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UNDERSTANDING INTER-ORGANIZATIONAL COLLABORATION AND PARTNERSHIPS IN THE DEVELOPMENT OF NATIONAL SDI

Abstract: The importance of spatial information is fast being recognized by governments as essential in supporting a country's economic, social and environmental interests. Demand for high-quality spatially related information that is complete, up-to-date, interoperable and integratable is increasing with impetus for managing widespread, long- and short-term disaster events, domestic security, environmental degradation and the need for improved community preparedness as a nation. The growth of spatial data infrastructures (SDIs) at all levels of government is reliant on collaboration both within and between jurisdictions and across the private sector and involves a multitude of users and stakeholders. Much effort is being reported globally towards National SDI development. However, our understanding of the collaboration and partnerships that contribute to building these SDIs is still relatively poor.

Whilst much literature exists on SDI initiatives, advances in SDI components, data sharing, and how to structure and manage GIS-based projects, little contribution has been made to the nature of the interactions between the various organizations and stakeholders. Further, National SDI initiatives have largely concentrated on lead agencies rather than the underlying states or provinces, which in some federated countries either underpin the National initiative or develop SDI independently.

This paper will explore current understanding of collaboration and partnership arrangements and will look at National SDI initiatives in Australia to explore these issues. The paper argues that with a matured understanding of the nature of collaboration, practitioners can better interact to form the long-lasting partnerships required to underpin National SDI development.

Keywords: National SDI, collaboration and partnerships, organizational interaction.

INTRODUCTION

Spatial information is rapidly being recognized by governments as essential in supporting the economic, social and environmental interests of a nation. Increasing impetus for managing widespread, long- and short-term disaster events, domestic security, environmental degradation and the need for improved community preparedness is driving demand for high-quality spatially related information that is complete, up-to-date, interoperable and integratable in the required format at the required time. Governments are striving to better manage their spatial data activities and resources to meet the needs of the community.

Spatial Data Infrastructure (SDI) is recognized as a cohesive framework for the policies, standards, technology and procedures that support the more efficient and effective use, management and production of spatial data for a community. SDI involves the users and providers of spatial information and is more than a product or collection of datasets (Williamson et al. 2003). SDI is about 'access' to data and reducing duplication of effort and expense. A nation's SDI is acknowledged as an important economic resource and an essential base for sustainable development of modern society (Wiberg 2002). In countries that are a federation of states such as the United States of America, Canada and Australia, SDI activities are spread across and within three levels of Government, the private sector, non-profit organizations, academia and the community. Furthermore, the responsibility for data collection or management is not wholly vested with a single agency, administrative level or sector, which can impede national initiatives.

This paper will explore current understanding of collaboration and partnership arrangements and will look at National SDI initiatives in Australia to explore these issues. This paper argues that a better understanding of the nature of collaboration that supports National SDI development will enable practitioners and administrators of spatial information to implement this type of infrastructure into the future. The paper will also highlight new research being conducted by the Centre for Spatial Data Infrastructures and Land Administration at the University of Melbourne.

COLLABORATION IN SDI

In approaching a study of the complex partnerships between multiple agencies (both public and private), across multiple jurisdictions and administrative levels, it is important to consider the extensive range of literature that exists on relationships, collaborations, cooperation and competition between organizations. The literature within the spatial information and GIS fields explore data-sharing arrangements (Onsrud & Rushton 1995), organizational management and complexity (Huxhold & Levinsohn 1995), multi-participatory projects and project-based partnerships (Grant & Roeberge 2001; Jacoby et al. 2002; Masser 1998; Mooney & Grant 1997). Whilst this literature is useful for understanding advances in spatial information management and how to structure and manage GIS-based projects, little contribution is made to the nature of partnerships, especially when the interaction is competitive and cooperation is maintained. Further, there is little work on how to forge relationships between the organizations or how to manage their ongoing operational and financial sustainability.

Several recent SDI studies have also concentrated on related problems involving organizational interactions. Montalvo (2000) in a study of spatial data sharing in South Africa undertook a comprehensive review of GIS literature to arrive at a range of determinants of the willingness of organizations to share spatial data. Giff & Coleman (2003) in an analysis of funding models for SDI note the potential to fund components of SDI through a range of public/private partnerships. This paper aims to reinforce that while

spatial data sharing is important in building SDI, many other forms of collaboration between organizations can occur for a variety of motives such as sharing costs, skills or knowledge. In terms of National SDI, where the spatial activities and needs of stakeholders are so varied, it is expected that development is underpinned by an array of different relationships.

GIS Perspective

The uptake of GIS throughout the past two decades came with the realisation that GIS is as much a function of management and institutional issues as of technology alone. This has led to much discussion on how to access spatial data, how to ensure currency and how to obtain it when needed (Huxhold & Levinsohn 1995). Most GIS initiatives are project and/or data orientated and do not provide a useful framework for understanding the institutional culture of data sharing. Selected author perspectives from Onsrud & Rushton (1995) will be examined as a sample of the GIS related discussion of data sharing arrangements.

Pinto & Onsrud (1995) identified that the continued inability of various public agencies at federal, state and local levels to develop collaborative arrangements restricted the ability of agencies to effectively share spatial information, integrate systems and constrained the widespread use of GIS. This resulted in extensive duplication of spatial information systems and services at different levels. Others repeat the institutional theme, such as Craig (1995) who describes 'institutional inertia' as the overriding reason why data sharing is restricted. He points to the mission and mandates of organizations that guide their existence and day-to-day activity, as precluding possibilities for sharing and cooperation. Overcoming organizational boundaries is a message repeated by Pinto & Onsrud (1995) and Obermeyer (1995), where Obermeyer argues that inter-organizational information sharing is achieved through a framework of inter-organizational alliances, grown from negotiation between relative equals.

Kevany (1995) in an attempt to empirically quantify sharing environments provides a useful framework of collaboration issues for consideration. Although the detail of the approach is beyond the scope of this paper, the issues provide areas for further analysis to determine the factors and relationships affecting data sharing and other collaboration forms and are summarised in Table 1.

TABLE 1. TABLE OF DATA SHARING ISSUES AND DESCRIPTION OF FACTORS (Kevany, 1995: p.76, Adapted)

<i>Issue</i>	<i>Description of factors</i>
Sharing Classes	<ul style="list-style-type: none"> • Classes of sharing arrangements, data, resources, skills • Access to a common dataset by multiple organizations • Copying separate datasets for each organization • Sale or purchase of data by an organization
Environment	<ul style="list-style-type: none"> • Number of organizations involved • Organizational goals/mission • Organizational relationships, current and historic • GIS specific (technical) relationships • Control of information, custodianship, centralised or distributed or ad hoc • Growth rate and rate of development, the need and benefits of sharing with respect to development rate in an area • Leadership/politics, local support, partisan or non-partisan, will support impede sharing
Need	<ul style="list-style-type: none"> • Adequacy of internal data and resources • Data of another organization is needed • Need that can best be developed and maintained jointly • Level of dependence from sharer perspective

Opportunity	<ul style="list-style-type: none"> • Organization(s) have a need for data: sharing may be greatly facilitated if organizations already maintain data that is required by others • Organizations(s) have a need for resources: the sharing of maintenance and development costs is the most effective means of establishing a successful sharing environment
Willingness	<ul style="list-style-type: none"> • Organization that own data, offer or a willing to share • Organization offers to share or is willing to share cost of data development/maintenance • Level of dependence from lead organization perspective: the level of perceived dependence of user organizations, may encourage the lead agency to facilitate sharing
Incentive	<ul style="list-style-type: none"> • Government program, policy or regulations that encourage or require sharing • Recognition of the value of sharing data: management recognize the value of sharing for cost reduction, improved availability, the sharing environment will be improved. Sharing tied to program funding or performance.
Impediments	<ul style="list-style-type: none"> • Real or perceived requirement for confidentiality • Incompatibility in the definition, specifications or structure of available data: the cost of redefinition, translation or modification could exceed value of sharing the data
Technical Capability	<ul style="list-style-type: none"> • Basis for sharing will facilitate or impede sharing: range from a formal detailed agreement to informal working relationship or ad hoc interaction. • Level of planning • Capacity and capability of organizations to support data sharing • Usefulness of technical specifications
Resources	<ul style="list-style-type: none"> • Funding source will determine the level of data sharing: whether funded by the lead agency, equitable contributions across organizations, payment for fees or for information provided or no payment for shared data • Data or source materials are available for shared data • Service area size in determining conditions of sharing: such as the area in square kilometres, number of parcels, population size

Azad & Wiggins (1995) document a simple typology of three spatial database sharing arrangements to highlight the 'ideal' arrangement termed multi-participant GIS. Type 1: One-way provision - An organization is the provider of spatial data for a nominal charge to other organizations, or provision for a one-off project where maintenance is not an issue. Type 2: One-way provision moderated by user demand - An organization is the provider of spatial data with universal value to other organizations. The continued maintenance and upgrade is dependent on users contributing to expenses and their requirement to demonstrate the usefulness to the provider agency. Type 3: Two-way mutual provision - Several organizations in collaboration undertake the development and maintenance of spatial data by sharing costs and resources in order to minimise duplication. The success of the two-way collaborative effort is dependent on the mutual consent of participant organizations.


Organization and Collaboration Management Perspective

Other schools of thought were also considered to contrast and possibly enrich knowledge in the spatial and GIS fields. A review of organization and collaboration management results in many and varied schools of thought (Axelrod 1984; Axelrod 1997; Child & Faulkner 1998; Lorange & Roos 1992). The main areas of literature comprise economics, game theory, collaborative theory, cooperative strategy, strategic management, joint ventures, strategic alliances and organizational behaviour (Child & Faulkner 1998). It is anticipated that the introduction of organization and collaboration management literature will provide insight to the nature of collaboration and management of partnerships in the development of SDI.

A vast range of definitions for collaboration exist, each are dependent on the context and the author perspective. Lawrence et al. (2002) define collaboration as a cooperative, inter-organizational relationship that is negotiated on an ongoing communicative basis

independent of market or hierarchical mechanisms for control. Cousins' (2002) argues that partnership relationships do not exist, referring to the range of collaborative relationships, all of which are competitive. This paper builds on the definition by Lawrence et al. (2002) to consider the broad range of collaboration forms: informal, formal, partnership, consortia, coalition, joint venture, alliance, networks and associations. The term partnership is used commonly across the spatial information field in the sense of organizations working together. A matured definition of partnership is adopted throughout this paper to denote a formal-collaboration, underpinned by binding agreements, contracts or legislation. Table 2 charts various types of collaboration from the economic and strategic management theory perspectives to collaboration in the SDI literature—against the level of integration of organizations: from highly integrated formal arrangements (hierarchically ordered) to independent or ad hoc interactions (open market).

TABLE 2. TYPES OF COLLABORATION AND LEVEL OF INTEGRATION FROM THREE PERSPECTIVES (Lorange & Roos 1992; Child & Faulkner 1998, Adapted).

Integration  Independence	Hierarchy		
	<i>SDI Theory</i>	<i>Economic Theory</i>	<i>Strategic Management Theory</i>
	Registered business, Central Regulatory Authority, Departmental restructure/merger	Mergers and Acquisitions	Strategic Alliance
	Registered business of collective organizations, Central council or body funded by member organizations	Joint Ownership	Virtual Organization, Alliance is effectively a new Organization
	Partnership for mutual benefit, Formal agreement, contract, legislated	Joint Venture	Dominated Network, Central Organization
	Formal Collaboration, SLA, MOU etc.	Formal Cooperative Venture	Unilateral Agreements
	Informal Collaboration, 'Getting the job done'	Informal Cooperative Venture	Equal-Partner Networks
	Markets		

Even within the organizational and collaborative literature, there is no unified approach to understanding collaboration and partnering between organizations. Child & Faulkner (1998: p.17) remark that 'one looks in vain for a unified theory or approach to provide the basis for understanding cooperative strategy'. In the absence of a unified strategy for forging cooperation or managing a partnership, the review of the various schools of thought across disciplines does yield a broader understanding of the nature of collaboration and enables comparison of methods and perspectives.

NATIONAL SDI AND COLLABORATION WITHIN AUSTRALIA

National SDI can be considered as infrastructure that meets the spatial information needs of a nation. Ryttersgaard (2001) describes a framework for the policies, standards and procedures under which organizations and technologies interact to foster more

efficient use, management and production of spatial data. National SDI is a framework that engages spatial resources and activities of all levels of government, industry, academia and the community within a country. National SDI has evolved differently in many countries, with SDI activities reported at different stages and pace of development. At present, 120 of the 192 countries in the world are working on National SDI initiatives geared towards creating an efficient environment for the access of spatial data (Crompvoets & Bregt 2003: p.43).

In countries that are a federation of states, governance is spread across a three-tier hierarchy of federal, state (territory or province) and local governments. In addition, the private sector and the community are also important stakeholders and contributors of SDI, which in the past has largely been the domain of the public sector. In terms of a country's spatial resources and activities, the responsibility may be distributed across and between levels of government and government agencies. Hence, a national fundamental dataset could be a single dataset of national coverage managed by a federal agency or the collective sum of data sets at a lower level. Similarly, the collective of spatial data activities at lower levels may underpin initiatives at a higher level. To explore these issues this paper will look at the Australian situation in a bid to understand the actors and the potential collaboration required to progress National SDI development.

An Overview of Australia

Australia in land area is the sixth largest nation after Russia, Canada, China, United States of America and Brazil. However, it has a relatively small resident population of over 19 million people (ABS 2003). Australia is the only nation to govern an entire continent. Since proclamation in 1901, the Commonwealth of Australia has maintained a federation of six states and two territories. Table 3 provides an overview of the activities and functions associated with each level of government, the predominant source of revenue, land area managed and an indication of scale of spatial data used or produced.

TABLE 3. OVERVIEW OF GOVERNMENT ACTIVITIES IN AUSTRALIA: LOCAL, STATE AND FEDERAL (ABS 2003).

Jurisdiction	Federal	State / Territory	Local
Key Activities and Functions	Defence, Post, Census, Foreign Trade, Immigration	Education, Transport, Health, Natural Resources, Land Administration, Policing, Emergency Services, Utilities, Main Roads	Local Planning, Community Services, Water and Sewerage, Garbage, Local Roads, Fire Services
No. of Governments	1 Commonwealth	6 States and 2 Territories	687 (≈ 80 to 150 per State/Territory)
Primary Taxation (Revenue)	Income, Trade, Goods and Services	Land Registration and Transfer, Payroll	Property / Rates
Land Area	Large (Australia 7.7M Km ²)	Medium to Large (upto2.5M Km ²)	Small to Medium (various)
Scale of Spatial Data	Small	Medium to High	Large

Australia's individual States and Territories (with some minor variations) assume responsibility for land administration functions, which produce key fundamental spatial information such as cadastre, road networks and topographic mapping. The federal and local levels also collect and maintain large amounts of spatial information in performing

their respective functions. Likewise the private sector collects enormous amounts of spatial information, which may be required for public needs.

Administration of SDI in Australia

Australia's Commonwealth, State and Territory governments have responded to this growing need to coordinate the collection and transfer of land related information between the different government levels through lead agencies established to implement the Australian Spatial Data Infrastructure (ASDI) (Clarke et al. 2003).

There are three key bodies providing leadership for spatial information and various elements of SDI development at the national level in Australia together with Australia's eight state and territory governments and the Commonwealth Government.

- Australia New Zealand Land Information Council (ANZLIC)
- Intergovernmental Committee on Surveying and Mapping (ICSM)
- PSMA Australia Ltd. (PSMA)

ANZLIC is the peak intergovernmental council for spatial information in Australia and New Zealand (see <http://www.anzlic.org.au/>) (ANZLIC 2003). An important feature of ANZLIC is that it represents an extensive community of coordination arrangements in the public sector. ANZLIC comprises ten members representing the Australian Government, the New Zealand Government and each of the State and Territory governments of Australia. A key concept of the Council is that each member represents a spatial information coordinating structure for whole-of-government within their jurisdiction. Some jurisdictions have formalised these arrangements by creating spatial information coordinating bodies such as the:

- Western Australian Land Information System (WALIS)
<http://www.walis.wa.gov.au/>
- Queensland Spatial Information Infrastructure Council (QSIIC)
<http://www.qsiis.qld.gov.au/>
- Commonwealth Office of Spatial Data Management (OSDM)
<http://www.osdm.gov.au/>

ICSM undertakes the development of national geodetic, topographic and cadastral standards and reports to ANZLIC. PSMA is a national consortium of all federal and state public sector mapping agencies and develops national spatial datasets by integrating jurisdictional datasets. Both PSMA and ICSM are represented on ANZLIC (Clarke et al. 2003). ANZLIC is also affiliated with regional SDI coordination bodies that support the development of the ASDI and its contribution as a component of regional and global SDI initiatives. ANZLIC's (2003) vision for the ASDI is for 'Australia's spatially referenced data, products and services [to be] available and accessible to all users'. To facilitate this access it is critical that organizations begin to collaborate to ensure that effective data sharing and access arrangements are put in place.

CURRENT RESEARCH

Research under way at the Centre for Spatial Data Infrastructures and Land Administration at the University of Melbourne is focussing on inter-organizational collaboration and partnerships in the development of National SDI within federated countries. The study aims to develop a methodology to facilitate the mapping of National SDI partnerships based on existing spatial industry alliances in order to better understand the evolving SDI concept.

The study will investigate public and private organizations that use and/or provide spatial or land related information in several Australian jurisdictions including New South Wales, Queensland, Western Australia, Victoria and the Commonwealth to identify drivers and barriers to data and resource sharing and to model these interactions across Australia. The Australian study involves qualitative research techniques (Maxwell 1996, Miles & Huberman 1984; Strauss 1987) comprising in-person interviews and questionnaire survey of stakeholder organizations and their staff at various levels, the results of which will contribute to model development. Interviews and site visits are conducted to gain insight to the way each organization interacts with others, their business processes and activities, and to discuss technical issues. The questionnaire tests the research hypothesis that collaboration between federal, state and territory and local governments and the private sector underpins National SDI development within countries that are a federation of states. The questionnaire also assists in documenting the different methods of interaction and confirms the presence of factors identified in the literature.

The research aim of the study is to develop a methodology to describe and map the partnerships and complex nature of National SDI in federated countries through:

- Documenting the complex and dynamic, intra- and inter-jurisdictional nature of existing partnerships contributing to NSDI development in Australia;
- Developing a methodology to map NSDI partnerships in accordance with appropriate principles of collaborative theory;
- Determining critical factors that advance or limit NSDI development.

The methodology prepared for Australia to map collaboration will be tested against another federated country namely Canada and selected provinces, in order to validate and generalize the model. Experiences gained from studies of other federated countries will contribute to refinement of the model for application in Australia.

DISCUSSION

Review of the various fields of literature confirms that collaborations are a complex set of relationships, both formal and informal, they are dynamic and difficult to classify in the absence of a unified approach to their understanding. The body of GIS works on participatory approaches is very useful for understanding advances in spatial information system management, how to structure and manage GIS projects. However, little work has concentrated on the nature of interactions between organizations. Related works such as Montalvo's (2000) study of organizational willingness to share data and Giff & Coleman's (2003) investigation of funding models for SDI development are contributing to the understanding of why organizations need or should enter into collaborative arrangements. More work is required on the how and what forms of collaboration are required. Spatial data sharing is central to the concept of SDI, yet there are many forms and types of collaboration. Organizations may engage to share resources, skills, knowledge, costs or may have mutually benefiting business processes or activities. Even in competitive environments such as the private sector, organizations may see benefit in working together.

Developing National SDI is recognized by governments throughout the world as essential in managing the economic, social and environmental imperatives of a nation. Ting (2003) emphasises this relationship between information and good governance in supporting sustainable development. Inspection of collaboration in Australia, confirms that in countries that are a federation of states, governance and responsibility is spread across all three levels of government, the private sector and community. The coordination of spatial activities and resources requires a strong coordination framework that is representative of whole-of-government and facilitates the unity of needs and interests of

spatial data users and providers across the public and private sectors, academia and the community.

CONCLUSION

Governments are rapidly recognizing the value of spatial information and National SDI as they strive to balance their nation's economic and social needs and environmental imperatives. Mounting pressure to better manage widespread, long- and short-term disaster events, domestic security, environmental degradation and the need for improved community preparedness is driving the demand for access to comprehensive spatially related information. National SDI presents a framework for countries to better manage their spatial data activities and resources to meet their community's need for sustainable development.

A look at the Australian situation demonstrates that in practice, National SDI in federated countries involves a multitude of activities and interests, which produce or depend on spatial data, spanning all levels of government, industry and the community. To reduce duplication of data, effort and to facilitate access, it is critical that organizations begin to collaborate more effectively. Organizational, institutional and economic barriers can be overcome through collaboration and building better partnerships. However, our current understanding of collaboration and how to create partnerships in the development of National SDI is limited and is potentially restricting progress. By knowing the critical factors, nature and possible types of collaboration arrangements, spatial information practitioners can build the long-lasting partnerships required to underpin National SDI.

In summary, this study has confirmed that collaborations are complex sets of relationships, formal and informal, dynamic and difficult to classify. Unlocking these complex collaborations and modeling the partnerships between jurisdictional agencies and the private sector will allow better management of spatial information and progress development of this form of national infrastructure.

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