ECONOMIC RATIONALISM IN MANAGING SPATIAL DATA INFRASTRUCTURE - THE AUSTRALIAN EXPERIENCE

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Abstract

One of the most interesting developments in GIS over the last few years has been the attention given to the development of spatial data infrastructures at state and national levels. These jurisdictions are moving towards holistic management of their spatial data to support both the government and the rapidly expanding spatial information industry. Paralleling this growth in spatial data infrastructure has been a move to economic rationalism and micro-economic reform in many developed countries worldwide. In Australian governments this has led to the development of a Purchaser/Provider model and the introduction of the National Competition Policy. This paper will use the State of Victoria in Australia as a case study to highlight the impact of economic rationalism in managing spatial data infrastructures. The analysis draws on current research on the diffusion of GIS, the experiences of working with governments in Australia and overseas on the development of spatial data infrastructures in general, and the key component, digital cadastral databases, in particular.

INTRODUCTION

There is no doubt that the development of the spatial data infrastructure (SDI) concept is one of the most exciting and challenging initiatives in the spatial data industry over the last decade. The interest in SDIs is understandable considering the fundamental role they play in our emerging information society. However the development of SDIs is not easy and is heavily influenced by political decisions and government policy, especially in an environment of micro-economic reform which has been enthusiastically embraced by many governments over the last few years.

The objective of this paper is to look at the impact of micro-economic reform and economic rationalism on the development of SDIs over the past decade in Australia. Australia, and particularly the Australian states, have been pursuing the development of components of SDIs since the early 1980s and provide a good case study to examine the difficulties of developing such systems. In particular the State of Victoria is worthy of examination since it has embraced economic rationalism more than any other state of Australia.

In pursuing this objective the paper describes the concept of micro-economic reform and economic rationalism in the Australian context. It then introduces national and
state SDIs and argues that the specific issues of developing a digital cadastral data base (DCDB) in a state serve as good illustration of the generic issues in developing national SDI.

After a description of the background of development of DCDBs in Australia, the paper continues to detail the historical development of DCDB in Victoria in the context of micro-economic reform and economic rationalism. On summarising the impact of economic rationalism, the paper attempts to look forward at some of the changes that are occurring as a result of the institutional development. One is the increasing recognition that land titles offices play a key role in the operation of SDIs. The other concerns the move to integrate the cadastral, topographic, and other datasets to form one State Digital Map Base (SDMB) and the trend to merge the mapping and land titling functions.

**ECONOMIC RATIONALISM IN AUSTRALIA**

Since the early 1980s it was recognised that the Australian community could not maintain its standard of living by exporting bulk primary products and importing more sophisticated goods and services. There was a need for the country to "enhance its capacity to produce internationally tradeable goods and services domestically; ...improve the productivity with which domestic production takes place; ...develop the capacity to take advantage of new export opportunities as and when these evolve" (INDECS, 1990:276). The Federal Labour government entered its third term of office in 1987 with micro-economic reform high on its agenda (INDECS, 1990). The authors adopt Terry and Forde's (1992) definition of micro-economic reform as "measures which increase the ability of the economy's resources to produce goods and services efficiently".

In the context of nation wide micro-economic reform, changes to the management of the Australian public sector were introduced. In the State of Victoria, in the words of Michael Vertigan, current Secretary of the Department of Treasury & Finance, the public sector reform has focused on "delivering better, more responsive and more effective services at lower cost" (Vertigan, 1996). This focus inevitably gives the Victorian reform a strong flavour of economic rationalism which is defined here as taking a rational view of management based on economic and financial principles. Economic rationalism has helped shape the current management model adopted for the public sector by the Victorian government.

In this management model the main responsibility of departments is "the delivery of outputs which satisfy performance standards and targets established in the budget in terms of quality, quantity, cost and timeliness" through contractual arrangements. This contractual structure within State departments is called the purchaser-provider model (Vertigan, 1996).

Based on the purchaser-provider model, in each department, the head and the team of policy makers serve as the purchaser and define the outputs. There are internal and external providers. Internal providers, located inside government, comprise traditional departmental staff (to be gradually converted to service agencies), state owned enterprises and government business enterprises that are part of government but managed in a commercial manner independent of any department. External providers are made up of private sector or community agencies outside government. Irrespective of the nature of the providers, the purchaser enters into service agreements with individual providers to deliver the outputs which satisfy performance standards and targets as agreed by government (Vertigan, 1996). An important element of the reform had been the restructuring of organisations to sharpen their focus on core business or service delivery objectives and improve cost attribution, so that management decisions took account of the full costs of service delivery (Vertigan,
Concurrent with the Victorian reform was the commissioning of an independent Committee of Inquiry by the Federal government in 1992 to develop a National Competition Policy to "consolidate the many reforms undertaken by governments over the last decade" (Hilmer, Rayner, & Taperell, 1993:preface). The report by the committee was published in 1993 with all State governments agreeing to implement the Policy in 1995. The Victorian State government was committed to the Policy which was considered complementary to its own micro-economic reform objectives. It published its policy statement on competition in 1996 in support of the introduction of the competitive neutrality principles to both government owned businesses and predominantly tax-funded general government services. The principle of competitive neutrality "aims to ensure that government businesses" and services "do not enjoy any net competitive advantage" through immunity from taxes, regulations, debt charges, and in general, full cost attribution (Department of Premier and Cabinet, 1996).

The micro-economic reform policy adopted by the Victorian Government in the past, and the recent commitment to a competitive neutrality policy in recent years constitute the context of economic rationalism in public administration in Victoria, and to a certain extent, in Australia. It is within this environment that spatial data infrastructures have developed in Australia over the last ten years.

**SPATIAL DATA INFRASTRUCTURES - AUSTRALIA and VICTORIA**

**Australia**

The concept of spatial data infrastructures (SDIs) in Australia recognises that there is a wide range of SDIs from global through regional, national, state to local and even institutional levels. The focus in Australia is definitely on national and state SDIs which play different roles based on the different federal and state responsibilities in Australia. For example the Federation through its Commonwealth Government organisation AUSLIG is responsible for medium to small scale mapping (mapping scales 1:50,000 and smaller) and the national geodetic network (it shares some of these responsibilities with Defence). On the other hand land administration and cadastral matters are a state responsibility and as such states are responsible for medium to large scale mapping (1:25,000 and larger) and particularly cadastral mapping (ANZLIC, 1996; Mooney and Grant, 1997). The above responsibilities are coordinated by the Australia New Zealand Land Information Council (ANZLIC) which was formed in 1986 and is the peak coordinating body for land information policies at a national level.

The proposed ANZLIC National Spatial Data Infrastructure is similar to that of the US and made up of four components: institutional framework, technical standards, fundamental datasets, and clearing house network. In simple terms ANZLIC envisages a distributed network of databases, linked by common standards and protocols to ensure compatibility, each managed by custodians with the expertise and incentive to maintain the database to the standards required by the community and committed to the principles of custodianship. The issue is to determine what is required of jurisdictions and their datasets to enable them to meet national standards (ANZLIC, 1996:5).

**Victoria**

The State of Victoria has a major commitment to establishing and maintaining a spatial data infrastructure to serve all government and non government stakeholders and users. Coordination is provided through Geospatial Policy and Coordination
Victoria (GPAC) with the operational arm being Geographic Data Victoria (GDV). GPAC is the Victorian representative on the ANZLIC Advisory Committee. Other states such as New South Wales are pursuing similar policies (see Mooney and Grant, 1997).

GPAC defines Victoria's spatial data infrastructure as a framework for coordinating and integrating the collection, management and delivery of spatially related information. The SDI is made up of the Victorian Geospatial Information Network (GISNET) and Geodetic Information Network (GPSNET). The components of the SDI are similar to the ANZLIC model but at a larger scale and in more detail. The State Digital Map Base (SDMB) which represents the fundamental datasets, includes the cadastral layer (DCDB), the digital topographic data base, digital elevation model and digital road network, administrative boundaries, geographic names or place names gazetteer and the geodetic framework (linked to the national network).

An important component which distinguishes the State SDI from the national SDI is that the State SDI includes the cadastre which is made up of the spatial (DCDB) and textual (land titles) components. This difference accounts for many complexities not found at a national level. This is because the cadastre is highly dynamic due to the daily subdivisioning of land and has a very high integrity with the title (textual) component guaranteed by the Government. The strong linkage between these two components relates to updating the spatial data set through the land administration processes of subdivision, consolidation and boundary amendments, not the daily operation of the land market (for more details on cadastral principles see FIG, 1995).

The fact that the cadastre underpins the State's land market and economic activity reinforces its position as the key data set in the State's SDI. Actually, governments in Australia are viewing spatial data much more holistically while at the same time recognising DCDBs as the most important component of the core spatial data sets in a state wide spatial data infrastructure (Price Waterhouse, 1995; Tomlinson Associates Ltd., 1993). Management of the two components of the cadastre while embracing micro-economic reform presents some of the biggest hurdles in introducing the state SDIs. Good lessons can be learnt about the generic issues of SDI development by focusing on Victoria's cadastre (the DCDB in particular) and the impact of micro-economic reform on its development and management.

BACKGROUND OF DIGITAL CADAstral DATABASE DEVELOPMENT IN AUSTRALIA

Australian cadastral systems have been strongly influenced by the historical settlement of the Australian states and territories. Departments of Lands or Departments of Surveyor General administered the ever decreasing Crown lands as a result of rapid alienation, as well as managing the jurisdictions' surveying and mapping infrastructure. State Land Surveyors Boards, within these departments, maintained a quality assurance function for cadastral surveys. The Land Titles Offices on the other hand, historically had responsibility for the titles and deeds associated with all freehold or private lands, which now comprise the vast majority of land parcels in the Australian states, and have also been usually responsible for examining cadastral survey plans of freehold lands. The Land Titles Offices, however, have only ever been concerned with individual transactions in support of an efficient land market, with the result that Australia lacked a European style cadastral office providing a complete cadastral record which could be used for land administration purposes.

Up to the 1970s and early 1980s, subdivisions of private lands were charted in Land Titles Offices on index maps which had a low spatial integrity. These maps were often copied from approximate valuation maps and were frequently used by many other authorities such as local government and utilities. There was major duplication in
maintaining these base maps with as many as 20-30 different base map series being maintained in each state. These maps were rarely if ever kept up-to-date. The integrity of the cadastral system however was based on the individual accurate cadastral surveys and plans kept in the Land Titles Offices and those relating to Crown land kept in the Department of Lands or Offices of Surveyor General.

While the state Land Titles Offices have been responsible for checking or maintaining records of cadastral surveys of alienated or private land, the Surveyors General in each state of Australia have had responsibility for a number of related activities. Historically the Surveyors General's offices have controlled the alienation of Crown land, the management of the Crown estate including all associated maps, the licensing of cadastral surveyors and the carrying out of Crown land surveys (Williamson and Enemark, 1996); Surveyors General have also had the responsibility for compiling cadastral overlays for topographic maps particularly over the last 30 or 40 years, and in most cases, the creation of DCDBs over the last 10 to 20 years. While the creation of DCDBs and their maintenance was a "mapping" function, for decades it was possible for the mapping to be done at "arms length" from the land titles offices. This has often created confusion and tension in states in Australia between the Land Titles Offices and survey and mapping departments, particularly regarding the establishment, development and maintenance of DCDBs.

**SDI/DCDB DEVELOPMENT IN VICTORIA**

In the context of micro-economic reform world-wide and economic rationalism in the public sector of Victoria, developing the Victorian SDI has been a turbulent process. The process can be studied in terms of three eras named after the lead agencies in GIS coordination in the respective era: LANDATA, OGDC (for Office of Geographic Data Co-ordination), GPAC/GDV (for Geospatial Policy and Coordination Victoria, and Geographic Data Victoria).

**LANDATA Era (Early 1980s - 1991)**

In the mid-seventies, the Victorian government was already aware of the significant duplication in the maintenance of computerised land information. Due to the scale of the problem, it was only after a decade of deliberation in 1984 that the State government finally agreed to establish an agency called LANDATA to minimise the incompatibilities and duplications, improve access to the information, develop and implement new information services (Rakkar, Eddington, Ralton, & Gung, 1984).

The establishment of LANDATA in 1984 was an innovative approach in the development of GIS/LIS nationally and internationally. It generated high hopes among stakeholders. However, LANDATA was ahead of its time. The extents of the problems - technical, political and organisational - in achieving the vision were under-estimated. It was under-resourced by government which viewed the agency more as a mechanism to achieve land administration reform than to develop a spatial data infrastructure in the wider context. LANDATA's emphasis was on developing the **textual** land information system (the textual cadastre). The mapping system developed in association could only produce digital map data in a format without topology.

By far the most significant blow to the success of LANDATA was the cost recovery policy adopted by government at that time. LANDATA was unable to deliver sufficient tangible benefits as predicted in its corporate plan to satisfy government. After a series of review, by early 1990s it was reduced to a public inquiry service of land ownership information in the State's Land Titles Office. By this time, there was no GIS strategy and government support for GIS development was limited and fragmented. In 1991, frustrated by not having the right digital map base to support their GIS, a
group of nine agencies from the natural resources sector pooled their resources together to hire an international consultant to review the State's GIS/LIS policy. Much of the background which led to this initiative is described in Williamson (1992).

The consultant produced a report highlighting past investment of up to A$134 million in digital mapping and GIS in the previous decade. A potential benefit of over A$130 million from use of GIS in state programs was identified (Tomlinson Associates Ltd., 1991). The consultant further suggested the need to "initiate GIS planning using thorough, modern methods" to define the goals, identify the performance indicators and in general develop a consistent cost-benefit analysis for future justification of GIS expenditure. The report took an approach of economic rationalism citing impressive figures of past investment and future benefits, and gained the acceptance of the State government. As a result, the Office of Geographic Data Co-ordination (OGDC) was established under the Department of Finance in late 1991, initially charged with the task of overseeing a more detailed GIS planning study of the government by the same consultant.


The study took 18 months to complete, costing roughly A$1 million. In the process there was a change of government from Labour to Liberal. The final report was produced in 1993 adopting a thorough and rigorous methodology for user needs and cost-benefit analyses. The consultant recommended an investment of A$56 million over a period of six years to develop 270 datasets which would generate 61 information products for use by 39 state agencies. In return, the consultant predicted a fully discounted benefit of up to A$312 million (Tomlinson Associates Ltd., 1993), albeit the returns were subject to achieving many technical, institutional and administrative reforms. The rigorous approach of economic rationalism adopted in the report was in tune with the Liberal government's micro-economic reform policy. OGDC was put in charge of formulating and implementing the State's detailed GIS strategy.

By that time, two main sets of DCDBs were being developed, the DCDB of Metropolitan Melbourne owned by a government business enterprise - the Melbourne Water Corporation (MWC), and the rural DCDB managed by a State agency called Survey and Mapping Victoria. By early 1994, government was keen to take over the metropolitan DCDB from MWC to develop a state wide DCDB. After much negotiation, in May 1994, an establishment agreement was signed between OGDC and MWC to bring the two databases together under government ownership at no cost but under certain conditions.

A special branch called Geographic Data Victoria (GDV) was created under OGDC to manage the new state wide DCDB in a commercial manner. The business case for GDV was developed with the help of business consultants. No additional resources was given to staff the branch which was to contract out its operations. Also, in line with the attitude of many national governments the State government developed a pricing policy under which all users apart from the state departments, and academic and education institutes were charged for using the DCDB and other digital map data.

The management, maintenance and distribution of the metropolitan DCDB was contracted out on 1 July 1995 to DATAflow Pty Ltd (the government owns the data set but does not hold a copy). With the experience gained, the maintenance of the whole state DCDB was then contracted out at the end of 1996 with DATAflow Pty Ltd again being successful. As a result the government's role in managing the DCDB has increasingly been focused on output and performance and less prescriptive in respect to hardware and software. Qualified private sector organisations will be sought to provide maintenance and distribution services.
Also in 1995, the State government moved the mapping function to OGDC from Survey and Mapping Victoria which then became the Office of Surveyor General. OGDC decided to group the core GIS datasets such as the DCDB, digital road network, and the digital topographic database (completed in late 1984) into a State Digital Map Base (SDMB). The overlap in these three datasets was recognised as being both in content and administration. However, the boost in authority of OGDC came with the requirements for it to downsize the mapping section and generally to prepare for the section's privatisation. It was expected to remain small, to contract out its business operations as far as possible, to manage the SDMB in a commercial manner and to be self-sufficient as soon as possible.

These requirements came as no surprise as from 1991 to 1995, OGDC was located within the Department of Finance (occasionally Department of Treasury). This gave it a neutral status, not being perceived to affiliate with any special business function in government. However, it was also placed at the forefront of economic rationalism spear-headed by its parent department. Requirements were imposed so that it would serve as a model for other government agencies.

Another outcome from the government's economic rationalism policy was to utilise universities and other research bodies to a far greater extent for its research needs. One result has been a major six year contract of research between OGDC and the Centre for Geographic Information Systems and Modelling within the Department of Geomatics at the University of Melbourne, which commenced in 1996.

**GPAC/GDV Era (1996-Now) - Current Development**

By April 1996, immediately after the re-election of the state government, OGDC, together with two groups of agencies responsible for managing the state's land and natural resources information respectively, were put under a line department — the Department of Natural Resources and Environment. It was perceived as another move of economic rationalism to re-engineer the management of the state's data/information resources, particularly in the land administration and natural resources program areas. The development was also in-line with the trend started in New South Wales in which the agencies responsible for managing land and natural resources information were amalgamated into one large department in 1991 (Watkins, 1994). However this did lead to OGDC being perceived as losing some independence since it was now part of an operational government department.

To complete the transition to the purchaser-provider model, OGDC was split into two offices: Geospatial Policy And Coordination Victoria (GPAC) and Geographic Data Victoria (GDV). The former was the purchaser, responsible for policy and coordination, and the latter was the provider, responsible for the management of the SDMB. At first, the two offices were independent of each other. Subsequently, in early 1997, GDV was brought under GPAC.

By this time, GPAC had completed six minor consultant studies to provide a vision statement for each of the six key program areas in government, namely, land administration, socio-economic planning, environment and heritage, emergency management, industry development, and transport. Based on much of the previous work by OGDC, GPAC also consolidated the concept of the state's SDI into GISNET the development of which was detailed in a draft Geospatial Information Strategic Plan (GPAC, 1997a) and a draft pricing policy for Victorian Government geospatial data (GPAC, 1997b). Much of this is presented on GPAC's WWW site (GPAC, 1997a).

The draft strategy recognises the role of the Government to promote, facilitate, coordinate and own the fundamental spatial data sets while embraces the Government's commitment to micro-economic reform, and as such adopts:
• a user pays philosophy as a major factor in service delivery
• a policy that the development and maintenance of extensive geospatial databases is a private sector activity

Currently, GPAC and GDV due to their statewide mandate are working independently of other offices responsible for land and natural resources information. However, they are all under the same Manager at deputy department head level. Indeed, with proper guidance and support from senior management, significant achievement in the development of the state's geospatial data infrastructure could be achieved. Inevitably, stakeholders, particularly those relying on a GIS infrastructure to improve the way businesses are conducted, have high expectations as they did in the past with LANDATA and OGDC. The big difference now is that the fundamental digital data sets are complete (with the exception of land titles).

**Changes In The Spatial Information Industry In Victoria**

Spatial information industry in Victoria is made up of three integral sectors: government, private and academic. Their relationship is so intertwined that changes caused by economic rationalism in one sector has resulted in changes in the rest. Over the past decade, these changes have been dramatic and are documented by Marwick (1997) as summarised below.

In the LANDATA Era in 1985, the Victorian spatial information industry was dominated by the public sector which had large organisations employing more than 1,500 people, large capital expenditures, and undertook extensive applied research and development. The private sector, represented by the surveying and cartographic professions, was mainly a "cottage industry" with about 100 small private firms which had little capital expenditure, and undertook little or no research and development. The academic sector as represented by the Department of Geomatics at The University of Melbourne (then Department of Surveying) was in a similar position as the private sector. The Department then was able to attract little external funding.

In the current GPAC/GDV Era, the public sector employs less than 250 people and undertakes minimal research and development. It plays a strategic and policy development role, a coordinating role across the industry, manages many contracts to the private and academic sectors, is "lean and mean" and is very cost conscious. On the other hand the private sector, while still having many small firms now has a growing number of larger firms employing over 30 persons. There are now many new firms not previously involved in the industry which now is less dominated by traditional professions. The private sector now employs in excess of 1,500 persons. These firms have a broader role with many investing in research and development and some exporting overseas. In the process, the Department of Geomatics at The University of Melbourne has expanded its undergraduate and graduate program significantly. It also generates about one third of its budget from external sources through contracts, consultancies etc, and has a close working relationship with both the government and private sectors.

**IMPACT OF ECONOMIC RATIONALISM ON SDI/DCDB DEVELOPMENT IN VICTORIA**

Based on the historical development of SDI/DCDB in Victoria highlighted in the previous section, economic rationalism left its marks in three main areas: GIS/SDI management mechanisms in the public sector, the spatial information industry in general, and the composition of a SDI. The detailed impact is discussed separately for each area below.

To the public sector, micro-economic reform have resulted in changed employment
conditions for many, a greater focus on economic & financial issues and a more pragmatic approach to system development and implementation. Agencies responsible for SDI coordination and management faded in and out of existence as economic rationalism evolved within government. For example, cost and benefit considerations drastically diminished the importance of LANDATA and subsequently created OGDC. The purchaser-provider model in turn split OGDC into GPAC and GDV. The management skill of the managers involved did not evolve fast enough to meet the challenge. Though frequent change is perceived to be bad for continuity in strategy formulation and implementation, it does not seem to affect the overall development of the SDI, particularly the more tangible components of technical standards and fundamental datasets. The perception of SDI widen from a set of intra-government GIS capabilities in the LANDATA era to a state wide mechanism to support the spatial information industry and in general to deliver spatial information to the community. In the context of the changing perception of SDI, change in the SDI coordinating and management agency actually helps to re-focus and reinvigorate the process of SDI development.

The changes in the spatial information industry in Victoria under the micro-economic policy of the State government suggests that the industry is more complex and no longer the primary domain of surveyors and cartographers. The changes have improved the capacity for the private sector to grow and invest in new technology, have opened up opportunities for overseas work for private firms, as well as providing a greater diversity of employment opportunities. The changes have also improved the academic sector's ability to support these technological and institutional changes, to react quickly when required, to operate in a business environment and to be a real partner with the government and private sectors in building a spatial information industry. Overall economic rationalism has produced a more challenging environment leading to better solutions for the development of Victoria's spatial data infrastructure.
There are two significant outcomes of the impact of economic rationalism on the development of SDI in Victoria. One is the integration of the core cadastral and topographic datasets and their derivative into a State Digital Map Base. The other is the forcing together of the traditionally separated mapping and land titling function within one department. In his Land Information Vision for Victoria, Williamson (1996) included a conceptual model of a parcel based geographic information system based on a legal cadastre shown above as Figure 1. The model emphasises the importance of the land registry function as a key component of the State's SDI. It proposes an optimal institutional structure providing the core spatial data sets for the State's spatial data infrastructure. The shaded activities are one organisation, having a single public image such as 'Land Information Victoria", being a single budgetary unit and having a reasonable amount of government budget independence. Unfortunately this is a data base oriented diagram which focuses on cadastral entities and consequently does not highlight the critical importance of developing appropriate cadastral processes within the vision.

The quest for an efficient spatial data infrastructure under economic rationalism means that most jurisdictions which have similar legal and institutional structures will inevitably combine their mapping and land titling functions. Increasingly the textual and spatial cadastral data are maintained in the same data base. The institutional change suggested in the model which reflects trends in Australia and internationally, provides an efficient mechanism for providing both types of cadastral data as a key component of the jurisdictions' SDIs.

CONCLUSIONS

There is no doubt that micro-economic reform and economic rationalism have had a dramatic effect on the development of spatial data infrastructures and the growth of the spatial information industry in Australia. The result is that in a little over five years the State of Victoria has moved from a situation where the private, government and academic sectors competed within an environment of distrust to one where each sector has a much clearer understanding of their roles. This results in far greater collaboration and productivity. While there is a perception in some quarters that micro-economic reform has reduced the effectiveness of government (particularly from the public sector unions), there are other views that it has dramatically improved government efficiency and effectiveness. What is not in doubt is the dramatic improvement of the viability and competitiveness of the private and academic sectors in the spatial information industry.

A key outcome of these changes has been a recognition of the importance of SDIs in promoting economic development and environmental management. This has been a catalyst for a far greater commitment to establishing and maintaining SDIs. The result is now a structure which integrates the fundamental data sets into one data model - the State Digital Map Base. This is particularly important from the point of view of integrating the cadastral, topographic, and all data sets related to or derived from them.

The development of the cadastral components of the SDIs has also confirmed the key role that land titles play in the spatial information industry. As GIS increasingly becomes part of mainstream information technology, spatial and textual components of our traditional data sets are being amalgamated and are becoming one. This is resulting in land title activities (textual) as traditionally found in land titles or deeds offices becoming key components of SDIs.
Historically the developments in Australia and particularly the State of Victoria are in a new phase - the phase of holistic development of the SDIs. It is important for the current players to understand history and recognise the pitfalls of the past. Fortunately the current structures now have the advantage of complete digital fundamental data sets.

The future however will continue to change - that is inevitable. What is certain is that the introduction of the spatial data infrastructure concept within an era of economic rationalism has provided a major boost to the GIS and spatial information industry - the future looks promising for those who are prepared to embrace changes.

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