

BUILDING THE SPATIAL DATA INFRASTRUCTURE THROUGH DATA SHARING - MEASURING PROGRESS WITHIN AUSTRALIAN LOCAL AND STATE GOVERNMENT JURISDICTIONS

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ABSTRACT

In the past decade efforts to develop spatial data infrastructures (SDIs) have migrated from the initial “top-down” national approaches to “bottom-up” and cross jurisdictional efforts at the sub-national level. Although national SDI developments are fundamental to building the SDI culture and policy, it is sub-national and local SDI development that will deliver the immediate benefits to citizens and the community. In countries which have highly decentralised federations of states such as Australia, United States and Canada, the challenge is how to co-ordinate the literally thousands of often small local government jurisdictions which are important contributors to state and local SDIs.

In recent years, a number of co-operative spatial data sharing partnerships between local and state government have emerged in Australia. These partnerships are relatively new initiatives that have been established to facilitate more effective sharing of spatial data between organisations, but also as a mechanism to contribute to SDI development. To maximise the benefits from these partnerships it is essential to understand the factors that contribute to their successful operation and sustainability. This paper investigates these collaborative arrangements and examines the motivations, mechanisms and frameworks for data sharing between local and state governments.

BIOGRAPHY OF PRESENTER

Kevin McDougall is an Associate Professor in the Faculty of Engineering and Surveying at the University of Southern Queensland (USQ). He holds a BSurv (Hons) and a Master of Surveying and Mapping Science from the University of Queensland and a PhD from the University of Melbourne. 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 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 focusing on GIS need analysis, GIS benchmarking and system implementation.

INTRODUCTION

Accurate, up-to-date, relevant and accessible spatial information at the local level is critical to the delivery of many government services, particularly emergency services such as police, fire and ambulance. The development of sub-national spatial data infrastructures (SDIs) which support these services increasingly depends on the effective co-operation and exchange of information between government jurisdictions and industry. However, in countries with decentralised systems of government, the sharing of data between jurisdictions, and hence SDI development, continues to be problematic.

Australia, like other countries around the world, began to take positive steps towards building its SDI through national policy development and co-ordination efforts. Progressively, the national SDI initiatives in Australia were followed, or often preceded, by state government SDI initiatives. As the state governments' understanding of SDI matured, they soon realised that building some of their fundamental data sets relied heavily on the contributions from jurisdictions such as local government.

With local government being a custodian of a number of strategic spatial data sets, it has a crucial role to play in the development of the state and national SDIs. In recent years, a number of co-operative partnerships between local and state government have begun to emerge. These partnerships are relatively new arrangements that have been established to facilitate the improved sharing of spatial data and to realise the full potential of the SDI. To maximise the benefits from these partnerships it is important to understand the factors that contribute to their successful operation and sustainability. Therefore, the focus of this paper is to understand these collaborative arrangements so that future data sharing initiatives can be improved and sustained.

This paper firstly examines the developments of spatial information within the local and state government environments in Australia from a historical perspective. The importance of property related information and the emergence of property information partnerships between local and state government is discussed. The methodology used to investigate these partnerships is then explained. Finally, the results of the research are presented and some recommendations for improving these initiatives provided.

SPATIAL INFORMATION DEVELOPMENTS IN LOCAL AND STATE GOVERNMENT IN AUSTRALIA

Local government in Australia was an early adopter of land information and geographic systems, both as a user of the early digital map products such as the digital cadastral data bases (DCDB) and also a prominent information contributor (McDougall & Perret 1987, Williamson & Blackburn 1985). Many of these developments were driven by the need for improved land use planning (Nash & Moll 1976) and better financial management of the organisation and their assets. In the late 1980s to mid 1990s with the maturing of GIS software and the affordability of computer systems, GIS was adopted widely across both large and small local governments (Wadlow 1989). This also coincided with the completion of many of the state government cadastral data bases which became a critical base data set for most local governments. However, some local governments in Australia decided to build and maintain their own digital cadastral mapbase for reasons of accuracy, data reliability or cost. This period also coincided

with one of the lowest points in the relationship between local and state governments with respect to sharing and exchange of spatial information as issues such as copyright and ownership of information began to emerge.

With an estimated 70-80% of all local government transactions having a land or geographic component (Somers 1987), the spatial information holdings within local governments began to grow rapidly. The size and structure of the local government GIS units also grew and developed rapidly as the appetite for spatially related information expanded beyond the traditional engineering and planning departments. GIS had become a tool and the information that it provided to the organisation went from being “nice to have” to being “critical” (Mayr 1992).

The late 1990s and the early 2000s saw the improvement in cost efficiency of GIS technology and greater utilisation of the spatial information within local government. GIS now supports many activities including front counter enquiries, land planning, asset management, local health, environmental compliance and animal registration amongst others. Web mapping introduced spatial information to a broad base of Local Government Authorities (LGA) users and also improved community access to basic land and spatial information. Local governments have continued to be leaders in the application of spatial information and technology through the use of web mapping applications and location based services.

In Australia, the State Governments have primary responsibility for the delivery of education, health, emergency services, resource management and transport programs, amongst others. The majority of state services are funded through grants handed down from the federal government and supplemented by a range of state government taxes and levies. State governments are also responsible for land administration activities including land titling and registration, land management, land planning and land valuation. As with local government, each state government has similarities and differences. One major similarity across the states and territories is their heavy reliance on cadastral or land parcel data (Grant & Williamson 2003). In the late 1970s and early 1980s, Australian state governments were challenged by the significant institutional and technical issues as they computerised their land related records. The development of these state databases also identified the need for a national approach to land information management (Grant & Hedberg 2001).

These early digital cadastral databases provided the impetus for the development of land and geographic information systems in many government jurisdictions. Through the 1980s, the multipurpose cadastre concept spurred major topographic and cadastral mapping “megaprograms” to support land administration at the local, state, and federal levels (Coleman & Nebert 1998, Dalrymple *et al.* 2003). With the advent of more powerful mini and mainframe computers, and the development of more effective data base structures, a number of state government agencies proposed the development of centralised land information systems or land “hubs”.

By the early 1990s, state-wide land information systems were showing significant promise and advancement due to data bases becoming on-line and operational, advances in data base technology and communications making integration more feasible and a rapidly growing demand for integrated data sets by the users (Eden & Barker 1992). State government agencies devoted significant resources to computerisation and

integration, resulting in some improvements in efficiencies, but with a relatively small return on their investment. During the early 1990s Australia suffered a period of economic downturn which was characterised by government policies to reduce the size of the public sector and outsource activities to the private sector. This “downsizing” approach gave little consideration to the re-engineering of functions or processes (Grant & Williamson 2003).

Government budgets at this time were under significant pressure and cost recovery policies forced many state governments to market their data in an attempt to recover some of their development costs. Most cost recovery efforts during this period were generally unsuccessful and created significant discontent, particularly amongst local government users, the private sector and even other state agencies. During this period, it was recognised that a significant investment had been made in the consolidation and conversion of spatial information. Spatial information was now considered to be an infrastructure, in a similar way that road networks or electricity distribution systems were considered to be essential infrastructure. However, unlike these physical infrastructures which could be accurately dissected and valued as assets, quantifying the value of spatial information presented a greater challenge.

The management of land administration and titling is a state government responsibility which includes the mapping of land parcels. The management of the property and address datasets are primarily the responsibility of local government. In Australia, both local and state governments have continued to duplicate the capture of some of these datasets in order to undertake their business activities. The resultant duplication in the collection and maintenance of this data by both jurisdictions is costly, inefficient and creates significant data quality issues. To rectify this deficiency, a co-operative approach was required to integrate the data from both state and local governments. In the late 1990s, state governments around Australia began to investigate mechanisms to build more accurate and authoritative databases and reduce duplication. Data sharing partnerships emerged as the preferred model to reduce inefficiencies and improve the quality of the property related datasets.

RESEARCH METHODS

This research utilised a mixed methods research approach which involved both qualitative and quantitative investigations at state and local government levels. The research investigated existing data sharing partnerships between state and local governments in Australia which had been established to facilitate the sharing of property related data. Three Australian states, namely Queensland, Victoria and Tasmania, were chosen as the basis for the research. The states were selected on the basis of an existing data sharing arrangement being in place and a variety of characteristics including geographic area, population and the number of local governments. The three data sharing partnerships investigated included the Victorian Property Information Project (PIP), the Queensland Property Location Index (PLI) project and the Land Information System Tasmania (LIST).

The first component of the research consisted of a semi-structured interview technique to collect data from staff within each state government agency that was charged with the management of the partnership arrangement. The structure of the interviews included organisation overview and role of partnership, historical developments within the

partnership, existing policy arrangements, an understanding of the data and data sharing processes, operational and resource aspects of the partnership, organisational and institutional arrangements; and barriers and issues – legal, technical, economic, institutional.

A descriptive framework for classifying these data sharing partnerships was developed from a range of literature including the collaborative process (Child *et al.* 2005, Gray 1989, Mulford & Rogers 1982), partnership process (Lank 2006, Lendrum 2000) and the dimensions of collaboration (Prefontaine *et al.* 2003). The descriptive framework consists of six main components, namely the jurisdictional environment, the institutional environment, establishment and direction setting, partnership operation and maintenance, governance, and key outcomes.

The second component of the research used an on-line questionnaire to investigate the motivations, capacity and effectiveness of local-state government data sharing partnerships from a local government perspective. The design of the questionnaire was constructed around an SDI framework to assess local government capacities and their appreciation of policies, data holdings, people, access arrangements and standards/technology. In addition to the SDI framework, the questionnaire also investigated the organisational setting, partnerships and collaborations and the participant's perspectives on the existing partnership arrangements. A total of 110 responses were received including seven responses which were rejected as either incomplete or invalid. The remaining 103 valid returns represented a response rate for the survey of 56%. The data from the questionnaires was automatically collected into an excel spreadsheet via the web server. This process was extremely effective as it eliminated coding and transcription errors and facilitated direct transfer to the analysis software.

The data collected from the two components of the research were then initially analysed to identify any specific trends. The outcomes of each of the components were then integrated to evaluate the effectiveness of the each of the data sharing partnerships.

RESULTS

Impact of the Institutional and Jurisdictional Environments

The research found that the state and local jurisdictional and institutional environments can have a significant impact on the establishment and sustainability of collaborative initiatives. Most commonly local-state government partnerships were established by a single state government agency directly with one or more local governments. The institutional arrangements within that state or local government agency often have a direct influence on the policies and operations of the partnership. To a lesser extent the political or jurisdictional environment influences the institutional or organisational policies and operations. Although many of these impacts are implicitly recognised by those individuals or groups who are forming the partnerships, it was found that the wider institutional and jurisdiction environments were not well understood or considered prior to development of a partnership model. A summary of the impact of the jurisdictional and institutional environments on the partnerships is given in Table 1.

Tab. 1: Impact of institutional and jurisdictional environments on data sharing partnerships

Environment Component	Victoria		Tasmania		Queensland	
	State Impact	Local Impact	State Impact	Local Impact	State Impact	Local Impact
Jurisdictional Environment						
- Political Environment	+	o	+	+	o	o
- Economic Environment	+	+	+	+	o	o
- Environmental Priorities	o	+	+	+	o	+
- Social Priorities	+	o	+	o	+	+
- Legal Framework	o	o	o	o	o	o
- Geographical Context	o	+	+	+	-	-
Sub Total	3+	3+	5+	4+	0	1+
Institutional Environment						
- Communication	o	+	o	o	o	o
- SI Policy	+	+	+	+	-	-
- Business Needs	+	+	+	+	o	+
- Resources	o	+	+	o	o	+
- Shared Goals	+	+	+	+	-	-
- Agency vision/mission	+	+	+	o	o	o
- Leadership	+	o	+	o	-	o
- Technology/ICT	o	+	+	o	o	o
- Loss of Control	o	-	-	o	-	-
Sub Total	5+	6+	6+	3+	4-	1-
Overall Totals	8+	9+	11+	7+	4-	0

As shown in Table 1, the jurisdictional environments in all three states were considered to be negative (-), neutral (o) or positive (+) with respect to the establishment of the partnerships. Tasmania was considered to be the state jurisdiction with the greatest positive tendencies towards collaboration due to a range of factors. Like the State of Victoria, Tasmania was under considerable economic difficulty in the mid 1990s, with a declining population, high unemployment and low business confidence. Therefore, it was a prime candidate for reforms to improve efficiencies and service delivery. The LIST project was put forward by the Department of Primary Industry and Water (DPIW), in response to a request from government for projects to deliver improved efficiency and encourage business activity. Tasmania is a state which now relies heavily on tourism and its natural environment for a considerable component of its economy. Spatial information has assisted the government in environmental management and decision-making, hence the LIST project has had a positive influence in this area. The relatively small geographical areas of Tasmania and Victoria were also seen as a positive influence on collaboration, in contrast to the geographically diverse and remote LGAs of Queensland which made communication difficult.

The cumulative impacts of the institutional environments of both state and local level in Victoria (5+ and 6+) and Tasmania (6+ and 3+) were identified as being more conducive to establishing partnerships (see Table 1). Specifically, leadership at the state government level and the subsequent development of policies which encouraged the sharing of information were considered to be critical. Through leadership, the partnership projects emerged with a clear vision for the future and shared goals. In

Queensland, the data sharing program suffered from the lack of an identifiable leader or clear goals. Support for the project was limited and resulted in poor funding which also limited the project's progress.

One of the important findings identified during the research was the trend for policy developments at a state government level to flow through to the lower jurisdictional level. Although the data from the local government surveys was not conclusive, evidence indicates that local governments with a limited capacity to develop their own policies, will tend to copy or adapt existing state policy on pricing and access to data. This trend is also visible at the national and state levels of government with the adoption of national government policies by state agencies, particularly if they are seen as positive initiatives. The correlation between the state and local policies was evident in each of the three case studies, but perhaps most pronounced in Queensland where a more restrictive policy stance on data access and pricing by the state government was mimicked by a number of LGAs.

Greater accountability of government organisations has resulted in the introduction of business management principles, including a focus on service delivery and core business responsibilities. These trends are not only evident in Australia, but can be seen globally as privatisation of government infrastructure and entities is undertaken to improve efficiency, save costs or to generate income. Collaborative initiatives undertaken by both state and local agencies must now show that these initiatives are a core component of their agency's business and also justify their development. Therefore, the alignment of business processes is not only a strong driver of partnership formation, but also a necessary ongoing requirement for success. The evidence suggests that the relatively poor alignment of business processes in Queensland has contributed to the mediocre performance of that partnership.

Assessment of the Collaborative Processes

The results of the assessment of the collaborative process are shown in Table 2. In the sub-component of partnership management, the Victorian PIP partnership was identified as having the highest positive contribution. It had the highest number of staff associated with the management of the project and multiple communication strategies for managing the partnership. The PIP had a defined stakeholder manager whose specific task was to manage the partnership operations. In both Queensland and Tasmania, this sub-component was identified as an area for possible improvement.

The partnership strategy and formulation sub-component had a very positive impact on the partnership outcome in both Tasmania and Victoria. Both states had put in place the building blocks for a successful partnership strategy and had clear goals and strong leadership. The Queensland partnership has struggled from the outset from a lack of funding, poor goal alignment and limited leadership.

For the data exchange and maintenance sub-component, each of the state case studies was assessed as contributing positively to the initiative. However, this partnership component across all three states has significant potential for improvement through better use of technology and greater system interoperability.

Tab. 2: Assessment of the collaborative process component

Partnership Component	Victoria	Tasmania	Queensland
Partnership Management			
- Project Management	+	+	0
- Resourcing	+	+	0
- Administration	+	0	0
- Geographical context	0	+	-
- Communication Strategy	+	0	-
Partnership Strategy and Formulation			
- Leadership	+	+	-
- Research	+	0	0
- Shared Goals	+	0	-
- Communication Networks	+	0	-
- Risk Assessment	0	0	0
- Negotiation Strategy	+	+	0
- Formal Agreements	+	+	-
- Funding and Capacity Building	+	+	0
Data Exchange and Maintenance			
- ICT and Technology	+	+	+
- Operation and Maintenance	+	+	0
- Review and Improve	+	0	-
- Interoperability	0	0	0
Business Rules and Responsibilities			
- Custodianship arrangements	+	+	0
- Communication protocols	+	0	-
- Exchange frequency	+	0	0
- Deliverables	+	+	0
- Exchange Standards	+	+	+
Performance Monitoring			
- Performance measures	+	0	0
- Monitoring Processes	+	0	0
- Continuous Improvement	+	0	0
Governance			
- Stakeholder representation	+	+	0
- Policy development	0	+	0
- Monitoring	+	0	-
- Strategic direction	0	+	0
Totals	24+	15+	5-

With respect to the business rules and responsibilities sub-component, all three state initiatives had attempted to define the roles and responsibilities of each partner, primarily through the partnership agreement. Overall, each state has made a positive contribution to the partnership outcomes in this area, although improvements could be made in communication protocols and exchange standards.

The components of governance and performance monitoring are highlighted as areas which are not well evidenced in the Tasmanian or Queensland partnership arrangements. The Victorian PIP has only begun to address the performance issues in

recent years and the review of the project in 2005 has confirmed that the importance of this sub-component to sustain the initiative. It is therefore not surprising that most of the state government agencies are currently reviewing their partnerships to improve some of these components. Tasmania was judged to be the most advanced with respect to governance arrangements, whilst Victoria has made significant progress in recent years.

This preliminary evaluation supports the findings from the LGA survey and the qualitative case studies which identified that the Victorian and Tasmanian approaches to their partnership formation and operation have generally delivered more satisfactory outcomes than the Queensland partnership. However, the complexity of the Queensland situation including the challenging geographical diversity and remoteness of LGAs, make it difficult to attribute the level of satisfaction solely to the collaborative process.

DISCUSSION

The jurisdictional and institutional environments have contributed to the outcomes of the partnership initiatives in a number of ways. Firstly, the more turbulent situations in Tasmania and Victoria resulted in positive conditions for collaborations to form, whilst the comparatively buoyant Queensland economy did not appear to have any significant influence. Secondly, the policy developments at the institutional levels were shown to be critical for fostering a data sharing environment. Without an equitable policy framework for the pricing and access of spatial information, it is extremely difficult to encourage the sharing of information. The State Government of Tasmania, through its partnerships policy, had a significant influence in bringing local government to the negotiating table.

Each of the partnership case studies has reached varying stages of maturity in the collaboration process. The Victorian PIP and the Tasmanian LIST partnerships have been the most comprehensive in their establishment and direction setting phase, with a considered and well researched approach to negotiation and the development of the agreements. The Queensland PLI struggled at this phase, as identified in the earlier comparisons, due to a poor institutional policy framework.

All of the states appear to have underestimated the resources required to maintain the ongoing operation and future development of the partnerships. Not surprisingly, communication has emerged as a key ingredient for maintaining an effective partnership. Importantly, good communication is not only required for the exchange of data, but also helps to maintain and support the relationships that have been built by the partnership.

The issues of governance and performance management are relatively new areas to many government projects. Projects established during the mid to late 1990s would not have considered performance measures during the project design. However, performance management issues are now impacting on each of these initiatives as they struggle to deal with the operational and maintenance challenges of a mature project. Each jurisdiction is responding differently to these challenges, but all would agree that understanding their performance and articulating that performance to upper management was extremely important. Governance arrangements, particularly in

Victoria and Tasmania, were identified as requiring improved reporting, performance management, greater stakeholder involvement and wider jurisdictional support.

CONCLUSIONS

This paper has presented some initial findings on the evaluation of local-state government data sharing partnerships across three states in Australia. The results identify that the institutional and jurisdictional factors can play an important role on the initiation and development of these partnerships. In addition, the operation of these initiatives needs to be carefully considered across a number of dimensions to more accurately assess their effectiveness and success.

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REFERENCES

- Child, J., Faulkner, D. and Tallman, S.B., 2005. *Cooperative strategy*, (Oxford University Press, Oxford).
- Coleman, D.J. and Nebert, D.D., 1998. Building a North American spatial data infrastructure, *Cartography & Geographic Information Systems*, vol. 25, no. 3, pp. 151-9.
- Dalrymple, K., Williamson, I.P. and Wallace, J., 2003. Cadastral Systems Within Australia, *Australian Surveyor*, vol. 48, no. 1, pp. 37-49.
- Eden, R. and Barker, T., 1992, The Queensland Land Information System, *Proc. of AURISA 92*, Gold Coast, 25-27 November 1992.
- Grant, D. and Hedberg, O., 2001, Public sector mapping agencies - Australia concept to incorporation, *Proc. of International Symposium on Spatial Data Infrastructures*, Melbourne, Australia, 19-20 November, 2001.
- Grant, D. and Williamson, I., 2003. State SDI initiatives, in I Williamson, A Rajabifard & M-E Feeny (eds), *Developing Spatial Data Infrastructures: From Concept to Reality*, Taylor and Francis Ltd, London, pp. 111-27.
- Gray, B., 1989. *Collaborating - Finding Common Grounds in Multiparty Problems*, (Josey-Bass Publishers, San Francisco, CA).
- Lank, E., 2006. *Collaborative Advantage*, (Palgrave Macmillan, New York).
- Lendrum, T., 2000. *The strategic partnership handbook - the practitioners guide to partnerships and alliances*, 3rd edn, (McGraw-Hill Australia, Sydney).
- Mayr, W., 1992, Desktop GIS - power to the workers, *Proc. of 20th Australian Conference on Urban and regional Information Systems*, Gold Coast, 25-27 November, 1992.

- McDougall, K. and Perret, P., 1987. The Australian Key Centre in Land Information Studies - its developments in LIS and local government, *Association of Consulting Surveyors Queensland Newsletter*.
- Mulford, C.L. and Rogers, D.L., 1982. Chapter 2 Definitions and Models, in DA Rogers & DA Whettons (eds), *Interorganizational Coordination: Theory, Research and Implementation*, Iowa State University Press, Ames, Iowa, pp. 9-31.
- Nash, K.R. and Moll, A.P., 1976, Council of the City of Sydney land information system: description of planning applications, *Proc. of 4th Australian Conference on Urban and regional Information Systems*, Melbourne, 25-26 November, 1976.
- Prefontaine, L., Ricard, L., Sicotte, H., Turcotte, D. and Dawes, S.S., 2003. New Models of Collaboration for Public Service Delivery - Critical Success Factors of Collaboration for Public Service Delivery, CTG, <<http://www.ctg.albany.edu/publications/reports/>>, (accessed 1 May 2006).
- Somers, R., 1987. Geographic information systems in local government: A commentary, *Photogrammetric Engineering and Remote Sensing*, vol. 53, no. 10, pp. 1379-82.
- Wadlow, R.F., 1989, The impact of land information systems in local government, *Proc. of The 17th Australasian Conference in Urban and Regional Planning Information Systems*, Perth, WA.
- Williamson, I.P. and Blackburn, J.W., 1985, Land information systems in Australasia: lessons and experiences, *Proc. of 1985 AURISA National Conference (URPIS 13)*, Adelaide, SA.