Local Government and SDI – Understanding their Capacity to Share Data

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Abstract
Local government has been recognised as an early leader in the development, deployment and innovation in spatial information systems. The introduction of corporate wide spatial data portals within local government was as significant as the release of Google Earth to the wider public. Although these information systems continue to expand and mature, the potential for these local spatial data infrastructures (SDIs) to contribute to higher level SDI initiatives remain largely unrealised. This article explores local government SDI within Australia to assess its capacity to contribute to higher level SDI initiatives. A comprehensive survey of over 100 local government authorities was undertaken to assess their SDI capacity and collaborative initiatives. The results were analysed to identify factors that contribute to their successful local SDI development and, more widely, to the development of higher level SDI initiatives through data sharing partnerships. The findings from the analysis indicate that suitable policy frameworks, an understanding of business needs, organisational support and ability to access data through equitable sharing arrangements are critical drivers in building and developing SDI from the local level.

Keywords: local government, spatial data infrastructure (SDI), data sharing.

1. INTRODUCTION

The exchange of fundamental spatial data between local and state jurisdictions continues to be problematic for a variety of technical, institutional, political and economic reasons (Harvey and Tulloch 2006; McDougall et al., 2005; Nedovic-Budic and Pinto, 2000; Onsrud and Rushton, 1995; Pinto and Onsrud, 1995). This impacts on the development of spatial data infrastructures, particularly at local and state levels, and hence the efficient delivery of government and community services (McDougall, 2006; McDougall et al., 2002; Warnecke et al., 2003). It is recognised that local-state government SDI environments are critical because it is within these environments where the most useful operational spatial data resides.

At the country or national level some progress has been made in describing SDI development (Masser, 1999) and spatial data clearinghouses (Crompvoets et al., 2004), however it is difficult to translate the outcomes of these studies to a local level. Some efforts have been made to understand the Australian SDI environments (McDougall, 2006; Warnest, 2005), particularly with respect to the sharing of spatial data and the models of collaboration between Australian jurisdictions.

The technical issues of data integration and interoperability are progressively being advanced (Abel et al.,1999; Dangermond and Brown, 2003), however it is the organisational, legal and economic issues that continue to impede the integration of spatial data in heterogeneous data sharing environments (Masser, 1998; Masser and Campbell, 1994; Nedovic-Budic and Pinto, 2001; Onsrud and Rushton, 1995). In particular, the

vertical integration of multiple levels of data across multiple levels of government is recognised as a major impediment to a fully robust National Spatial Data Infrastructure (NSDI) (Harvey et al., 1999). Masser (2005) has identified that the vertical integration of data is not well understood and that greater efforts are needed to explore the nature of spatial data sharing and its effectiveness in a multilevel SDI environment, particularly with respect to the organisational issues.

Our knowledge of SDI frameworks has come from the first generation of SDIs which emerged from national mapping and land administration authorities in the mid 1990s. Countries that developed the first generation of SDIs had a limited knowledge of the different dimensions and issues relating to the SDI concept (Rajabifard et al., 2006). The major objectives of these initiatives were to promote economic development, to stimulate better government and to foster sustainable development (Masser, 1998). So, like the national information infrastructure visions espoused by governments in the early to mid 1990s, SDI has developed in all shapes and sizes (Masser, 1999) and is viewed differently by different stakeholders. In recent years we have seen the second generation of SDIs emerge. Craglia and Signoretta (2000) identified in their case studies of local municipalities that because of the heterogenous nature of this level of government, framework models to describe SDI cannot be easily replicated.

Increasingly, partnerships are considered essential for SDI development because they provide the mechanism to allow organisations to work together to achieve SDI goals and to share the implementation responsibilities and eventual partnership benefits (Wehn de Montalvo, 2001). Experience in several countries, including Australia, has identified a number of problems with establishing partnerships at every level of government. These problems include poor structure of the partnerships, lack of awareness of the benefits of the partnership, lack of clear responsibilities of each partner, fear of losing of control of data, funding and buy-in (Wehn de Montalvo, 2001). Although these issues have been identified, the key problem remains of evaluating or measuring the impact of these issues (Dangermond and Brown, 2003; Nedovic-Budic and Pinto, 2001).

The successful implementation of the next generation of SDIs will, to a large extent, depend on the ability of SDI coordinators to comprehend and build on the success or failure of previous SDI initiatives (Giff, 2006). Although the SDI community continues to promote the benefits of spatial data infrastructures to society, no methodologies currently exist to measure the performance and outcomes of these infrastructures. Future investment in these increasingly critical infrastructures and guiding of government policy on the access to spatial data will depend on the availability of appropriate performance measures to justify further funding and development.

2. SDI DEVELOPMENT AT THE LOCAL LEVEL IN AUSTRALIA

The majority (77%) of Australia's 20.1 million people is located in the eastern states (Queensland, Victoria and New South Wales), although these three states represent only approximately 36% of the total land area. Although the majority of land management is undertaken by the state governments, it is local government that services the general community with respect to day-to-day property management issues. In September 2005, there were 673 local governments (councils) consisting of cities, towns, municipalities, boroughs, shires, districts, and in the Northern Territory, a number of rural Aboriginal communities.

Australia, like many developed countries, has progressively established a capacity to build, manage and distribute its spatial data across the government and non-government sectors. Local government in Australia is a system of government established under state government legislation and is governed by a council, elected directly by, and accountable to, the various communities which they serve. Local government authorities (LGAs), or councils as they are commonly termed, are multifunctional and provide a wide range of services through a single administrative structure for the governance and good management of towns, cities and communities (Hullick and Cooper, 1993).

Most local governments control or oversee land development and planning, parks, community facilities, environmental compliance, water supply, sewerage and community health amongst other responsibilities. The land related information and mapping that supports their decision-making is typically at a detailed level or large scale (1: 100 to 1:5 000). 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 and Perret, 1987; Williamson and Blackburn, 1985). Many of these developments were driven by the need for improved land use planning (Nash and Moll, 1976) and better financial management of the organisation and their assets (Cushing et al., 1975).

By the late 1970s, many local governments in Australia had computerised records of their properties for the purpose of rating and taxation, however these systems constituted financial management systems rather than spatial information systems. Even at this early stage of land information systems development, the problems of dealing with the complex nature of address, property and land parcels were recognised, and the concept of a unique property identifier was considered (Moyer and Fisher, 1973). The local government developments in Australia parallelled efforts in other countries such as the United Kingdom, where the development of systems such as the Local Authority Management Information Systems (LAMIS) were undertaken by local governments in conjunction with mainframe computer vender ICL (Mayr, 1992). Traditional computer applications for planning began to make way for more spatially demanding and accuracy specific applications such as engineering infrastructure, transport planning, property management and facilities management (Bomberger, 1983).

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 period was characterised as a time of system consolidation and data collection. It 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. Trends on adoption and diffusion of GIS and geographic information technology in local government have been explored in the USA (Budic, 1994; Budic and Godschalk, 1994; Warnecke, 1995), the UK (Campbell, 1993; Masser, 1993; Masser and Campbell, 1995) and Europe (Masser and Campbell, 1996). Although GIS technology has been adopted widely across local government in Australia, there is little documented evidence on its growth or diffusion within this sector of government in Australia.

The late 1990s and the early 2000s saw the improvement in cost efficiency of GIS technology and greater utilisation of the spatial data 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. GIS had become a tool and the information that it provided to the organisation

went from being “nice to have” to being “critical”. Web mapping introduced spatial data to a broad base of LGA users and also improved community access to basic land and spatial data. Local governments have continued to be leaders in the application of spatial data and technology through the use of web mapping applications and location based services.

Compared with many countries, local government in Australia has a relatively narrow range of functions. For instance, it does not take general responsibility for the provision of services such as education and policing (United Nations Economic and Social Commission for Asia and the Pacific, 2003). The size of local governments in Australia reflects the diversity and often complexity of this tier of government. Approximately 36% of local governments are populated by less than 3 000 people and almost three quarters have a population of less than 30 000 people. Many of these sparsely populated local governments are located in the rural areas of Australia and provide critical infrastructure including roads, housing, water and sanitation.

3. A RESEARCH METHOD FOR UNDERSTANDING SDI CAPACITY AT THE LOCAL LEVEL

To better understand the complexity of the heterogeneous nature of local government and their capacity to contribute to SDI development, a survey of local governments was conducted across the three Australia states namely Victoria, Queensland and Tasmania. Contact was made with 183 LGAs across three states comprising: 74 in Victoria, 89 in Queensland and 20 in Tasmania). The states were selected on the basis of a variety of characteristics including geographic area, population and the number of local governments. These three states represent almost 50% of Australia’s population base, approximately 35% of the total number of local governments and about 25% of the geographic land area, thereby providing a contrasting mixture of local governments, geography and institutional arrangements.

In order to ensure a high response rate to the survey, direct telephone contact was initially made to each of the local governments in the first instance. This enabled a contact person in each LGA to be identified so that the questionnaire was directed to the relevant person. After the telephone contact an email containing the URL for the web based survey was then sent to each LGA contact. After two weeks a reminder email was sent to follow up and improve the response rate. A total of 110 responses were received including seven responses which were rejected as either incomplete or invalid. The remaining 103 valid returns represent a response rate for the survey of 56%.

The LGA questionnaire was arranged in eight parts and included questions on each LGAs organisation, information policies, access to data, data holdings and maturity, use of standards, personnel, existing collaborations and outcomes from data sharing partnerships. Table 1 summarises the structure of the LGA questionnaire. Parts 1 to 7 investigated the capacity of each LGA across the components of an extended SDI model, whilst part 8 of the questionnaire examined the outcomes and overall level of satisfaction of LGAs with the data sharing partnership.

The LGAs surveyed across the three states varied dramatically in terms of the number of properties they manage and their capacity. The largest local government to respond was Brisbane City Council, with approximately 400 000 properties in its local government area. The smallest LGA to respond was also from Queensland, Nebo Shire Council, which has approximately 1 500 properties, but spread over an area of almost 10 000 square kilometres.

Table 1: Structure of the LGA questionnaire.

LGA Questionnaire Component	Topics Covered
Part 1: LGA Organisation	Number of properties, staffing, ICT capacity, GIS capacity, management support
Part 2: Policy on Use of Spatial Data	Internal and external policies, cost recovery, attitudes towards privacy, copyright and legal liability.
Part 3: Accessing Spatial Data/ Technology	Locating LGA data, technology and mechanisms to access spatial data
Part 4: About LGA Spatial Data	Importance of property data, use of state government data, requests for their data, completeness of their data
Part 5: Spatial Data Standards and Integration	Attitudes towards standards, use of metadata and level of data integration
Part 6: About People	Profile of staff in spatial management area, organisational change, training
Part 7: Collaboration with organisations	Level of collaboration, barriers and drivers, preferred models, expectations from data sharing and collaboration
Part 8: Outcomes from Specific Data Sharing Partnerships	Outcomes in terms of value, improved quality, improved communication, updates, overall satisfaction

A range of quantitative and qualitative analysis was undertaken on the questionnaire data. Analysis of the variations between the LGAs in each of the state government jurisdictions was determined by using statistical significance testing of the mean state results for each variable. Finally, factor and multiple regression analysis was undertaken to determine areas across the SDI framework that impact on the capacity of the LGAs to contribute to higher levels of SDI development.

4. RESULTS AND ANALYSIS

The results are presented in a summary form across the broad SDI component areas of data, policy, access arrangements, standards, organisational capacity, people and partnerships. Only the key findings are reported here for the sake of brevity.

4.1 Key Findings on Local Government Capacity

Although Australia's ICT infrastructure is poor in many remote areas of the country, its overall ICT infrastructure and capacity is comparable to other developed nations. In 2005, Australia was rated 11th out of 115 countries based on the network readiness index, and has generally improved its position since 2002. The survey results reflect these findings with most LGAs indicating that the ICT infrastructure was adequate.

The technical capacity within the local government sector is in part reflected by its ability to provide online services or e-business to their customers. The survey results indicated that 39% of LGAs are already providing online services to customers, whilst another 22% were in the process of developing these services. The states of Queensland and Tasmania were found to have the most mature spatial information systems with over a third of the LGAs having had a GIS established for 10 years or longer. This contrasted significantly with Victoria where only 7% of LGAs indicated that their GIS had been in place for more than 10 years whilst more than 53% of LGAs identified their GIS was less than six years old. The major area of resource deficiency identified was in the area of staffing. Most LGA respondents (84%) indicated that their GIS unit was staffed by three staff or fewer. In some cases, the officers responsible for managing the GIS were undertaking the GIS management in conjunction with other activities.

Approximately 59% of LGAs indicated that they did not have any formal policies on the use of their spatial data by external organisations or users. These findings agree with a 2004 survey of LGAs by Australian Local Government Association which found that approximately 60% of LGAs were found to have no formal policies on information.

The questionnaire findings found that approximately 30-40% of staff in LGAs having access to GIS at their desktops. This indicates the growing level of importance of spatial data to the organisations. Only 13% of LGAs indicated that external clients used the internet to find data which generally identified that the LGA had a web portal open to the public. However, this trend is most likely to change over the next few years as more LGAs begin to provide web access to their spatial data. The following comment was indicative of the general experience of LGAs to opening up their spatial data to the public:

Making the common property-based data freely available to the public via web-mapping has resulted in a sharp decline in ad-hoc queries and resulted in significant savings on staff time.

Local governments obtain a significant amount of their spatial data from the state government. LGAs from all three states indicated that the cadastral mapbase, property valuations data, orthophotography and topographic data were the most commonly sourced state datasets. When asked the question if the data they required from the state government agencies was easily accessible, 76% LGAs agreed or strongly agreed. On the separate question on the pricing of the data, 63% agreed that the cost of acquiring this data was acceptable. Additionally, the average level of completeness or maturity of LGA data sets is generally quite high, which indicates that LGAs have significant holdings of data which may potentially be available for sharing.

Although standards and formats were identified as being problematic by some LGAs, most indicated that standards were not a significant issue. Metadata is considered an important component of spatial data and identifies its source, currency and quality. However, only 42% of LGAs currently enter metadata within their GIS. These findings are supported by other documented studies such the Local Government and the Australian Spatial Data Infrastructure Project which identified that only 44% of LGAs stored metadata (Hawkesbury-Nepean Catchment Management Trust, 2000). Not surprisingly this study also identified that the majority of the metadata collected by these LGAs was not compliant with national metadata standards, which may inhibit future state and national efforts to exchange data.

The results indicate that almost 66% of LGAs have only one GIS staff member, a further 18% have either two or three GIS staff, and remaining 16% of LGAs have four or more GIS staff. This highlights the difficult situation faced by many LGAs in participating in data sharing partnerships. With only one staff member to manage the organisation's GIS work, the time available to undertake extra duties, such as partnership participation, is often limited.

Local government collaboration was examined across a range of possible partners including state and federal government, private sector, academic institutions and local government associations/groups. A number of general trends were evident. Firstly, LGAs were most likely to collaborate with State governments, followed closely by the relevant state local government association or regional local government group. Secondly, the difference in the level of collaboration/co-operation of LGAs with the state governments in Tasmania and Victoria in comparison to Queensland was significant

($p<0.001$). This significant variation between Queensland and the other two states provides a useful barometer of the degree of trust and interaction between local and state government in each of these states.

LGAs identified that the greatest barriers to collaborating with state government agencies for spatial data sharing were legal liability, data standards, accessing of data, copyright and privacy. Motivations for the sharing of spatial data were found to be closely aligned with improving decision making and the delivery of services which emphasise the strong business basis for the exchange of data. The questionnaire found that 83% of the total respondents who had signed a data sharing partnership arrangement either agreed or strongly agreed that it had been worthwhile for their organisation. The levels of agreement were highest in Tasmania and Victoria whilst there was a lower level of agreement (approximately 60%) in Queensland.

A similar trend was observed on the question on whether the data sharing partnerships had improved their organisation's data quality. Again, the overall level of agreement to this question was high (71%) across the aggregated state data, with both Victoria and Tasmania responding positively. However, the level of agreement from Queensland LGAs was only 36% which reflects that the initial data sharing arrangement had done little to improve the quality of the LGAs data.

The overall level of satisfaction of the LGAs with the data sharing partnerships being investigated in each of the states revealed that across the three states, 73% of LGAs were either mostly satisfied or very satisfied with the outcomes of the data sharing partnership. The individual levels of positive satisfaction found for each state were Tasmania (92%), Victoria (91%) and Queensland (52%). Again the difference between Queensland and the other two states was significant.

4.2 Inter-Jurisdictional Differences

An analysis of the average responses on a state by state grouping was undertaken to determine areas of key inter-state difference. The results of the difference analysis are summarised in Table 2. The variables used in the questionnaire included a range of measurement types including continuous numeric values (e.g. number of properties), descriptive ordinal/internal values (e.g. Likert scale – agree, strongly agree) and categorical or nominal values. The categorical or nominal variables were not suitable for factor analysis and were therefore not utilised. Prior to the analysis the continuous numeric variables and the ordinal Likert variables were transformed to numerical interval classes between 0 and 5. Only the variables that illustrated significant inter-state variation ($p<0.05$) are tabulated. The variables highlighted in Table 2 have the highest level of significance with respect to inter-state variation with p-values <0.01 for both the ANOVA and Kruskal Wallis tests.

The length of time having a GIS was identified as a significant inter-state variation. This is partially explained by a recent Victorian state government data sharing partnership which assisted in the establishment of a large number of geographic information systems at the start of the project. A significant difference was identified in the cost recovery policy between the states which reflected the more restrictive pricing and access arrangements in Queensland at the time.

Table 2: Variables that illustrate significant inter-state difference (p <0.05).

Variables	State			ANOVA Significance p<0.05	Kruskal Wallis Significance p<0.05
	QLD	VIC	TAS		
	Mean	Mean	Mean		
Length of time having GIS	3.21	2.50	3.62	0.000	0.000
Cost recovery policy	2.02	1.31	1.62	0.000	0.000
Cost of state data is acceptable	3.31	3.74	4.23	0.001	0.002
Access to training	3.52	4.10	3.00	0.001	0.002
Average level of collaboration across organisations	2.93	3.25	2.52	0.002	0.001
Data sharing partnerships is worth-while	3.67	4.36	4.54	0.000	0.000
Data sharing has improved quality	3.21	4.29	4.38	0.000	0.000
Believe that the benefits are equal	3.40	4.05	3.31	0.001	0.001
Are provided updated data regularly	3.17	4.69	4.23	0.000	0.000
Communication frequency	3.35	4.12	3.92	0.000	0.000
Overall level of satisfaction	3.48	4.17	4.31	0.000	0.000

Differences between the states were identified in the trends on collaboration. Tasmania and Victoria appear to have developed a higher level of trust and intergovernmental relations than Queensland. The overall level of satisfaction with the data sharing partnerships was also highest in Victoria and Tasmania. Queensland and Victoria showed significant differences towards web mapping and external accessibility of data when compared to Tasmania. The difference between the LGAs' perspectives on the cost of state government data is most evident between Queensland and Tasmania, with Queensland LGAs less satisfied with the pricing arrangements and Tasmanian LGAs generally very satisfied. A similar trend can be seen on the LGAs view on the limitations placed on the use of state data by the data custodians.

Tasmania showed significant differences in the overall maturity levels of their spatial data holdings, generally being higher than Queensland and Victoria. There was also evidence of greater staff stability in this state than in the other states, perhaps related to the relative isolation of this island state and the smaller size of their LGAs in comparison to Queensland and Victoria. Victoria showed strong differences from the other two states in the areas of access to training and the level of positive collaborations with other organisations. It is suggested that the smaller state size and access to training provided by the state government in return for sharing data is responsible for these results.

4.3 Factor and Regression Analysis

A factor and regression analysis was undertaken to identify which variables or groups of variables were contributing towards the success of the data sharing partnerships and hence SDI development. Factor analysis is a well documented technique that assists in identifying clusters of variables that may be logically grouped into a smaller set of these variables which have common underlying constructs or factors (Brace et al., 2006). The factor analysis was undertaken using the standard principal component analysis method to reduce the total number of independent variables from 36 to 13 grouped factor components.

Table 3: Results of multiple regression modelling.

Factor	Unstandardised Coefficients		Standardised Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	2.202	.895		2.461	.016
Size	-.015	.076	-.025	-.203	.839
Organisational Support and Attitudes	.294	.156	.221	1.883	.063
Data Accessibility/Maturity	-.164	.149	-.148	-1.100	.274
Internal Accessibility	-.103	.127	-.102	-.811	.420
Access to State Data	.372	.115	.343	3.244	.002
Level of concern on data restrictions	.110	.089	.111	1.240	.218
Standards and Metadata	-.067	.092	-.068	-.726	.470
Use of State Data and Restrictions	.104	.114	.095	.914	.363
Organisational Change	-.172	.132	-.128	-1.301	.197
Staff Growth and Training	.057	.126	.047	.456	.650
Business Needs	.266	.098	.247	2.705	.008
Policy on External Access to Data	-.237	.077	-.260	-3.056	.003
Length of Collaboration	-.036	.041	-.076	-.898	.371

A multiple regression model using the simultaneous technique was then applied using the 13 grouped components from the factor analysis as the independent input variables and the satisfaction with existing data sharing partnerships as the as the dependent variable. The analysis yielded a model (see Table 3) that was significant: $F(13,88) = 4.659$, $p<0.005$, with an Adjusted $R^2 = 0.32$, which indicates that the model has accounted for approximately 32% of the variance in the criterion variables.

The highlighted component factors in Table 3 namely, organisational support, awareness of state data, external access policy and the business needs are identified as significant to the partnership outcomes. The organisational support factor importantly encompasses ICT capacity, management support and attitudes to making data and resources available. This emphasises the importance of assessing a potential partner's capacity during partnership development to better understand the ability of the organisation to contribute to the partnership outcomes.

Policies on access and pricing were again identified as important to the outcome of the partnerships. Policies at state and local level should be aligned to ensure that there is minimal conflict. Local government are more likely to follow state government policy direction due to their limited capacity to resource their own policy development. External access policies and the use of the internet are identified as important considerations for partnership development.

The business needs factor underlines the importance of maintaining a business focus for the data sharing initiative to be sustainable. If the data sharing initiative is linked to important business processes, it is more likely to receive priority and be incorporated within mainstream operations. Wehn de Montalvo (2003) in her study on the willingness to share data, found that attitude and social pressure were the strongest determinants of willingness to share spatial data. In particular, organisational pressure, GIS community pressure, knowledge creation and social outcomes were identified by as key determinants.

5. DISCUSSION AND IMPLICATIONS FOR THEORY AND PRACTICE

This analysis of local governments examined their capacity, characteristics and outcomes of the data sharing partnerships in the states of Queensland, Victoria and Tasmania. A number of significant trends and differences were identified amongst the variables and across the three states. The initial analysis of the questionnaire data has identified a number of important characteristics of local governments including their capacity across a number of the identified SDI component areas, existing preferences for collaboration and their level of satisfaction with the existing data sharing partnerships. The organisational analysis identified that the ICT capacity of LGAs was significantly better than expected and management support for GIS was generally satisfactory. Policies on access and pricing are not well developed in local government, as small staff numbers and other activities take priority. It is therefore important that state government agencies continue to lead and support LGAs to develop their policy frameworks. LGAs appear more likely to adopt or mimic the state government policies on access and pricing, although this has not been proven conclusively.

The findings from the factor analysis underscore the key motivations for sharing of data, particularly at the local government level. LGAs are very tightly resourced and highly business driven. Therefore, the linkage of data sharing initiatives to the business processes of LGAs is more likely to result in more successful and sustainable outcomes. The research also indicates that policies at that state and local level should be aligned where possible to ensure that there is minimal conflict. Local governments are more likely to follow the lead of state agencies on policy development due to their limited capacity to develop their own specific spatial data access and pricing policies.

Often, LGAs are at the cutting edge of spatial data access and provision through the use of the internet and web mapping. Because of the closeness of LGAs to their customers, they see immediate and significant benefits through providing information access to the local community. Information access facilitates better service and evidence indicates that it reduces the number of general enquiries. Organisational support and leadership were also rated highly and agree with previous theoretical and empirical research.

Local government data is increasingly available over the web and indications are that it will be a strong driver for facilitating business and reducing the number of over-the-counter enquiries for LGAs. The level of completeness of core data sets was very high for most local governments which should provide an excellent basis for exchanging digital data. Standards and metadata were identified as issues that will continue to demand attention and strategies to improve compliance in these areas. Integration of data across the LGAs is well advanced, but full interoperability is still some way off.

6. CONCLUSIONS

Spatial data is widely utilised across all levels of government, business and the general community. The objectives of SDI initiatives are to create, maintain and disseminate spatial data for the benefit of society. However, the co-operation and exchange of information has continued to be problematic with detrimental impacts on government business and areas such as emergency services. This research has found that local governments have mature spatial data holdings and the ICT infrastructure to facilitate SDI development through the wider sharing of data.

The role of local government in building and developing SDI at the local level is critical. Although the local government environment is complex, a number of important trends have emerged from this research. Firstly, LGAs have a strong focus on meeting their business needs and, therefore, SDI development should be considered as a significant business enabler. Secondly, LGA capacity to develop information policy frameworks is often limited, so it is essential that strong and positive information policy is provided and disseminated at the state level. Finally, local government must be viewed as an equal partner in SDI development to engender trust and facilitate data sharing on an equitable basis.

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