ABSTRACT

The paper discusses the role of land information systems (LIS) in the management of cities; LIS in the urban context are defined, the reasons for having urban LIS are listed, the benefits of having urban LIS are discussed and problems of implementation are highlighted. The paper particularly highlights the importance of urban LIS to providing an acceptable quality of life which is derived to a large extent from an acceptable urban environment. In addition the paper considers the broader political and institutional environment for the establishment and operation of urban LIS.

THE CONCEPT

The concept of a land information system for a large city is simple to describe, however implementation of a LIS is very difficult.

In simple terms an urban LIS consists of the following:

a. A common geodetic reference framework to which all land-related information is referenced;
b. A common base map(s) which is used to record different land-related data;
c. A set of standards which is adopted by all the participating agencies in the city and which defines such things as land parcels, parcel identifiers, land title details, buildings, building identifiers, facility identifiers, names of roads and buildings, road boundaries, street furniture and similar items;
d. A lead agency responsible for preparing and updating the base map and common overlays;
e. An executive steering committee comprising senior personnel from the participating agencies responsible for policy and funding arrangements;
f. A technical committee from the participating agencies which is responsible for making recommendations to the executive steering committee on appropriate standards, coordination strategies and funding mechanisms. This committee should ensure that the data bases and map layers produced and updated in the participating agencies are capable of being integrated or overlaid;
g. A funding arrangement from all participating agencies which meets the cost of the standard base mapping and any technical support needed by the executive steering committee. Basically, a "user pays" approach is adopted; however, funding is shared with regard to the cost of producing the standardised base mapping. The cost of preparing or maintaining map-based data or textual data which is unique to an individual organisation, is the responsibility of that organisation; and
h. An education and applied research strategy which ensures that there are adequate trained personnel at all levels to design, develop and maintain the land information system. This strategy should be fully supported by the executive steering committee. The implementation organisation for education and applied research should work closely with
It is important to note that the development of an urban land information system does not necessarily require the adoption of a digital mapping approach and the use of GIS technology. In many, if not most cases, a fully digital approach is not recommended. A traditional hard copy common base map has a much greater chance of success. In fact, in many cases, a move to a digital approach in the initial stages, before appropriate processes have been established within a LIS management framework, will doom the system to failure.

LESSONS FROM DEVELOPING COUNTRIES

Often in a developed society, with sophisticated administrative system in our cities, it is difficult to recognise fully the importance of a coordinated approach to managing our land-related data. As a result, sometimes for political expediency, governments make short-term decisions to cease some government services previously considered essential or at best they are re-structured such that the long term effect is the same. This has happened in the past, particularly with regard to the preparation and updating of a common base map for cities.

The above view can be implemented for perhaps a decade, as a state continues to rely on the good work of the past. However, in the long term, very serious damage is done to the management of land and services, particularly in the cities. In such circumstances it is valuable to look to the experiences of some developing countries, where the importance of a coordinated approach to land management in urban areas is very obvious. In this regard I am drawing on my experiences as a Land Information Consultant in the Urban Research Division of the World Bank, in Washington DC, in 1989/90 (see Williamson (1991) and Holstein (1990) for further details).

There is increasing recognition that cities are the economic engines of the Third World. For example, approximately 60% of GNP of developing countries comes from urban areas, even though these areas contain only about one third of the total population in such countries. Also, about 80% of the growth of GNP of developing countries is in urban areas. Over the past three or four decades, the urban population in the Third World has increased from less than 300 million to about 1.3 billion. In 1989, the urban population in developing countries increased by some 45-50 million as compared to 7-8 million in developed countries. Up to the turn of the century, the cities and towns in the developing world will have to absorb another 600-700 million people, or about two thirds of the world's total population increase (World Bank, 1988).

Despite progress in some areas, the urban environment continues to deteriorate in most developing countries. The managers of cities are trying a whole range of techniques to improve the quality of life and are "running harder and faster than ever", but they are continuing to slip further behind. One obvious indication of this is the rapid expansion of informal settlements, with poor infrastructure facilities and dilapidated houses. Other signs are increasing congestion, air and water pollution, and deteriorating infrastructure. Simply the rapid urbanisation has outstripped many, if not most, governments' ability to provide even the most basic of services. As a consequence, the major international aid and lending organisations, and their borrowers, have to tackle the serious distortions which exist in the financial, land and housing markets.

There are large inequities in most Third World cities, where, as a consequence of poor mapping and land administration systems, a large number of well developed properties are not paying important taxes. It is not uncommon to find luxury apartments with swimming pools and tennis courts where the road outside is often unmade and gets flooded regularly, and the basic services and utilities are in a very poor state of repair. Simply, if the city administration does not have an up-to-date record of property; does not know where it is, who owns it and its value; it is difficult to tax land and property equitably. Without an adequate tax base it is difficult, if not impossible, to fund essential infrastructure and services. At the same time, if a city does not know the location of all existing services, it is difficult to repair and upgrade them. Other consequences of poor land management include the inability to undertake any city planning or
acquire land for public purposes. Land information systems are seen as one method of helping overcome these urgent problems.

In the cities of the developed world we take a lot for granted. We often forget the importance of efficient, effective and economic land administration and management systems in our cities. If we ever need a reminder of the vital nature of these systems, we need only look at the cities of the Third World.

JUSTIFICATION FOR LAND INFORMATION MANAGEMENT IN URBAN AREAS

Land information systems are not just hardware and software. They are a complex arrangement of:

- People;
- Politics;
- Institutional arrangements;
- Procedures;
- Information technology;
- Data bases.

As shown in developing countries, LIS are a critical part of the land administration and management system of any city. LIS provide an infrastructure for linking or networking land-related systems within a city. On the other hand, a generally accepted view of geographic information systems (GIS) are that they are more a tool, are more project oriented and are more concerned with hardware, software and data.

However LIS play an important role in providing an acceptable quality of life, an essential requirement of any city. As can be seen from the diagram below, a desirable quality of life in most Third World cities requires an acceptable urban environment. This is only achieved by the effective management of a city which can only be achieved by effective information management of all facilities and services within the city. In addition, an acceptable urban environment can only be maintained by raising sufficient rates and property taxes in an equitable manner. This requires an efficient and effective land information system. This is one of the basic justifications for urban LIS. It is an argument which is now readily accepted worldwide by organisations such as the UN and World Bank.

Note these are quite separate arguments from those used to promote cadastral and land titling projects in urban areas, although they are closely linked but are not totally dependent. Land Titling projects will result in a good up to date operational cadastre including land parcel records and maps. While this provides important information for the city, improving the urban environment is not totally dependent on it since taxes in Third World cities are often based on buildings and rents.

As a result there is a strong argument for the development of urban LIS based on environmental grounds only.
There are however many other reasons (which are promoted to a greater extent than environmental considerations) for introducing the LIS concept in urban areas.

Standardised base mapping will enable better delivery of public services, especially through the ability to combine data for such uses as valuation of real estate, land tax, planning, facility management, environmental impact assessment, land acquisition and cadastral administration. This will also enable better analysis of data and consequent planning for public services.

- Standardised data arrangements to improve the ability to share and exchange data between organisations.
- A formal data management system to improve the updating and consequent timeliness of data.
- Standardisation reduces the initial cost of developing the map based and textual data bases and the cost of updating that data through sharing the costs
- Standardisation ensures adequate standards and quality assurance are maintained
- Standardisation minimises duplication of effort in maintaining land information

THE ISSUES

In developing a strategy for a land information system for urban areas, there are many issues to consider:

Coordination and management The development of land information systems in urban areas is primarily based on the need for coordination of the major information providers, resulting in a common vision and common objectives. This reduces duplication and increases efficiency. Coordination is however only part of a good management.

Leadership Coordination cannot be achieved without leadership and goodwill. It is as simple as that!
Common base map
After coordination and leadership, the basic principle of a LIS for an urban area is the need for a common base map. If institutional and funding mechanisms can be found to prepare and maintain a common base map for use by all the key users in a city, then the major obstacle in developing a LIS strategy has been overcome.

Urban vs Non-Urban - The dichotomy
The Urban vs Non-Urban debate can be very complex. In general, "Urban" is concerned with parcel-based and utility data, while "Non-urban" is primarily concerned with natural resource, environmental and agricultural data. This dichotomy is important in the design of a state or national strategy rather than an urban strategy. In addition, in the developing world, there is an on-going debate as to the contribution that the two sectors make to a national economy. The consequences of this issue are explored in more depth later in the paper.

LIS/GIS being technology driven
There is a great danger that land and geographic information systems are technology driven rather than being driven by user needs. This is a particular concern in developing countries where there is often a lack of knowledge and understanding about the associated LIS/GIS technologies. There is a danger of the vendors being the only organisations in many Third World countries with technical expertise in LIS/GIS. Under these circumstances great care must be taken.

Deregulation
The present trend towards deregulation will make it increasingly difficult to control LIS in a traditional legislative or regulatory manner. Coordination will have to be by a mechanism which is in the interests of all parties; in other words, cooperation not regulation.

Privatisation, cost recovery and the role of the private sector
Cost recovery and financial accountability are moving all persuasions of government in Australia to privatisation. No longer can LIS/GIS be driven solely by government with "lip service" given to the private (and academic) sectors, as in the past. Any new LIS coordination approach must consider privatising government functions where applicable, and recognising the role of the private sector to a greater degree. These issues are also explored in greater depth later in the paper.

Copyright
Government must fully embrace copyright laws with regard to land-related data and the issues of cost recovery. However, recognition must be given to the position of the USA, where any data which has been collected with taxpayers' money is free, except for charges relating to copying the data, etc. This is still a major issue which has not been fully resolved in Australia. There are two very strong and contrary views with regard to cost recovery of basic land related data.

Legal liability
Issues of legal liability with regard to use of land-related data are being considered by government LIS institutions however the associated difficulties have not been overcome.

Politics
Any initiative which involves a number of different organisations in sharing information becomes a political issue. Every organisation wishes to protect its "turf" and its staff, unless there are strong reasons to do otherwise. Simply, the importance of having a "tireless champion" who continually works to ensure there is something for everyone in a project or who continually reminds all partners that the initiative is in their long term interest, cannot be over emphasised.

Dichotomy: privatisation/cost recovery vs standards
The major arguments against a totally free market or "laissez faire" environment are duplication and a lack of standards. The latter reason has become increasingly important as we move into an information society. Appropriate standards are critical for the success of a land information system. As a consequence, this creates a demand that there is some coordinating mechanism which can set such requirements.

Influence of the utilities
One of the major influencing factors which is, amazingly, overlooked in the design of a LIS in urban areas, is the influence of the utilities or, to put it bluntly, the influence of those organisations which require land-related information, and especially map-
based data, and are financially independent of government. More often than not it is these institutions which set the priorities in LIS and must therefore be accommodated. Otherwise, they simply go away and undertake their own initiatives, which in the long term may not be in the interests of the city.

**Cost-benefit** Whatever criticisms can be made about cost-benefit analysis as a methodology, it is a sobering mechanism which forms an integral part of any initiative in today's society. Quite often, the cost-benefit process is more important than the outcome, as long as the cost-benefit ratio is favourable! It must be recognised however that the application of cost-benefit analysis to land information management is very difficult, especially regarding the quantification of the benefits.

**Total Quality Management (TQM)** TQM is a management technique which is rapidly gaining in popularity. In simple terms it consists of doing "things right the first time". Any new LIS initiative should incorporate TQM in the implementation strategy.

**Education and Research** As distinct from many other Western countries, government in Australia has traditionally given only given "lip service" to tertiary institutions; there has been a culture of doing any training and research internally. This has been the case particularly in the surveying and mapping area. To a large extent, this has been facilitated by government being able to fund such activities from their own resources. At the same time government departments were usually much better equipped with the latest technology than were the tertiary institutions. The tertiary institutions were seen as not particularly useful, except for educating personnel at the undergraduate level. Many government organisations preferred not to even acknowledge expertise or resources in tertiary institutions; it was as if there was a view that by ignoring the tertiary institutions, they would go away and not be a bother. The current economic environment has changed all the above. Government, especially in the professional and service areas, has been reduced by financial cuts. The tertiary institutions in surveying and mapping, however, have tended to become stronger, better equipped, more highly attuned to market forces and more vocal. Ten years ago there was one Professor of Surveying in Australia; today there are seven. Ten years ago the tertiary institutions were not very interested in government policies and systems which had an impact on the broad community; today they are very interested and demand to play a role. Recognising the financial constraint on government and the resources and expertise available in universities, government cannot afford to ignore this sector as in the past.

**THE INSTITUTIONAL AND POLITICAL ENVIRONMENT**

**Background**

Historically in most countries the broad range of land administration activities have developed in isolation or at best with weak linkages. The information revolution has put major pressures on these historical institutional structures, especially in the urban context. This has been especially evident in the areas associated with the management of spatial information which incorporate cadastral, land and geographic information systems.

The last decade has seen the growth of three major thrusts in both government and society which are having a profound impact on the future management of these land information systems. The first has been the growth of importance of environmental management; this will surely be the high profile issue in the 1990s as it was in the mid to late 1980s. Secondly is the growth in importance of the management of cities and urban areas in both the developed and developing world, as the importance of cities as the engines of economic growth is increasingly recognised. Lastly is the move by governments world wide to privatisation of public facilities and services. This has a major impact on the management of spatial data.

The above developments are coming into conflict in a number of jurisdictions as governments
grapple with the competing interests within a general move to an information society. The ensuing debate increases substantially as governments in both the developed and developing world often believe that modern information technology (IT) alone will solve many of the problems in managing our environment and our cities, while at the same time believing they will return hundreds of millions of dollars in savings in government expenditure. While there is some truth in the value of IT in these areas, the benefits and savings will only be achieved after major political, institutional, educational and technological changes.

The lessons and politics from Victoria over the last decade or more are a reminder to other countries and jurisdictions that it is essential to understand the broad political dimension of the management of land and geographic information, and the pitfalls if the interests of all "players" are not taken into account and a global view of the management of all spatial data is not taken. Such an understanding of the political environment is essential if basic LIS reforms are to be successful.

**Putting Urban LIS in Perspective**

The importance of looking at all the components within a state-wide land information system, as one global system in order to solve a state's land and geographic information management problems, has been promoted by many authors and most systems since the early 1970s. It was an issue raised at the Conference on Cadastral Reform two years ago (Williamson, 1990a) in Australia. There has been a recognition in most of the models of state-wide systems of the necessity to link the two major groups of land related data, namely parcel-based or cadastral data and natural resources data. However most models have been conceptual in nature and have lacked a strong institutional framework to ensure that all the disparate data sets in land information systems are linked both institutionally and technically. Simply, most proposals to link cadastral and environmental type data have been a pious hope rather than based on serious institutional reforms. The political consequences of not developing an appropriate model to accommodate both types of data, and more importantly the problem of not raising the coordination of all land and geographic information to a higher level on a state wide basis above these two interest groups, can be major.

At the same time the development of land and geographic information systems, including cadastral systems, must recognise the wider political environment in which such developments take place. As mentioned there are three major changes which are occurring world-wide and which are having a major political and social impact on the development of such systems. The first is the growth of cities and urbanisation and particularly the impact of this in the developing world. Secondly, the major interest in the 1980s and 1990s in environmental issues and thirdly, the move by governments in the late 1980s and 1990s to privatisation of government services.

These major changes are occurring as societies both in the Western and developing world are moving to an information society. We are often told of the significant impact that information technology will have on our lifestyles, however it is hard to grasp until it actually impacts on the individual. To look at the potential of information technology one only has to look at the impact of electronic mail, the facsimile machine, the mobile phone, the "portable office" and the increasingly large optical fibre networks. All these systems are very quickly moving us toward the global village.

As the world moves quickly in this direction with the consequent growth and dependence on information technology, there is an increasing interest in land and geographic information systems which was not seen even a few years ago. Unfortunately there is also an increasing belief that such technologies alone will solve many of societies current problems, albeit they have the potential as part of a broad range of initiatives to make a significant contribution.

At the same time however governments have begun to realise the importance of the management of land and geographic information and the political consequences if such information is not properly managed. While land and geographic information management has
raised its profile in the government arenas over the last couple of decades, there has been increasing incidence for the decisions on the development of such systems to be based on political motives rather than sound technical and institutional decisions.

This paper suggests that politics has had a very significant influence on the development of land and geographic information systems both in Australia and overseas. This is both healthy and appropriate but must be kept in perspective. Such politics also has a major influence on the development of LIS in urban areas. This is however, an area which is rarely discussed in public forums although its impact far outweighs many of the technical reasons for the establishment or success of such systems. If we as land and geographic information professionals are to develop the systems we believe society needs, then we have to understand the political processes which influence such developments.

An historical perspective of land management in Australia

In order to better understand the influence of political processes involved in the development of cadastral systems, and land and geographic information systems, and their consequent impact on the development of urban information systems it is worth examining the development of land management in the State of Victoria as a case study. Further background on this area can be seen by reference to Williamson (1990b).

When Australia was settled in the early 1800s, the major objective of the state governments were to alienate land. This was a very important political process which was controlled by the then Surveyors General departments. As time progressed, and the processes moved more from alienation to land management, departments of Lands were created both in Victoria and other states to manage both the alienation of land and the Crown estate.

At the same time however, around Australia there was a growing activity with regard to the sale and subdivision of private lands. Since these were not state lands, such activities were not managed within the existing Lands departments. Initially existing deed registration systems were established within the Registrars General departments and eventually title registration was introduced in the mid-1850s. Importantly, the management of private lands in this context was seen as a legal function with such responsibilities residing in Attorneys General departments. History records that title registration and land ownership was of such political importance in the mid-1850s in South Australia that it was the platform which assisted Robert Torrens becoming Premier of South Australia.

In time, activities concerned with the sale and subdivision of private lands outstripped the activities surrounding the management of Crown lands. As a result, in the mid-1900s the Registrars General departments (under the direction of the Attorney General) became much more influential in managing the states land resources since they controlled the sale and subdivision of private lands. The growing activity in the 1970s led to the computerisation of land records within land titles offices to better manage the transfer and subdivision of private lands. Such initiatives were often part of state wide land information management strategies which tended to grow out of initiatives from Surveyors General in Lands departments, however there tended to be an uneasy relationship between the surveyors and lawyers in managing such information. Such strategies in the early to late 1970s can be exemplified by the establishment of LANDATA in Victoria. Such strategies were predicated on significant revenue savings to government due to improved management of land related information.

Ironically there are many similarities between the growth in European cadastral systems and their Australian counterparts. The comparison between Australia and Germany in this regard has been quite striking, particularly the similarities between the role of the cadastre and the legal land register in Germany, and the creation of a land information system in Australia based on a cadastral map and the role of the land titles offices. Unfortunately Australian administrators have not been very willing to accept these similarities, which in turn could help Australia identify possible future directions for its cadastral systems.
The most important difference between the classic cadastral approach and the Australian approach is in the role and importance of the cadastral map. In classic cadastral systems the cadastral map is the basis of the system with the cadastral surveys being simply a means to an end. In Australia, cadastral surveys and the related plans (Deposited Plans) are still paramount, with a resulting cadastral map being more analogous to a charting map, albeit this is changing as seen in the Australian Capital Territory where the concept of a "Continuous Deposited Plan" (in fact a legal cadastral map) appears to be gaining favour (Williamson, 1987a and 1987b).

Along with trends elsewhere in Australia, it was recognised in Victoria in the early 1980s that in order to manage land related information effectively it was desirable to incorporate all the land related organisations into one department. As a consequence the Titles Office, the Division of Surveying and Mapping, LANDATA and the Valuer General's Department, were consolidated into one organisation.

The mid 1980s saw an increasing concern in government for cost recovery and increased efficiency in government services. One reaction to this was the awarding of a consultancy for the development of a future strategy for LANDATA to consultants from Sweden. They recommended an increased concentration on textual data and cost recovery. The recommended focus was on non-graphic parcel-based data to the exclusion of graphic and particularly digital topographic data. In the mid to late 1980s this increasingly resulted in a natural resource lobby being excluded from the major thrust of government policy in the development of land information systems in Victoria. The alienation of this lobby group increasingly brought pressure to bear on the government for a review of the unsatisfactory situation. At the same time there was major concern in government that LANDATA had "not delivered" savings as promised. As a response, in late 1990 the Minister then responsible for LANDATA and all the other land related information activities in government, established a review to determine an appropriate strategy to address the imbalances in the management of land and geographic data and the future of LANDATA.

With regard to the three major changes occurring mentioned above, there is no doubt that the original LANDATA thrust was heavily influenced by cost recovery issues and the dominance of parcel based data in the urban context. However it was not influenced by environmental concerns. Privatisation has certainly had an impact over the last couple of years with the privatisation of the parcel base map maintained by the then Melbourne and Metropolitan Board of Works through the creation of a private company to manage all its spatial data. This has destabilised previous arrangements where data was in general exchanged at the cost of duplication. Due to the increasing pressure on privatising utilities, the utilities group in Victoria is becoming an even more important land information player than in the past.

Meanwhile, dissatisfaction and political pressure from the natural resource interests continued. For this group the major problem was access to digital map data to support small to medium scale GIS for environmental and natural resource purposes. They were also concerned at the lack of an overall vision or strategy for the management of land related data in the State. These concerns had been simmering for a number of years prior to the review called by the Minister responsible for LANDATA. However the concerns of the environmental and natural resource interests led to the involvement of the Office of the Premier and the group mandated for the state's information technology (IT) strategy. These concerns resulted in a decision to review geographic information systems in Victoria.

During 1991 there was a major government reorganisation and a new Premier appointed. The then Minister responsible for LANDATA was given a new portfolio. The new government, as part of its re-organisation and for unknown political reasons, dissolved the department responsible for all the parcel based, cadastral, mapping and land related components of government. First, the Division of Surveying and Mapping and LANDATA were put in the Department of Finance, and secondly the Titles Office was transferred to the Attorney-General's Department due to the ever present pressure by the legal fraternity in government to control land titles.
As a consequence of the environmental and natural resource interests, the GIS review was undertaken in 1991 through the Office of the Premier, driven very much by the environmental and natural resource lobby. A key result of this review was the establishment of an Office for Geographic Data Coordination in the Department of Finance. The new Director-General of the Department of Finance, who was a former Director-General of the Department of Conservation, Forests and Lands, appointed as Deputy Director the former manager of GIS within his former department. The person appointed as Director is also from a natural resource and environmental background.

Soon after the establishment of the Office for Geographic Data Coordination, there was a Ministerial reshuffle with the Director-General of Finance being moved to the Department of the Treasury. For political reasons, he took the Office for Geographic Data Coordination with him, albeit it further split up the coordination of land related data in the State.

In order to carry out the GIS review, the government obtained the services of a consultant, with broad expertise in GIS with a natural resource and geography background, to assist in developing a GIS strategy for the State. This consultancy is presently under way.

The danger of these recent appointments are that the natural resource and environmental interest groups may overly dominate LIS/GIS policy in the State over the next few years. This is a particular concern for the development of urban LIS. After the political dominance of a narrow interest group within the cadastral area for many years in the State, such a development may appear justified however it has the potential for creating the same destabilisation as before in the years ahead.

The dichotomy of Land and Geographic Information Systems

Over the last decade the terms "land information systems" (LIS) and "land information management" (LIM) have been used in general across Australia to describe the management of spatial data of all forms in a government context, both Federally and at the state level. These terms have been used as the "global" term to include all cadastral and parcel based, environmental and natural resource systems at both small and large scales. The terms have been used to describe systems and processes, with minimal emphasis on technology.

The term "geographic information systems" has not been generally used in Australia for administrative systems although there has been some limited use in the environmental and natural resources areas particularly at small scales and in a project context. The term has been used more in reference to the technology rather than the administrative systems themselves.

The term "land and geographic information systems" is used in this paper to cover all spatial systems including cadastral, environmental and natural resource information systems, including the associated technology. Increasingly the Government of Victoria has been using the term "geographic information systems" (GIS) as the global term to include all such data and systems due to the current dominance of environmental and natural resource personnel in managing the State's system. There is no doubt that this lack of consistency within the Government in Victoria will cause confusion in the years ahead.

It is important to recognise the fundamental difference between these two major data sets and the associated systems which inevitably have to be managed and coordinated within one overall system. First, land information systems tend to be parcel based, large scale, dynamic, administrative systems having very high integrity and accuracy. They include cadastral systems as a key component. They are typically major administrative systems which support government or semi-government activities such as land registration, land tax, land subdivision, local government administration and the management of utilities and services. They primarily support the rating base for our cities and are key targets for governments as they move to privatisation.

Geographic Information Systems on the other hand are typically medium to small scale, more
often that not are raster rather than vector data, are generally one-off or project oriented and are usually concerned with a lower integrity and accuracy of data as is common in environmental and natural resource systems. Geographic Information Systems do not usually support a major rating base and usually have a large component of public good. However they are equally important to LIS, albeit for different reasons.

There are other sub-groups of spatial data such as socio-economic data and demographic data which have much in common with geographic information systems. However, from a political perspective, the data sets surrounding these areas have not grown to the extent of the parcel-based or natural resource groups and are not significantly influencing the future direction of systems.

As background to the political environment, the development of land related data in Australia grew out of a very strong professional involvement of surveyors. Their heavy involvement has continued to the present time, however increasingly from the middle of this century, the Land Titles offices (and the legal interests in government) have become increasingly involved due to their critical role in the development of broader land information systems. The result through the 1970s and 1980s has been in Australia that the major influence on the development of cadastral and land information systems was by the survey related professions. The move to an information society has seen increasing demands from the environmental and natural resource groups from within government to gain greater access to appropriate data to support small to medium scale geographic information systems. Due to a lack of understanding of these dynamics and a focus on more traditional cadastral data, the natural resource interests became alienated from the LIS initiatives to a significant extent in the 1980s. Political and institutional problems between these two groups have been evident in Australia in most states and at a Federal level since the mid to late 1980s.

At the Federal level, the major consequence of these two thrusts saw the amalgamation of the Australian Survey Office (in the Department of Administrative Services) and the Division of National Mapping (in the Department of Minerals, Energy and Resources) to form the Australian Surveying and Land Information Group (AUSLIG) within the federal Department of Property and Services. A direct response to the loss of National Mapping was the establishment of the National Resource Information Centre (NRIC) in the Department of Minerals, Energy and Resources (basically an organisation with GIS interests).

There is a similar trend in Australia with regard to academic departments in universities. Due to the major involvement of the management of cadastral and land administration systems by surveying professionals, many departments of surveying around Australia have played a major role in the growth of land and geographic information systems through education, research and consultancies. Due to the strong professional basis of surveyors both in Canada and Europe, similar developments have occurred in those countries. On the other hand in the UK and the US, the surveying professions have not had a strong base as compared to Australia, Canada and Europe. As a consequence, the major growth in education and research in land and geographic information systems in these countries has tended to occur in geography and other departments.

The dichotomy between these professional groupings, which traditionally have aligned themselves with the land information and geographic information management areas, should not be trivialised. These two groups have very different backgrounds, training and perspectives. They often have different priorities and perspectives on the management of spatial data. Without doubt bridging these two disciplines will be one of the key objectives with regard to the management of land and geographic data this decade as shown by the experience in Victoria. It is one of the most important political challenges to be faced by governments in the land management context in Australia and elsewhere over the next decade.

The issues
Three important political consequences which arise from the debate to develop land and geographic information systems are:

1. Information technology and LIS/GIS technology alone will not return millions of dollars in savings to any government nor solve the institutional or societal problems created from urbanisation and environmental issues. Statements such as:

"Geographic information systems are a technology (emphasis added by author) that have direct application to Victoria. The potential benefit is high; as much as $130 million per year has been identified and it may be several times that amount. Any technology that has the potential of reducing government expenditure by over half a billion dollars in the next decade should be fully implemented ..." (Tomlinson, 1991) and,

"... savings as much as $130 million per year have been identified across government and potential expenditure reductions may be several times that amount.", and "GIS delivers the right information in the right place at the right time and at the right price,..." (Government of Victoria, 1992),

should be used with care.

2. The parcel-based and environmental/natural resource interests must be equally accommodated, and provide input to the political processes in both balanced and appropriate manner. It is absolutely essential not to marginalise either the environmental, parcel based or utility interests.

3. As governments world-wide move to "small government" through the process of privatisation, there is an important change in the dynamics between the relationship between the government, private and academic sectors in society. Up to the 1970s the government sector was the major force in the surveying industry in Australia. Over the last decade there has been increasing emphasis on education with a result that education institutions have grown and are offering a much broader range of services and expertise than a decade ago, especially in the cadastral and land and geographic information areas. At the same time there is a transfer of activities from the government to the private sector. The result is that government must learn to adopt a leadership role which maintains a balance between the government, private and academic sectors.

Suggested solutions

While it is essential to understand the political processes and the operation of government, it is fundamental that appropriate institutional and political structures are put in place to ensure the success of land and geographic information systems within an information society. Lessons from around Australia and overseas strongly suggest that the management of land and geographic information should be coordinated by a central representative body. This should involve all groups, sectors, government private and academic. It should however be coordinated by government due to the necessity to ensure no duplication, the adoption of suitable standards and overall efficiency.

Experience also suggests that one large government department coordinating land information systems is highly desirable and at the very least one government department controlling the cadastral system (including all land parcel records and the digital cadastral data base for the state or jurisdiction) and the digital topographic data base. All other databases and data sets are specific to an individual user or organisation and will build on these central databases.

One of the greatest areas which requires support from government is education and training and applied research in the broad land and geographic information system area. Simply without
a commitment to education and training, it will be very difficult to establish and support the systems in the medium to longer term and a continual reliance will be made on consultants and vendors.

CONCLUSION

There are many similarities between developing a land information management strategy for urban areas, and developing a national or state-wide LIS strategy. However, there are some very important differences. The concept for a LIS strategy for urban areas as described is simple, yet difficult to achieve without a major effort. The justification is also simple and logical.

Cities in both developed and developing countries have difficulties in creating a working LIS. It is very easy to take for granted the systems that have taken a century to put in place in Australia for the management of our cities. However, the review of LIS for urban areas in developing countries does give a clear insight into the importance and role of LIS for urban areas in general.

As pointed out, the justification for LIS for urban areas is clear, but the implementation is not. There are many issues which must be considered in developing a LIS for urban areas, with such issues as coordination, leadership and a common base map being at the forefront.

Land information management in urban areas has little to do with introducing a computerised GIS. Some vendors and consultants are all too willing to sell and install a computerised GIS based on a digital map base when there is little likelihood of success. Simply, technology in the form of GIS, will not solve the urgent problems facing cities in the Third World today. This technology must be used with great care.

However in order to establish urban LIS in today’s information technology environment, it is important to look at the broader management of land and geographic information systems within any state or jurisdiction. It is essential to understand the major influences currently affecting the development of such systems. These are without doubt urbanisation, the environment and a thrust by governments towards privatisation. The forces of urbanisation and privatisation tend to focus government attention on cadastral data (and LIS) while environmental pressures focus attention on natural resources data (and GIS). These pressures must be seen within the broader perspective of an information society, however it is essential to match these societal pressures with the realities of political processes for the development of land and geographic information systems.

It is important that governments are aware of the significance of taking into account all land related data and particularly the two key areas of cadastral and natural resource data. The key individuals who coordinate land and geographic information systems must improve their understanding of the political processes and the processes of government. They must realise that it is essential to not only get a balance between the parcel and utility based interest groups and the environmental and natural resource based groups, but the importance of rising above these two interest groups to manage land and geographic data within one total policy for a state or jurisdiction. There are many examples both world-wide, as well as in Australia, where one group has dominated to the detriment of the management of the state as a whole. The key however is to let all the players be heard!

We must learn to look at the management of spatial data in a global context incorporating all players and all users.

What is certain is that land information systems in the appropriate form are vital for the effective and efficient management of our cities, especially in the current age of an information society.
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