ABSTRACT

The objective of this paper is to describe the Australian Cadastral System with an emphasis on cadastral surveying and mapping and the role of the professional land surveyor.

First an overview of the Australian land market is presented, followed by a discussion of the difference between European cadastres and cadastral systems developed under English Common Law. Next the historical development and current status of both the Torrens System of title registration and the cadastral surveying system is given. The trend for Australian cadastral systems to move from cadastral surveying of individual parcels to an integrated cadastral mapping system is highlighted together with the development of the associated digital cadastral databases.

The paper describes the professional qualifications required of a land surveyor as well as the institutions supporting the survey system. The relationship of the cadastral system to the development of state-wide land information systems is discussed. The paper concludes by highlighting future trends in the Australian cadastral system.

INTRODUCTION

The free land market in Australia is fundamental to economic development and the creation of wealth, and supports environmental management, sustainable development and a relatively high standard of living. The Australian cadastral system in turn is essential infrastructure in support of this land market.

The Australian cadastral system derives many of its principles and concepts from English Common Law. It has married the system of land transfer under English Common Law with the needs of a vast developing country. As a result a land registration system, a cadastral surveying system and a land surveying profession have developed which to a large degree are unique to Australia.

A major difference between the Australian cadastral system and its European counterparts is that the Australian system is derived from individual surveys of individual parcels for individual owners in support of the legal land transfer system. It is not derived from a complete cadastral record of all land parcels as shown on a cadastral map having its genesis in a land taxation system, which is the case with most European systems.
While the Australian cadastral system is a very secure land transfer system, it should not be seen as an ideal system of automatic relevance to other countries, however a study of the Australian system is very informative for any country undertaking cadastral reform. In many respects it is an expensive system designed specifically to support the land market and the individual land owner. It was not designed as part of a wider land administration system albeit it has increasingly developed such a role. Australia can afford this relatively expensive system whereas many other countries in the world cannot afford such a luxury and have to look at more cost effective approaches to providing the infrastructure on which to base an efficient and effective land market which in turn serves broader land policies.

HISTORY

At the time of settlement by the English colonists in 1788, Australia was considered a vast unsettled and unexplored continent. The country was however fully settled by the indigenous aboriginal peoples who had divided the country into many regions each under the jurisdiction of a clan group. It was not until 1993 that the Australia Federal Government first acknowledged the historical right of the indigenous peoples to land ownership, even though the Federal Government did provide for unalienated Crown land to be made available for the indigenous aboriginal owners in the Northern Territory in 1976. However, the development of the Australian cadastral system has not been influenced by the land ownership systems or patterns of the indigenous peoples (also see Ogleby, 1993 and Prescott, 1994).

At the time of settlement by the English, the second most important person in the colony was the Surveyor General. He was responsible for alienating and managing all land in the colony. However, due to the difficulties in undertaking surveys in this vast harsh country and the rapid settlement that resulted, especially after the gold rushes of the late 19th Century, settlement often preceded survey, even though the actual alienation of land was always based on a survey.

For about the first seventy years of Australian settlement, all land transfers were done using the English system of Deeds Registration where ownership of land was proved by a chain of deeds which evidence the transfer of interests in land from one person to the next. In this system the interest in land only transfers if the transferor has the right and ability to convey the interest. A single defect in the chain of deeds can nullify the "title". The only real advantage to registration under this system is that it confers priority in any counter claim to "title". It was not until the mid 1850s in South Australia that Robert Torrens introduced his now famous system to simplify land transfer which had become expensive, complicated and inefficient. However, the introduction of his system was not without great opposition from the conservative legal profession which had a vested interest in maintaining the status quo which was complex, slow and expensive. Of interest, the introduction of Torrens' system of land registration was of such political importance that it resulted in Robert Torrens becoming Premier of South Australia and being Knighted.

Alienation of land continued unabated through the 19th Century and well into the 20th Century with the result that dual land title and land survey systems grew up in all the Australian states. On the one hand there were the systems which controlled the management and alienation of Crown lands, usually under the responsibility of the State Surveyor General. In parallel with this were the systems to manage the land ownership records concerned with private alienated lands, which was typically the responsibility of the Registrars within the State Land Titles Offices. Each of these systems managed land records and had its own survey system and regulations, one relating to Crown lands and the other relating to alienated private lands.

Prior to the Second World War and particularly afterwards, alienation of lands reduced significantly while at the same time the activity of the Land Titles Offices increased with the subdivision of already alienated private lands and the consequent growth of the land market. The result has seen a reduction in the influence of Surveyors General around Australia with the increasing influence of the Registrars of Title.
Today Australia is a country which has moved its focus away from alienation and subdivision of Crown land, to the development and subdivision of private lands and the management of the Crown estate where the emphasis is on sustainable development and environmental management.

There has always been friendly competition between the Surveyor General and the Registrar of Title in the Australian states. However, the trend is for their respective organisations to be brought closer together in the one government department, more in line with other systems around the world. In most States today, the separate title and survey systems for Crown and private lands have been combined into one cadastral survey system with the objective of having a complete cadastral record of all land parcels in a State in one system.

An important aspect to note about the Australian Land Titles Offices which makes them virtually unique around the world is that they are centralised. These offices are very large and complex organisations storing vast amounts of paper records. For example the Land Titles Office in the State of Victoria has about 2.1 million live land titles (noting there are less land titles than land parcels), 0.43 million plans of survey (including plans of field notes) and 14 million live supporting documents. As a result there has been a greater need to streamline records storage and computerise the title systems in Australia than in most overseas countries which operate decentralised land registry systems. For example in most countries it is not unusual to have between 50 and 1000 regional or local Land Titles Offices.

**THE AUSTRALIAN LAND MARKET**

Australia is a large continent with a population of approximately 18 million and with about 10 million legal land parcels. It is one of the most urbanised countries in the world with most of the population living on the south-eastern seaboard of Australia within 100 kilometres of the sea. For example nearly half the population live in the urban sprawl surrounding the two cities of Sydney and Melbourne.

Australia became a Federation of States in 1901 with all legal matters relating to land remaining a State responsibility. Even though there is considerable commonality between the States, each State still has significant individual idiosyncrasies and complexities in its land law and cadastral system. Land laws and the laws concerning land transfer and mortgages are the total responsibility of the each State.

Over 50% of Australia's wealth is in real property with about 70% of Australian families owning their own free standing house or apartment. This is one of the highest percentages of any country world-wide. Most of the population live in free standing houses having a land area of about 500 to 1,000 square metres. On average, Australians sell their homes and buy or build new ones about every ten years. The price of an average Australian home (eg. a home of about 150 square metres constructed with brick walls and a tiled roofs, having three bedrooms and being located on a 700 square metre block of land) would be between US$80,000 to US$200,000 depending on location. The average salary of a well qualified employed tradesman or professional person with ten years experience is about US$25-35,000 pa. Over 50% of married women are in full-time employment. At the same time there is an increasing percentage of the population which lives in individually owned strata title apartments which are typically in three storey walk-up buildings, having between 10 and 30 apartments in each building.

On average it takes about four to eight weeks to transfer Real Property in Australia with legal fees being about US$300 to US$500 per land transfer (although much faster transfers are possible, especially if the purchaser is not seeking bank finance to assist in the purchase. In such cases a transfer could be completed in less than a week.). However, government taxes of up to 5% of the purchase price must also be paid. About 30% to 50% of properties transferred in Australia also require a cadastral survey (approximately US$250) each time a property is transferred even though the property is in a recently surveyed subdivision. This is to ensure the house is built on the parcel of land described in the land transfer and that the building does not
contravene any local government ordinances.

The land market operates almost totally within the private sector with the only exceptions being the operation of the Land Titles Office and the oversight of cadastral surveys by a Board of Surveyors in each State. State governments do however still alienate several thousand remnant parcels each year across Australia.

Most real property is purchased by borrowing money from a bank (up to about 80% to 90% of the purchase price can be borrowed) in exchange for a mortgage. Interest rates are currently about 10% per annum with loans repayable usually over a maximum period of 25 years.

The major players in the land market are land developers, land surveyors, solicitors, real estate agents and banks.

**LAND REGISTRATION**

In the three States which were first settled, namely New South Wales, Victoria and Tasmania, there are still land parcels held under the old Deeds Registration system although these numbers are reducing (about 3% of freehold land in the State of Victoria). This is a system where upon each transfer a Deed is prepared transferring the land from one person to another. The title constitutes the unbroken chain of deeds. In most States today, when an owner wishes to transfer property held under the Deeds Registration system, it is automatically brought under the Torrens System of Title Registration.

The Torrens System is a system of title registration where the State Government guarantees that the person shown on the Certificate of Title displayed in a public register is the registered proprietor. The folio of the register is conclusive evidence that the person named in the folio as the proprietor of an interest in the land is the legal owner of that interest. Interests in land can only be created, varied or changed by registration. If there is an error on the Certificate of Title, the government will compensate the registered proprietor for any loss incurred by the error. There are three fundamental principles to the Torrens System; namely the Mirror Principle, Curtain Principle and Insurance Principle. The Mirror Principle states that whatever is shown or reflected on the Certificate of Title is guaranteed by the State to be correct. The Curtain Principle means that once a Certificate of Title under the Torrens System is issued all other interests which may have related to the land previously are negated. It is not possible to "look behind the title to previous interests". The Insurance Principle means that the information on the Certificate of Title is guaranteed by the State. The Torrens System as conceived had four qualities being speed, simplicity, cheapness and suitability to the needs of the community. However in reality due to the complexities of Common law and the cadastral survey system, it is relatively expensive, in some cases slow and in some cases very complex, but this varies depending on the jurisdiction.
There are three components in a Torrens Certificate of Title (Figure 1), namely the Parcel Section which identifies the parcel, gives it a unique identifier and describes the Metes and Bounds (usually graphically by reference to the plan of survey), the Proprietorship Section which identifies the owner, and the Encumbrances Section which identifies any other interests in the parcel such as a mortgage, an easement or a restriction as to user. The registered proprietor holds a duplicate Certificate of Title to the one held by the Land Titles Office.

Within each State, there are one or more State Acts of Parliament which support the cadastral system. It is important to note however that the system which Torrens introduced is quite different from today's "Torrens System". On many occasions since a Torrens type system was introduced into each State during the last century, there have been changes to the legislation to update and improve the legislation in each State.

Usually the legislation defining the Torrens System is called a Real Property Act or Land Transfer Act with this legislation relating to individual land parcels subdivided in the normal broad acre subdivision manner. However, over about the last thirty years or so all States of Australia have introduced Strata Title legislation to allow Real Property to be subdivided vertically as well as horizontally thereby permitting individual ownership of apartments. This initiative has given an enormous impetus to the development of medium to high density housing in Australia.

In addition to the primary legislation concerned with transferring interests in Real Property, there is a range of other legislation providing legal infrastructure to the land market. This
includes legislation supporting the mortgaging of land as well as environmental, planning and local government legislation supporting the occupation and development of land.

As mentioned previously it is important to note that Australia is almost unique in having its land registration system centralised in one office in the Capital City in each State. This imposes enormous pressures on the system due to the maintenance of very large records, however it has initiated a major thrust towards computerisation.

Another important aspect to note about the Australian Cadastral System is that the primary focus is on individual transfers of individual parcels between individual people in support of the land transfer system. These transfers historically have not been part of a broader cadastral system supporting land management, land tax, planning, as well as land ownership, as in Europe. This means that in order to develop a state-wide cadastral system in the Australian States, all the individual parcels have to be tied together to form a whole. This means that the overall system is developed from the "part to the whole" as distinct from the normal surveying practice of going from the "whole to the part", however this is indicative of the way the States were developed.

Most States are still trying to compile a complete cadastral system where every land parcel in the State has a unique identifier and is recorded on a state-wide cadastral map. The unique identifier typically used in Australia is the parcel number shown on the plan of subdivision which created it. Also as mentioned previously, the Australian cadastral system certainly supports secure land ownership thereby supporting an effective land market. However, while the System has some excellent strengths, it also has some significant weaknesses such as its cost and complexity.

The complexity of the System, coupled with centralised land registries, have been a major impetus for Australia to computerise land titles. As a result, all States have moved to introduce a system of computerised land titles where there is no longer a paper record but the title is held in digital form in a computer which is State guaranteed. This move to computerised titles is also facilitating the development of state-wide land information systems (Figures 2 and 3).
CADAstral Surveying

Australia has a heritage of over two centuries of expertise in cadastral surveying of parcel boundaries in support of the land transfer system as part of an effective land market. However, it is important to note that the cadastral surveying which is undertaken in Australia is not part of the state-wide cadastral mapping process. Cadastral surveys of individual land parcels are carried out to a high mathematical precision and are only connected into neighbouring land parcels. These are termed "isolated" surveys. The surveys are usually not based on coordinate systems and in fact coordinates are not permitted to be shown on most cadastral survey plans in Australia; cadastral surveys in the Australian Capital Territory are an exception. In this regard Australia is one of the few countries world-wide which does not use a coordinated cadastral system which is an integral part of a cadastral mapping system. A number of States are introducing systems whereby a common azimuth is adopted for all cadastral surveys in designated regions.

Boundaries are surveyed to a high accuracy in a local sense and corners are typically marked with wooden pegs with reference marks usually buried adjacent to corners. Each cadastral survey is also connected into one or more Permanent Survey Marks which tend to be concrete blocks or marks in concrete kerbs which are planned to be integrated in time into the State coordinate system. The normal measurement precision for urban cadastral surveys is 1 part in 4-10,000 (Figures 4 and 5) with traverse closures of 1:8,000.
Even though Australian cadastral surveys are in one sense an anachronism, cadastral land surveyors use the latest technology including digital theodolites, Global Positioning System, "field-to-office" techniques and computerised drafting systems in undertaking cadastral surveys and preparing cadastral plans. Some State's permit cadastral plans to be submitted to the Land Titles Office in digital form thereby facilitating the updating of the State's Digital Cadastral Data Base.

The practice of cadastral surveying in each State as undertaken by professional land surveyors is normally controlled by a Surveyors Act with associated regulations. These Acts specify the duties and responsibilities of registered cadastral land surveyors, the regulation of them in undertaking cadastral surveys, the role of Boards of Surveyors and the requirements to become a registered Surveyor.

**CADASTRAL MAPPING**

The last two decades have seen a move to establish complete cadastral maps in support of land management, land administration and local government administration in every State of Australia. This has necessitated projects to provide a unique parcel identifier for every land parcel. The typical techniques in establishing a cadastral map have been to fit all the isolated cadastral survey plans together on to a topographic base map using fence lines, road boundaries etc as control using a rubber sheeting approach, particularly in rural areas. In urban areas field control is often used with typical scales usually 1:2-4,000 and in rural areas 1:10-50,000. The result is that cadastral maps in Australia represent boundaries to a graphical accuracy with the result that in urban areas the coordinates of those corners can be many metres out of position and in rural areas, hundreds of metres out of position. However in some of the State systems the accuracy of the scaled boundary coordinates is about 1 mm at map scale (2.5 m at 1:2,500). It is important to note however, that these maps are used primarily for identification of land parcels and land management. However increasingly they are also being used as a basis for recording utilities with the result that a greater accuracy is being demanded.
The major trend over the last decade however, has been to convert these cadastral maps to digital form and thereby create digital cadastral databases. Most States of Australia are now well advanced in creating digital cadastral databases or have completed them. Figure 6 shows the output from a typical digital cadastral database. This facilitates the use of geographic information systems in many government departments and in local government (Hesse and Williamson, 1990). A big issue however with regard to the digital cadastral databases in Australia concerns the problems associated with updating and upgrading these digital cadastral databases, particularly from the point of view of the utility organisations.

QUALIFICATIONS AND REGISTRATION AS A SURVEYOR

The typical qualification for a professional land surveyor is a 4-year university degree with the degree having a range of names including Bachelor of Science (Surveying), Bachelor of Surveying, Bachelor of Land Information, Bachelor of Geomatics or Bachelor of Geomatic Engineering. Within these degrees, the emphasis is on basic sciences, computer science, measurement science, land and geographic information systems, land management and professional studies. The land surveyor in Australia is quite different from many of his or her counterparts around the world in as much as they have a good mathematical and scientific education supporting the measurement and management of spatial data, yet they have good background in issues concerned with land management, environmental management, local government law and practice, and land development. There are nine universities giving such degrees in Australia. Current student numbers studying surveying at a university at an undergraduate level in Australia are about 1000 with about 200 undertaking graduate studies in
surveying or related areas ranging from graduate diplomas to doctorates. About 20% of students studying surveying at an undergraduate level in Australia are women. At the technician or sub-professional level, 2-year surveying certificates or 3-year surveying diplomas are available.

In order to practise as a cadastral land surveyor, an appropriate university degree is required in addition to the surveyor being registered by the Board of Surveyors in the respective State. To become registered, a surveyor typically requires 12 to 24 months under a training agreement with another registered surveyor and in addition must pass some further professional examinations and practical exercises supervised by the Board of Surveyors. Once a person has been registered by a Board in any State of Australia or New Zealand, that person can apply for registration in any other State of Australia or New Zealand under a reciprocity agreement.

Of interest only about 20% to 30% of graduate surveyors now become registered to undertake cadastral surveys with the rest working in other areas of surveying or in allied industries or professions. A graduate surveyor does not have to be registered to undertake any surveys other than cadastral surveys although registration as a surveyor is seen to be acknowledgment of a high professional standard.

**INSTITUTIONAL AND PROFESSIONAL ASPECTS**

Most cadastral, engineering and other surveys are undertaken in Australia by the private sector. This has changed dramatically over the last decade. About ten years ago nearly 50% of surveys were undertaken by government surveyors. Today there is only a relatively small percentage of surveys undertaken by government. However, each State does have a surveying and mapping organisation which is generally headed by a Surveyor General. The secretariat of each State’s Board of Surveyors is also usually found in this organisation. While the role of Surveyors General has reduced gradually over the last hundred years in Australia with some States having given away the term "Surveyor General", some State Surveyors General still retain significant authority within their States since by statute they are ex-officio on all electoral redistribution commissions. This means that in these Australian States the Surveyor General cannot be dismissed, or the position be made redundant, without full endorsement of all political parties of both Houses of Parliament.

At a national level, surveying and mapping is coordinated by the Inter-governmental Committee on Surveying and Mapping (ICSM) and for cadastral surveys by the Reciprocating Surveyors Boards of Australia and New Zealand. Land and geographic information is coordinated by the Australia New Zealand Land Information Council (ANZLIC). The members of this are typically not Surveyors General but are either Directors General of the government department which includes surveying and mapping, or the Head of the State’s organisation which coordinates land and geographic information in the broadest sense.

At the professional level, surveyors are represented by the Institution of Surveyors, Australia, which is the Australian representative in the International Federation of Surveyors. The private sector is represented by an affiliated body called the Association of Consulting Surveyors, Australia (ACSA). There are about 3,000 members of the Institution of Surveyors, Australia (ISA) which represents about 70% of professional surveyors in Australia. At the technical level, there is an Institute of Engineering and Mining Surveyors. In addition cartographers are represented at both professional and technician levels through the Australian Institute of Cartographers (AIC). Persons interested in the broader area of land and geographic information systems belong to the learned society called the "Australasian Urban and Regional Information Systems Association" (AURISA). For professional land surveyors, the Institution of Surveyors, Australia (ISA), is responsible for professional standards and ethics.

**EDUCATION AND RESEARCH**
As mentioned there are nine universities with surveying programs in Australia which serve a population of about 18 million people. There have been suggestions over the years that there are too many surveying programs especially compared to countries like the United Kingdom, Canada and the United States. However, an understanding of the independence and nature of the Australian States is required in appreciating the Australian education structure. The two populous States of New South Wales and Victoria each have two universities with surveying programs. This provides healthy competition between programs which significantly benefits the profession and industry.

An example is the program at The University of Melbourne, Australia's second oldest university, and the oldest university teaching surveying. The program is taught through the Department of Geomatics. There are approximately 200 undergraduates undertaking undergraduate degrees in Bachelor of Geomatics, Bachelor of Geomatics/Bachelor of Science (specialising with either Computer Science or Environmental Science) and Bachelor of Geomatics/Bachelor of Arts (specialising with Geography).

There are approximately 60 postgraduates in the Department undertaking either a Graduate Diploma in Geomatics, Graduate Diploma in GIS, Master of Geomatic Science, Master of Geomatics, Master of Applied Science (GIS), and Doctor of Philosophy.

The Department has 10 academic staff including tutors, lecturers, senior lecturers, associate professors and a professor (who holds the Chair of Surveying and Land Information), with two research fellows, two research assistants and five support staff. As is the case in many departments at The University of Melbourne, the Professor is not necessarily the Head of Department. The Department also includes a Centre for Geographic Information Systems and Modelling.

The Department is very well equipped with the latest technology including a large range of computers (PCs, Macintosh, SUN, Intergraph, VAX, Silicon Graphics, Tektronix), the latest digital theodolites and data recorders, GPS, digital and soft-copy photogrammetry, and a large range of software including most GIS (Intergraph, ArcInfo, Genamap, GRASS, MapInfo, ERDAS etc), field-to-office systems, and many in-house adjustment and data reduction packages.

About 30% of the funding for the Department comes from consultancies, research grants, etc. with the other 70% coming from direct government grants. Of interest The University of Melbourne receives just over 50% of its annual budget from direct government grants with the rest of the funding coming from its own academic and research initiatives.

The Department of Geomatics at The University of Melbourne has an extensive research and development program in the areas of land and geographic information systems, cadastral systems, land tenure, measurement science and digital photogrammetry, most of which is undertaken in partnership with industry or government.

In the past, most research and development in surveying and related areas in Australia was done by government departments. However, increasingly research and development in Australia is done by universities and the private sector.

**RELATIONSHIP OF THE CADASTRAL SYSTEM TO A STATE-WIDE LAND INFORMATION SYSTEM**

Most States of Australia have established State Land Information Centres which are usually separate from the State surveying and mapping organisations. However, these Land Information Centres are usually in the same government department as surveying and mapping.

Over the last decade, most States of Australia have introduced a program of allocating unique parcel identifiers for every land parcel with the program either completed or nearing completion.
in every State. These programs have developed indexes linking the unique parcel identifiers to other parcel identifiers used by valuation, local government or utilities organisations. The move to computerisation has been facilitated by the introduction of computerised land titles as well as the development of digital cadastral databases in each State.

Increasingly the focus in each State is on the development of core spatial data sets which provide the basic infrastructure to support the use of spatial information across a broad range of areas ranging from emergency services through to environmental management. The core spatial data sets in each State include:

- digital cadastral database
- digital topographic database
- digital road network
- geodetic network
- administrative boundaries database
- geographic names database

A generic model of the land information systems in each state is shown in Figure 7. As can be seen cadastral data plays a central role in all State land information systems in Australia.

FUTURE TRENDS

Along with most other OECD countries, Australia has gone through a decade where there has been a very strong move to privatise government services, with the principles of "small government", deregulation of the professions, cost recovery of government services and the introduction of Total Quality Management having been enthusiastically promoted and adopted.

Within the private sector this has resulted in the establishment of larger private surveying companies which is moving the surveying profession from being "a cottage industry" to an industry based on larger businesses which can afford better technology and can undertake or support a limited amount of applied research and development. The move to larger surveying companies has also been given impetus by the move to introduce Total Quality Management which the smaller companies have difficulty in adopting to the time and cost of gaining the
accreditation.

The professional institutions have also seen significant change over the last decade with the result that they have become much more cost conscious, streamlined and efficient. There has been a trend to bring together the disparate parts of the profession into one organisation representing diverse professional and technician interests. The best example of this in Australia has been the development of the Institution of Engineers, Australia. However, to date the surveying and mapping profession has remained largely fragmented. The big trend over the last decade in the profession has most probably been the move to introduce Continuing Professional Development such that surveying personnel can remain up to date technically and professionally.

The last decade has also seen education institutions widening their sphere of activity to encompass the science and management of spatial data in the broadest sense, incorporating land and geographic information systems, remote sensing, environmental management and land administration. A result of this has been the dropping of the name "Surveying" from many of the departments and degrees, albeit "Surveying" as a professional discipline is still the core activity. Increasingly the term "Geomatics" is being adopted to reflect the broad discipline.

**CONCLUSION**

The cadastral systems found in the Australian States have been developed to serve the specific needs of a vast developing nation over the last two hundred years. As a result, the Australian cadastral systems are unique and cannot be readily transferred to other countries in total, but this must be said of every system in the world. However there are many aspects of the Australian system, such as the world renown Torrens System of Title Registration, that are transferable to a large degree and have been adopted by many countries world-wide. In addition there are many other valuable lessons can be learnt from studying the Australian cadastral system as a whole.

Due to the inherent wealth of Australia, relatively expensive and complex cadastral systems have been allowed to evolve in the individual States. However, it is important to note that these systems work well and underpin a secure land transfer system supporting a very active and effective land market.

Due to the relatively complex cadastral system, the land surveying profession in Australia has developed to a very high standard. The complexity of the system requires highly trained and educated professionals. There is no doubt that over the next decade or so, the cadastral system will become simpler as coordinates are used to a greater extent and as digital cadastral databases become fully established and their accuracy upgraded. Even though the generic Australian cadastral system may not be the "ideal model" the surveyors and other professionals operating it are well educated and highly skilled, and embody all the ethical principles expected of well respected professionals. The Australian surveyors and legal professionals have a very good reputation for finding pragmatic solutions to difficult problems. There is no doubt however that the limitations to cadastral reform in Australia are institutional, not technical.

Over the last decade the private sector has increasingly been the major provider of cadastral services to the extent that within a few years it is expected that virtually all cadastral surveys will be undertaken by private surveyors. The result will be that the primary role of government in the spatial information industry will be to support, manage and maintain the standard of the core spatial data sets which underpin the use of spatial information in each State.

One of the unfortunate aspects about the Australian cadastral system is that in one sense it has become too successful with the result that both Federal and State governments tend to forget the fundamental role that the system plays in underpinning the economy in the States. This lack of interest by government is also fuelled by the move to increase the role of the private sector. The result is that the government will have to take considerable care that it does not go too far
in privatising the cadastral system such that it will undermine the land market and the resulting economy. Over the last couple of years State governments have considered "privatising" the Land Titles Office. If this does not happen completely the privatisation of the updating and delivery of land records information is highly likely. In the State of South Australia, the Board of Surveyors has been transferred to the Institution of Surveyors, Australia indicating a bold move to reduce the involvement of government in the delivery of services. This is similar to the engineering profession where professional accreditation rests solely with the Institution of Engineers, Australia.

Another down side of the strong move to privatisation is that typically the private sector tends to be slow to move forward to adopt new technologies and new areas of expertise with the result that it is the academic institutions and some of the remaining State Surveyors General which are leading the profession and industry into the information era.

Recognising that the surveying profession is in a period of rapid change, which is threatening to some members, it must be remembered that it is also in a very exciting period where technology has given the profession the ability to expand its horizons and to move into new areas. Only time will tell to what extent the Australian surveying profession meets the challenge.

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