Understanding the Motivations and Capacity for SDI Development from the Local Level

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SUMMARY

Local government is a rich source of accurate and detailed spatial information which is utilised not only at the local level but increasingly at other levels of government. To build the spatial data infrastructure (SDI) at a state and national level, the role of local governments and their motivation to participate in the sharing of spatial information must be better understood. Although institutional problems still present some of the greatest challenges in building multi-jurisdictional SDIs, the technical and physical capacity of the smaller jurisdictions can impact on their ability to participate with larger and usually better resourced jurisdictions.

In recent years partnerships have emerged as a useful mechanism for establishing a framework and environment conducive to data sharing. However, unless the partnership arrangements are carefully designed and managed to meet the business objectives of each partner, then it is unlikely that they will be sustainable in the longer term. This paper outlines research being conducted on the factors that contribute to the success of local-state government partnerships initiatives. The research methodology, which consists of mixed method approach utilising case studies and a qualitative survey of local government experiences in partnerships arrangements will be discussed. Some initial results of the research will be presented and their possible implication to future partnership initiatives will be discussed.

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1. INTRODUCTION

Spatial information plays an important role in many social, economic and political decisions. Governments, business and the general public rely on spatial information for practical decision making on a daily basis (Onsrud & Rushton 1995). However, with the exception of a few professionals that work within this specific industry sector, the source, accuracy, accessibility and value of this information is too often taken for granted.

In the late 1970s and early 80s, Australian state governments were challenged by the significant institutional and organisational issues relating to the computerisation of their land related records. The development of these state databases identified many technical issues, but also highlighted the need for a national approach to land information management (Grant & Hedberg 2001). These early digital land databases provided the impetus for the development of land information systems (LIS) and geographic information systems (GIS) in many government jurisdictions. Through the 1970s, the multipurpose cadastre concept launched major topographic and cadastral "base-mapping" mega-programs to support land administration at the local, state, and federal levels

It soon became evident that the silo approach to the control and management of these databases would limit the full potential and value of these resources. The increasing focus on data as an infrastructure, analogous to a road system or power network (Coleman & Nebert 1998), led to the development of the framework that we now call the Spatial Data Infrastructure (SDI). Since 1990, the Federal Geographic Data Committee in the United States has promoted the National Spatial Data Infrastructure (NSDI). In 1994, Executive Order 12906 (since revised in EO 13286 in 2003) established a clear policy and framework for the establishment of the NSDI (Federal Geographic Data Committee 1995). In the mid 1990's, the Australian and New Zealand Land Information Council (ANZLIC) began to formulate policy to improve the access and sharing of this valuable resource to other sectors of government, business and the community.

However, the SDI is more than the integration of discrete spatial databases. ANZLIC (1996) defined the national SDI as having four components namely institutional framework, technical standards, fundamental datasets and a clearinghouse network. Although simplistic, this definition encapsulates the core components of the SDI. Later definitions have attempted to refine this perspective to include the human and social components. Rajabifard and Williamson (2001) defined the components of the SDI as 'policy, access network, technical standards and people (including partnerships)'. The inclusion of partnerships, in particular, is a significant addition that clearly recognises the importance of establishing linkages for data sharing and exchange.

The view that SDIs within different jurisdictions can form an integrated system is still a relatively new concept. Rajabifard et al (2000) identified that SDIs can be viewed as a pyramid of building blocks and potentially displayed many hierarchical properties. They argue that by viewing SDIs as a hierarchical system it is possible to gain a better understanding of the political and administrative issues that impact on SDIs. Local government SDI with their detailed data sets would form the base of the pyramid and global SDI with its more generic data sets would form the top of the pyramid. Another perspective of SDI put forward relates to understanding the inter-relationship between the levels of SDI and the areas of policy, fundamental datasets, technical standards, access network and people (Rajabifard et al. 2000). However, the development of national SDI policy has been less than inclusive of all of the jurisdictional participants with a particularly low level of participation at the local government level.

Although local government was an early leader in the GIS/LIS technology (Budic 1993), the recognition by other jurisdictions of their efforts, data sets and potential contribution to the SDI is disappointing. However, it is not just Australia where these problems have been experienced. The lack of progress of data sharing initiatives between state and local government infrastructures in the USA poses a significant problem (Harvey, Buttenfield & Lambert 1999; Nedovic-Budic & Pinto 1999). To some extent this poor progress can be attributed to the lack of recognition by national co-ordination bodies such as the Federal Government Data Committee (FGDC) (Anderson & Nystrom 1999).

This paper will discuss some of the issues that motivate organisations to exchange and share spatial data and examine some Australian state and local government partnerships. A framework for understanding these relationships will be put forward and the future sustainability of these arrangements will be discussed.

2. THE LOCAL-STATE GOVERNMENT ENVIRONMENT IN AUSTRALIA – A CASE STUDY

In Australia, state and local governments have enjoyed a somewhat turbulent relationship. Having a significant level of autonomy, but at the same time having to yield to the whims of both state and federal government, does not make life easy for local government. Rarely do they hold the upper hand in any relationship and it is inevitable that they are required to conform on important decisions. However, it is now appropriate that local governments have an opportunity to be equal partners and achieve real benefits from spatial data sharing partnerships.

To understand the complexity of building local-state partnerships across Australia, it is useful to understand some of the demographic and jurisdictional statistics. Australia comprises six states and two territories with a total area of approximately 7,692,000 square km. In 2001, there were 684 local governments (councils) consisting of cities, towns, municipalities, boroughs, shires, districts, and in the Northern Territory, a number of rural Aboriginal communities (Trewin 2002). Local government has a limited constitutional position in

Australia and is organised under State or Territory legislation through generally similar legislative arrangements.

Local governments provide a variety of services to the community, although these can vary significantly from state to state and between urban and regional councils. Their responsibilities may include the management of health, sanitation, road construction and repair, water supply, sewerage, drainage, museums, planning and development, building, parks and land services such as valuation. In recent times, some of the state governments have devolved further duties to local government including environmental management and monitoring. Other recent structural changes include the incorporation or privatisation of business units in areas such as the provision water and sewerage.

Another significant difference between the tiers of government is their level of revenue and hence, government expenditure. In percentage terms, government expenditure amounts to almost 57% for the federal government, 38% for state, and 5% for local government. In recent years partnerships with business and state governments have been used as a mechanism to adapt to these changing environments.

Australia is generally well positioned by world standards to take advantage of new technologies, particularly the Internet. Kirkman (2002), in a report on the current status of information technology infrastructure, identified the readiness of nations for the networked world. Of the 75 countries surveyed, Australia was ranked 14th, with 44% of the population utilising the Internet. The report indicates that Australia is well placed to further expand its e-business interfaces on a global level, although gaps still exist between the infrastructure levels of metropolitan and rural areas.

These statistics indicate that the governments around Australia, at all levels, have access to the necessary infrastructure enable effective exchange of information not only between organisations, but also to interface with the public. However, it will not be the deficiencies in the IT infrastructure that will limit the exchange of information between organisations, it will be the institutional barriers that will inhibit the potential networking and exchange of spatial data. Therefore, it is essential that mechanisms are put in place to encourage and facilitate the exchanges.

In recent years there has been a trend for countries to expand their efforts in developing SDIs through partnerships, as governments recognise that data sharing is crucial to the successful building of SDIs. Constrained by existing technical and institutional arrangements, SDI developing agencies have focused on promoting adoption of common standards, as well as fast-tracking integration among certain strategic data sets through partnership arrangements (Jacoby, O'Keeffe & Warnest 2001; ANZLIC 1996). Partnerships are formed to create business consortia to develop specific data products or services for strategic users, by adopting a focused approach to SDI development.

In Australia, there are a number of local-state partnerships that have been established for the integration of property information. Some of these include the Property Information Project

(PIP) in Victoria, the Property Location Index (PLI) in Queensland and the Land Information System Tasmania (LIST). Another significant project is the development of the Geocoded National Address File (G-NAF) through the PSMA. The G-NAF has been developed to provide standardised urban and rural address point that will linked to a geographic position (Paull 2003). The maintenance of local-state property databases is crucial to the continued update of the G-NAF database.

Most of these partnerships in Australia have been in place for less than ten years and many lessons can be learnt from their development and operation. SDI partnerships between local and state governments are particularly challenging with the high degree of heterogeneity within the local government environment. However, the potential rewards from these arrangements can be significant, so it is therefore important to understand the drivers that may enable them to succeed.

3. PARTNERSHIPS AND COLLABORATION

Partnerships have existed in government and business for many years. In its simplest form a partnership may be described as: *The fact or condition of being a partner; association or participation. Now esp. of relationships in industry and politics* (Oxford English Dictionary Online 2005).

The number and types of partnerships existing in business and government are overwhelming, making a definition of partnership difficult (Walzer & Jacobs 1998, p4). In some cases a partnership may be as simple as an informal arrangement to share a resource, for example a building or to provide an incentive to land development. In the context of this work however, the partnerships under investigation will normally consist of an ongoing formal relationship between state and local government to which each makes a defined contribution and from which each expect to receive benefits.

The clear definition of purpose of the partnership, the responsibilities of each party and expected outcomes is critical to the success of these arrangements. Although most formal agreements are a form of contractual obligation, evidence suggests that the legislation of these responsibilities may be counter-productive and in fact further limit co-operation.

Unlike many business to business (B2B) or government to business (G2B) partnerships, which are generally focussed at improving economic outcomes, inter-governmental partnerships generally have a significant focus on achieving public good or improved public service. The Tasmanian State Government has taken a proactive approach to inter-jurisdictional partnerships between state and local government. Their process involves the joint identification by teams of State agency and Council officials of key issues in a local area requiring cooperative action, and then formal agreement amongst the parties concerned on the action to be taken to address priority tasks (Tasmanian Department of Premier and Cabinet 2002).

The terms of cooperation, coordination and collaboration are often used to describe inter-organisational relationships (IOR). Many authors has examined the issue of IOR in an attempt to identify the determinant that either encourage or discourage these relationships (Mulford & Rogers 1982; Oliver 1990; Nedovic-Budic, Pinto & Warnecke 2004; Schermerhorn 1975). Although there are similarities in the drivers or motivators for establishing an interorganisational relationship, each environment usually has its individual motivating factor.

Cooperation between organisations is usually seen as the first stage in the development of more significant organisational relations. For example organisations may agree to cooperate with each other for the purposes of establishing some standards for collecting spatial data. (Schermerhorn 1975) defines interorganisational cooperation as "the presence of deliberate relations between otherwise autonomous organisations for the joint accomplishment of individual operating goals". In the example given above the process may facilitate improved standardisation of data within each organisation, however they may well choose to continue to limit the data to their own business activities.

Interorganisational coordination is generally seen as more formal than cooperation, requires resources and relies on the interdependence of the organisations (Dedekorkut 2004). It usually reduces the autonomy of one or more organisations in order to accomplish their respective or shared goal. (Mulford & Rogers 1982)define interorganisational coordination as "the process whereby two or more organisations create and/or use existing decision rules that have been established to deal collectively with their shared task environment". They also distinguish coordination as being either managed or unmanaged. In the early stages of building spatial databases it was recognised that coordination of effort in data capture between government agencies was important from both an economic and data quality perspective. Often these coordination efforts were sporadic and very much based on projects eg a mapping project over areas of common geographical interest.

Collaboration between organisations may be seen as an extension and inclusion of both cooperation and coordination. (Gray 1985)describes collaboration as " the process through which parties who see different aspects of a problem can constructively explore their differences and search for solutions beyond their own limited vision of what is possible". Mulford & Rogers (1982) describe the collaboration continuum from the perspective of cooperation through to various strategies of managed coordination in Table 1. Spatial data sharing arrangements exist at all levels of the continuum defined by Mulford & Rogers.

Table 1: Collaboration Continuum

Dimensions	Cooperation	Managed Coordination Strategies		
		Mutual Adjustment	**Alliance**	**Corporate Partnerships**
Actors	Lower ranking members (subordinates)	Professionals or staff members at the supervisory level	Administrators (agency heads) or professionals	Administrators
Formalization	No formal rules	Few rules	Negotiated rules	High formality
Resources	Minimal resources committed	Few resources committed	Medium level of resource commitment	Resource commitment high
Focus of power	Decentralized power, largely independent; little threat to autonomy	Decentralized power but interdependent	May or may not use central administrative unit	Centralized power
Focus of control	Informal trade offs and reciprocity in the absence of rules	Reliance on informal norms and benefits for agencies	Interagency systems decisions may have to be ratified	Interagency systems decide regulations that represent collective interest
Goals	Vague, individual organizations' goals	Primary focus on agency goals	Agency goals and collective goals	Collective goals stressed

Adapted from Mulford and Rogers (1982: 13-22).

Motivations for collaboration will vary with each organisation and each type of collaboration. Oliver (1990) suggests that the critical contingencies for relationship formation include necessity, asymmetry, reciprocity, efficiency, stability and legitimacy. Dedekorkut (2004) identifies the following reasons why organizational collaborate: the pursuit of common goals, environmental uncertainty, mutual interdependence, fragmented jurisdictional structure, need to meet legal or regulatory requirements or resource scarcity. Many of these reasons are evident in the partnership arrangements being investigated, however the motivations for sharing data are generally related to cost or improvements in data quality (Nedovic-Budic, Pinto & Warnecke 2004).

4. A RESEARCH APPROACH TO UNDERSTAND AUSTRALIAN LOCAL-STATE SDI PARTNERSHIPS

In Australia, and in fact many other countries, the use of formal collaborative arrangements such as partnerships to promote the efficient exchange of spatial data have experienced varying levels of success. In order to assess the success and sustainability of SDI partnerships

it important to understand the environments of each organisation, the factors that motivate them, the partnership activities and the resulting outcomes.

Qualitative research approaches are useful when the context of the phenomena are not well understood (Yin 1994). In the case of spatial data sharing partnerships the context of organizational relationships are not always easily identified. In addition, the structure and arrangements of each partnership differ and requires further indepth investigation. On the other hand quantitative approaches provide the opportunity to measure the effectiveness or value of factors or issues within a relationship. For example a quantitative methodology may best suit the assessment of success or otherwise of the various elements of an existing partnership arrangements. Case studies often provide an opportunity to mix both qualitative and quantitative approaches where both the context of the phenomena is required and also a measure of the effectiveness of outcomes.

Three Australian states have been chosen as the basis for the research study. The states were selected on the basis of existing data sharing arrangements being in place. In addition, the states vary in geographic area, population and numbers of local governments (Table 2). Queensland is the second largest state in Australia by area and also contains a large and varied group of local governments. At the other end of the spectrum the Tasmania is a compact island state has only 29 local governments and approximately half a million people. The third state to be chosen was Victoria which is one of the most populated states in Australia and is also well advanced in its partnership arrangements. These three states provide a contrasting mixture of local governments, geography and institutional arrangements.

Table 2: Details of the State and Local Governments in Case Study

State	**Area (km^2)**	**% of Total Area**	**Population (million)**	**No. of Local Governments**
Victoria	227,000	2.96	4.77	78
Queensland	1,731,000	22.5	3.57	125
Tasmania	68,400	0.89	0.47	29
Australia Total	**7,692,000**	**100.0**	**19.2**	**684**

Detailed information regarding the state-local partnerships in each state has been collected from a variety of sources including existing papers, internal documents and on-site interviews. Interviews with state government officers have provided a good understanding of the motivations for establishing the partnerships and some of the problems encountered.

In each of the three cases the partnership arrangements being investigated focus mainly on property related information. Property information including cadastral boundaries and address has in the past been considered to be a spatial data set that has the potential to generate significant income. From this perspective the commercial interests of each of the collaborating organisations needs to be considered carefully, as sharing of information does

not necessarily translate to sharing of revenue. However, in recent years most of the state governments have realised that the monetary windfalls have not eventuated and the need to support the sharing of information for the public good must be a priority.

In all three case studies the state government has been the instigatotor of the partnerships due to the need to update state government databases with accurate detailed local information such as street address. The local governments have been co-opted through a variety of means including upfront incentive payments, revenue sharing arrangements of consolidated data, arguments regarding public responsibility and exchange of useful data sets. To measure the effectiveness of these arrangements a survey of local governments is currently being undertaken in each of the states. The survey is being distributed via a web based form to each of the local governments. In order to improve the response rate for each local government telephone contact is firstly made and an explanation of the survey provided. The URL of the web survey is then emailed to the contact person. If no response is received in three weeks a follow up email or phone contact is made. It is hoped that this technique will generate a response rate in excess of 75%.

The survey examines the capacity and experiences of the local governments in each of the following areas:

- Local government size, use of GIS, ICT capacity, management support
- Policy on access, use and pricing of spatial information both internally and externally
- Discovery and access mechanisms for spatial data
- Forms of spatial data held and requested by agencies including the maturity of data
- The use or knowledge of spatial data standards and integration or interoperability
- Role and skills of people managing the spatial data
- Existing collaborations, preferences, motivations and business needs
- Success and experiences with the current partnership

The use of factor analysis techniques will enable the success factors to be identified and prioritised. An understanding of the state and local governments motivation, capacity and experience will enable the development of an improved model for collaboration. This model will build on our existing understanding of SDI components and inter-relations (see Figure 1).

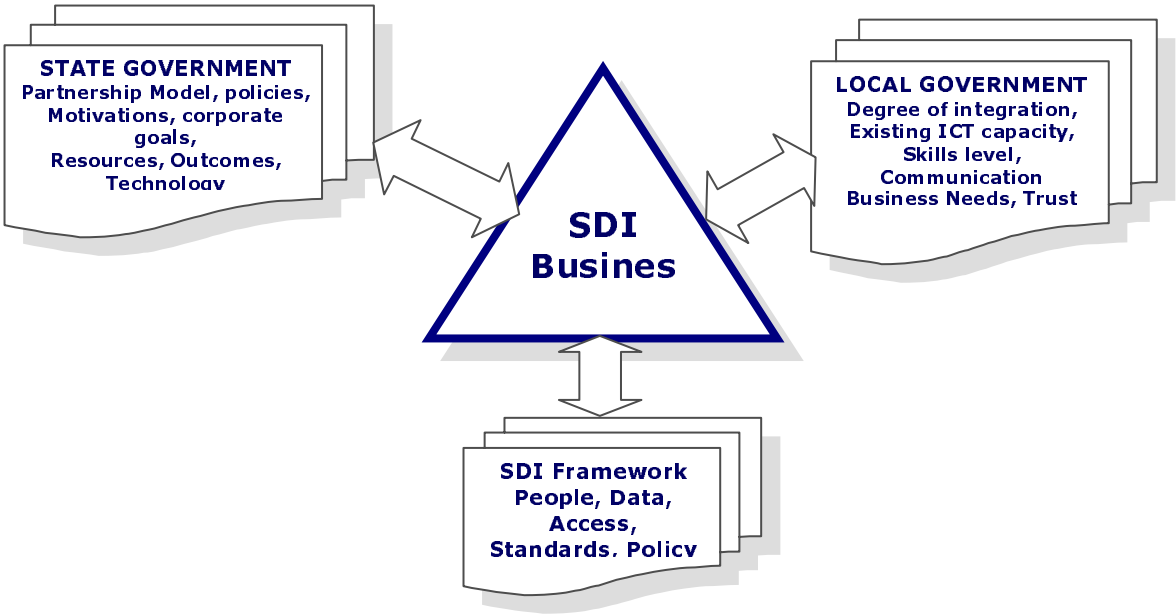

Figure 1: Integration of mixed method research and existing SDI knowledge

The developed model will draw on the success factors identified in each of the three case studies to form a best practice business arrangement. The characteristics of this arrangement when completed can be used to measure each of the local governments and state agencies against this model. The comparison will assist in the validation of the model and identify potential deficiencies in any of the partnership members. Refinements to the best practice model can then be undertaken to gauge the sensitivity of the model and its relationship to each organisation. If necessary the model may be used to identify activities that need to be undertaken to improve the effectiveness of the arrangements and perhaps improve the efficiency of the operation.

5. DISCUSSION

Although the research is ongoing there are a number of areas that warrant further discussion. The partnership arrangements under investigation vary in structure, resourcing and scope. Each of the state government agencies would be the first to admit that in recent years their attitude to local government has changed. Local government were, and still are in some jurisdictions, considered to be the poor cousins to both state and federal agencies. Little effort was previously made by the higher jurisdictions to interact with local government or to treat local governments with equally.

However, the wheel has turned full circle in the context of SDI with the need to more universally improve the accuracy of state government databases. This has been driven by both cost (through downsizing of governments) and the need to service the public in areas such as emergency services. It is becoming unacceptable that with the technology available today, an emergency service vehicle cannot be directed to the corrected street address because of poor quality databases.

It may seem obvious to many, but an important motivator for local government involvement at the early stages is money. Without sufficient financial incentives many local governments are unlikely to participate at the critical early stages. However, once the relationships has been established it becomes somewhat easier to interact and to establish a more trusted and cooperative framework. Frequent communication between the partners is also an important aspect in a continuing long term organisational relationship. It appears that organisational partnerships are not so different from personal relationships; they need to be constantly nurtured and good communication between partners is essential. Sufficient staff resources are therefore critical to the sustainability of these partnerships to maintain regular contact and to solve the ongoing problems that invariably arise.

Most local governments rely on their internal spatial data sets more than the external data that they may acquire, so the benefits for involvement in data sharing must be substantial and clearly articulated to gain their involvement. Initial responses indicate that councils receive regular requests for spatial data with many requests being ambiguous and often from the same state government agency. Issues such as cost recovery, liability, privacy, copyright, training and resources are common to many local governments dealing with spatial information management.

The establishment of criteria for measuring success will be an important component in establishing a best practice model. Success can be measured in many ways however the basic metrics must consider the outcomes of the partnerships. These may include the realisation of the partnership goals, improved capacity, the durability of the agreement, the improved level of communication, improved trust, satisfaction with the processes, improved quality of data and resource or greater efficiencies.

6. CONCLUSIONS

Collaboration for the sharing of spatial information requires more than our traditional co-operation or co-ordination approaches. It requires the establishment of well organised and resourced formal arrangements. The success of Australia's rapidly maturing spatial information industry is dependent on the access to a consistent and reliable source of spatial information from within all jurisdictions. Although a policy framework exists at a national level its understanding, acceptance and implementation at the state and local levels varies dramatically. Building bridges to link jurisdictions through the use of partnerships has the potential to provide a mechanism for building the NSDI from the local government up.

For too long local government has been treated as the poor cousin with respect to state and national endeavours. Now however, with their rich holdings of detailed and strategic spatial information, it has been recognised that their role is critical to integrating a range of disparate data sets. There is no doubt that partnerships will play an important role in integrating these disparate holdings and an understanding of what makes them successful may be as equally important.

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BIOGRAPHICAL NOTES

Kevin McDougall is a senior lecturer in the Faculty of Engineering and Surveying at the University of Southern Queensland (USQ) and is currently undertaking his PhD in the Department of Geomatics at the University of Melbourne. He holds a BSurv (Hons) and Master of Surveying and Mapping Science from the University of Queensland, Australia. From 1995-2002 he was the Head of Department of Surveying and Land Information at USQ and has also served on a number of industry bodies including the Board of Surveyors. Kevin is currently the President of recently formed Australasian Spatial Information Education and Research Association (ASIERA) and has published widely in the areas of surveying, geographic information systems and curriculum development. He has undertaken project consultancies in Australia and overseas including a number of projects within local government focussing on GIS need analysis, GIS benchmarking and system implementation. Kevin's PhD topic is "Developing a Business Model for Sustaining Local-State Government SDI Partnerships."

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