way to facilitate data management and data sharing and utilise their spatial data assets as this information is one of the most critical elements underpinning decision making for many disciplines. The steps to develop an SDI model vary, depending on a country's background and needs.

However, it is important that countries develop and follow a roadmap for SDI implementation. In the European context this is organized through procedures for implementation of the INSPIRE directive at national level.

Development of SDIs have played a major role in helping to form the concept of a spatially enabled platform. Initially SDIs were implemented as a mechanism to facilitate access and sharing of spatial data hosted in distributed GISs. Users however now require precise spatial information in real time about real world objects and the ability to develop and implement cross-jurisdictional and inter-agency solutions to priorities such as emergency management, natural resource management, water rights and animal, pest and disease control.

In order to achieve this, the concept of an SDI is moving to a new business paradigm, where SDI is emerging as an enabling platform to promote the partnership of spatial information organisations (public/private) to provide access to a wider scope of data and services, of size and complexity that is beyond their individual capacity. SDI as an enabling platform can be viewed as an infrastructure linking people to data through linking data users and providers on the basis of the common goal of data sharing – and thereby paving the way towards spatially enabled society.

The emergence of spatially enabled societies

The term 'spatially enabled society' emerged in the mid 2000s as new spatial technologies began pervading mainstream user groups: in-car navigation systems, GPS enabled mobile devices, and various digital globes (e.g. Google Earth) quickly gained traction and popularity amongst the wider community. Combined with the web environment, the communication of information amongst agencies and citizens could be vastly improved (Rajabifard et al, 2010). This new spatial pervasiveness led the research community to define the emerging cultural phenomenon as 'spatial enablement'.

In the literature, Wallace et al, 2006) first describe spatially enabled societies as those 'where location and spatial information are regarded as common goods made avai-

lable to citizens and businesses to encourage creativity and product development'. Locations were presented in a variety of ways such as address, maps, coordinates, landmarks, and increasingly 'places'.

Another recurring characteristic of spatial enablement was that existing spatial and land administration organizations needed to readjust their focus. Spatial tools and information would no longer be sequestered in mapping agencies where they were originally created (Rajabifard et al, 2010). The previous focus of these organizations on 'managing spatial information' needed to shift to a focus on assisting society to manage itself spatially. In-line with the mantra of social-informatics, spatial enablement was about more than just developing and using geographic information systems (GIS). It was a concept that permeated and changed the whole of government and society, drawing heavily upon the spatial data infrastructures within a jurisdiction (Williamson et al, 2010).

In summary, descriptions of spatially enabled societies are still undeveloped and continue to evolve. Despite this inadequacy, there is firm agreement that spatially enabled societies are emerging and will continue to do so.

Practical applications
Various approaches for achieving spatial enablement in practice are evident: hierarchical systems, market mechanisms, or networked approaches provide examples. Molen (2007) argues that three key participants are evident in spatially enabled societies: government, data supplier sectors, and society as a whole. The roles and contributions of these participants are described. Specifically, it is suggested that it is the responsibility of the government to facilitate the underlying spatial data infrastructure. The underlying reason here is to safeguard the availability and access of spatial information for greater society. Further, as the spatially enabled society evolves government should bear the responsibility for organizing the availability and access to information and respond to the needs of society.

The debate continues as to whether hierarchical, market, or network approaches are best used for designing and assessing SDIs. Meanwhile, regardless of the underlying infrastructure, the number and types of spatially enabled applications continues to grow. For example, geographically referenced statistics can be used to monitor activity within an area: health, wealth, and population distributions can be collected, aggregated and analysed spatially. Spatially enabled data is becoming an increasingly critical resource for planning and decision making in disciplines including epidemiology, economics and environmental management. Analysts are being required to integrate growing numbers of information sources to feed into increasingly sophisticated applications (Rajabifard et al, 2010).

Buhler and Cowen (2010) provide another example of how spatial enablement could be utilized in the government realm. The proposed application here was an early warning system for economic events such as the global financial crisis (GFC). Bennett et al (2011) provide a simple illustration of such an application in practice (Figure 4). Information from land administration systems, such as land registry data relating to mortgages and ownership, could be spatially enabled and used to deliver a visual snapshot of the health of a nation´s property market.

Another example of spatial enablement in action is the use of Google Maps or Bing Maps to allow mash-up capacity to facilitate simple, and sometimes complex, service provision. There are many instances from the business and citizen sector using spatial mash-up technologies in providing user friendly services or organizing private and business activities (Rajabifard et al, 2010). Spatial systems now combine information from other services and convert queri-
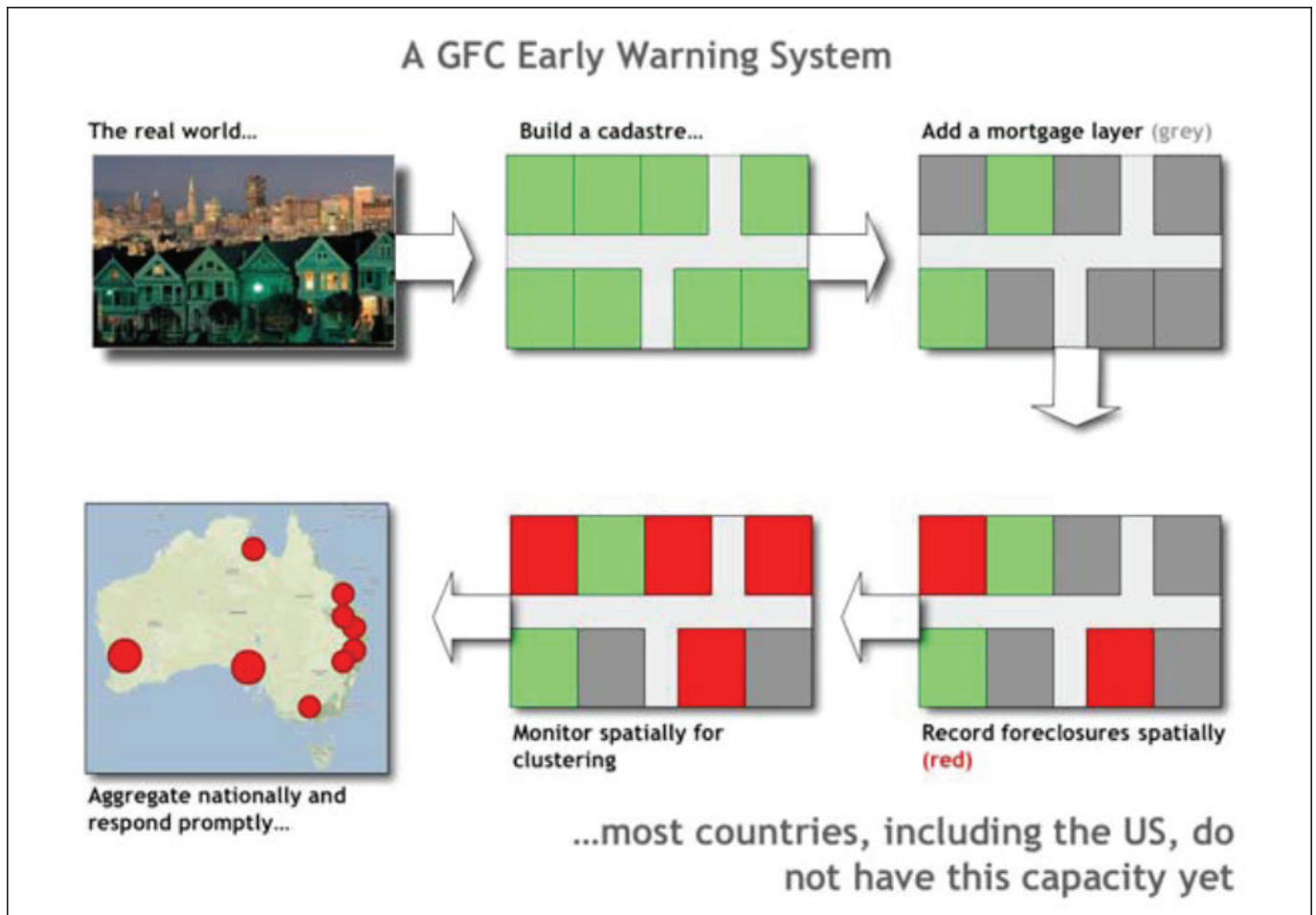
Figure 4. A spatially enabled GFC (Global Financial Crisis) early warning system (Bennett et al, 2011).

es into much more user-friendly results. For example, finding properties for sale is much more convenient by combining buyers' preferences and presenting final results in an easy to comprehend visual (map) format.

In summary, the number and range of spatial applications is growing exponentially within all sectors of society. While some aggregation in the numbers of applications will occur in the coming years, the quality of the applications, if not the associated data, will continue to improve. Not explicitly mentioned above is the rapid increase in volunteered geographic information (VGI) and associated applications. This swathe of non-authoritative spatial information is challenging traditional notions of SDIs (Jackson et al, 2010), but at the same time is expediting the delivery of spatial enablement across society. Attention is now given to other future directions and emerging challenges in the realm of spatial enablement.

Future directions
It is important to acknowledge that spatial enablement cannot emerge without supporting infrastructure. The understated, non-visible nature of this infrastructure often means it is taken for granted. Spatial enablement cannot hope to be achieved without some form of coordinated spatial data infrastructures (SDIs) and reformed land administration system. These managing metadata, building complete national digital cadastres, modelling and building blocks, established over decades, make possible spatially enabled societies. The importance of promoting these building blocks is a challenge for the international spatial community. In particular the Global Spatial Data Infrastructure (GSDI) associ-

ation and the International Federation of Surveyors (FIG) are undertaking work programs to meet this challenge.

Along with the need for awareness and maintenance of existing spatial infrastructures a number of other challenges are evident. First, a long-term view is required: the development of a spatially enabled government and society is ongoing and multi-disciplinary. Jurisdictions will need to work together over the long-term if the vision is to become reality (Rajabifard et al, 2010). Overcoming the political and financial impediments to implementing long-term visions needs further consideration. Second, achieving spatial enablement also requires multidisciplinary approaches to research and governance. A wide range of experiences and disciplines from surveying and mapping, land administration, GIS, information and communications technology, computer science, legal and public administration, economics and many more is required. Finally, there is a need to develop institutional practices to make existing and future technology more effective. Research has found that very few jurisdictions have developed a framework for establishing a spatial infrastructure that addresses comprehensively operational, organisational and legal issues (Rajabifard et al, 2010).

In summary, future directions associated with realizing spatially enabled societies should include a focus on creating awareness of the importance of maintaining existing spatial and land infrastructures, promoting a long-term approach across government, ensuring multidisciplinary groups to work together with respect to SDI design, and developing comprehensive institutional practices for establishing spatial infrastructures.

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