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DOES THE CADASTRAL SURVEYING PROFESSION HAVE A FUTURE?

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Abstract

The surveying profession is currently facing the biggest challenge in its modern history. Rapid technological change, micro-economic reform, internationalisation, de-regulation of the professions, and the Internet are placing pressures on traditional professional operations and structures never previously experienced.

Yet issues of environmental degradation, sustainable development, the management of our cities and economic rationalism are presenting opportunities and challenges to our profession never thought possible. Issues central to our profession such as cadastral reform and spatial data infrastructures are grabbing the attention of policy makers as they realise their importance in economic development, environmental management and social stability.

Within the context of the Global Village, surveyors are increasingly working in the international market place. This is placing pressures on our education and training and the role that we see ourselves playing in society. The international push for cadastral reform, land and geographic information systems, improved urban management, environmental management and sustainable development is creating almost unlimited opportunities for our profession if we are prepared to grasp them; there are already other professions moving or ready to move into these traditional areas of the surveyor if we don't act.

Can the surveying profession survive these changes and what does the future hold? This paper endeavours to seek answers to these questions by looking at the past, endeavouring to understand the present and trying to look into the future. The paper focuses on the Australian surveying profession while recognising that many of the issues discussed may be relevant to Southern Africa.

Introduction

The surveying profession is currently struggling for an identity in both the developed and developing worlds. Its traditional cadastral surveying base continues to contract due to the impact of technology and the resulting improvement in efficiency and productivity. Rapid technological change, political changes, micro-economic reform and economic rationalism, the Internet and the World Wide Web, the growth of 'geomatics', trends in the international market place and the development of the 'Global Village' are placing pressures on the profession not

previously experienced in its 'modern' 200 year history.

The de-colonisation and gaining of independence in many developing countries has contributed to this pressure. In former colonies the surveying profession usually had its roots in supporting a land market for the expatriate population. It now finds itself inappropriate or struggling to survive as it learns to serve a larger indigenous population.

The paper adopts the broad definition of a surveyor defined by the International Federation of Surveyors (FIG, 1995), but focuses on that sector of the profession which has a traditional close affinity with cadastral surveying, land development and land management. It is a substantial component of the profession, which has been traditionally highly regulated by government in order to maintain the integrity of a state's or nation's cadastral or land parcel framework in support of the land market. This has had a negative impact on our profession by making us focus on one very specific form of cadastral system. It has limited creativity in the cadastre, and it has made us think that our current parochial State practice is the only option and is the best solution for all cadastral problems. The reality in Australia is that we have eight different cadastral survey systems, eight different Torrens systems, eight different cadastral mapping systems and eight different Digital Cadastral Data Bases (DCDBs) (the national data base compiled primarily from the eight state DCDBs for the 1996 Census took 90 man years of effort!). Our legislative framework has protected us from competition and encouraged conservatism. While this paper draws heavily on the experiences of the profession in Australia, it is hoped that the conclusions may have some relevance to Southern Africa.

The surveying profession has built on the synergy between measurement science and land management. This relationship is the underlying strength of the profession and provides it with a competitive advantage in the market place. This underlying structure is reflected in most of the university degrees around the world which prepare students for the profession, be they surveying, land information, geomatics, geoinformatics or geomatic engineering degrees.

Today these concepts and models manifest themselves in a profession which is responsible for the measurement and management of the spatial dimension of our natural and built environment. The profession differentiates itself from other land (and marine) related professions, such as the geography, land use planning and landscape architecture professions, by building on a rigorous scientific foundation where measurement science, and increasingly spatial information science, is central. The profession matches this with a wide range of land management skills which build on this scientific base and which give the profession a strategic advantage in many areas, such as the development of cadastral systems, land development, natural resource and environmental management, and spatial information system development and management.

The profession also has a natural affinity with the engineering profession. For most of the 19th Century surveyors and engineers in Australia were almost one and the same. The early surveying programs usually grew out of engineering programs in universities. Surveyors also share many of the same skills as engineers, such as a design ability and an ability to take a concept, convert it to a firm plan which can be designed and costed, and then control and manage the implementation of that plan. The recent engineering accreditation of two geomatics programs in Australia recognises the roots of the surveying profession, as well as its close affinity with the engineering profession.

One of the most informative indicators for the health of the profession in many countries has been the number of surveying graduates who seek registration to practise as a cadastral surveyor with a Surveyors Registration Board. In the 1970s in Australia, about 90% of graduates were registered nationally, with this reducing to about 50% in the 1980s and about 30% in the 1990s, with the trend in some states being much less (Fryer, 1996. Also see Fryer, 1992 and Kelly and Fryer, 1995). The profession's traditional cadastral surveying base continues to contract.

Trinder and Li (1996) examined employment trends for surveyors and membership in the Institution of Surveyors Australia (ISA) and concluded that in *traditional* surveying services:

- there will be little if any growth in demand and if current increases in productivity continue then there may be a reduction in demand.
- based on the current numbers of surveyors being produced by universities and seeking registration, and the current age profile, then there is the possibility of a shortage of surveyors in 5-10 years.
- accepting a possible short term increased demand for surveyors, the long term future is for a smaller profession with limited growth potential.

In the early 1960s the number of surveying graduates in Australia was about 50/year or less even though these numbers were balanced by the remainder of those entering the profession through the articled pupil system. The number of graduates increased dramatically to over 200 in the late 1970s and over 300 in the 1980s with the number of institutions offering surveying degrees increasing from three in the early 1960s to ten in the 1980s. The 1990s saw the number of graduates gradually reduce and plateau at about 150, however indications are that numbers in the early part of the next century will again reduce to about 100. Recognising that recent graduates are generally well paid and have no difficulty in gaining employment, particularly in the broader spatial information discipline, this trend also supports the premise that there will be a shortage of graduates in the next few years.

The research by Trinder and Li also shows that membership of the ISA has not kept pace with population growth and the increased numbers of surveying graduates. Unfortunately many surveying graduates are working in related areas and particularly in the spatial information areas, and are not identifying with or joining the ISA.

Can our modern profession survive its greatest challenge in today's rapidly changing world? The profession has two choices; first, pessimism, regulation to maintain our 'patch' and survival mode, or secondly, optimism, grasping all opportunities as they arise and expansion of the areas included under the profession's umbrella.

In responding to this challenge the surveying profession is fortunate that it has a well developed sense of history. A great deal of the profession's rich history has been documented and published. One of the important lessons that this historical perspective provides is that change in the profession is constant and inevitable.

Within the context described above and recognising the identified trends, this paper reviews developments in the past, considers the present and tries to look into the future to attempt to identify possible challenges and opportunities for the surveying profession, with a focus on Australia. It argues that surveyors and the surveying profession must internationalise if they are to continue to be relevant and to grow.

History

Of central importance to any debate about the future of the surveying profession is an acceptance that the profession has been relevant across the centuries. This relevance is built on the basic philosophy of the discipline and what the discipline contributes to society in the broadest sense. As mentioned the basic philosophy builds on the synergistic relationship between measurement science (and now spatial information science) and land management (which includes aspects of land administration, land development, infrastructure development, cadastral surveying and environmental management. Increasingly over the last two decades 'land' has also included the sea bed and 'surveying' has included hydrographic surveying). While many in the profession have specialised in one area or the other, the mainstream has drawn on both areas of measurement science and land management.

A review of the last 150 years shows that the profession has continued to change. It is not the intention of this paper to describe this historical development of the industry or profession in depth but to show that change in the surveying profession has been continuous and that it has been facilitated by a combination of political, economic and technological factors. Importantly that change in the profession and discipline is inevitable, and that the rate of change is increasing.

Following are many of the major events which have impacted on the development of the profession in Australia, particularly over the last century. Due to my experience and background the focus is on developments in Australia although the same changes have influenced or are influencing many countries world-wide. The paper highlights the importance of the cadastral surveyor in opening up Australia in the 19th Century. It then notes the strength of the cadastral surveyor in expanding the major urban areas for most of the 20th Century even though cadastral surveying and land development assumed a low profile behind Australia's national mapping and geodetic activities, and major infrastructure developments after the Second World War. The reducing influence of Registration Boards for Surveyors would suggest historic cadastral surveying issues are becoming less important. However the last decade of the 20th Century has seen cadastral issues assume major importance from an economic, environmental and social justice perspective on an international scale, especially in developing countries. The 1990s has also seen the ISA increasingly taking an international focus.

TABLE 1 - *THE AUSTRALIAN STORY*

Review of historical events which have influenced the surveying profession in Australia

Major Event	*Influence on profession*
Power and influence of Surveyors General (1788 onwards)	Surveyors General were very influential in the early days of settlement, especially their control of Crown lands. Their influence over the surveying and mapping profession was traditionally very strong but has gradually reduced although it varies from state to state.
Torrens system of title registration (LTO) (1850s)	Tightening of cadastral surveying controls and regulations. Strengthening and institutionalisation of the profession as a result of the profession playing a key role in the operation of land markets.
Power and influence of Registrars General or Directors of Land Titles Offices (1850s onwards)	Influence of LTO on the profession has gradually increased as more land was alienated and became registered in LTOs.

Breadth of the land surveyor (19th C and first half of 20th C)	Surveyors assumed land administration, land and resource management, land valuation, land development, construction of civil works and town planning roles in society (in some parts of Australia land surveyors still assume many of these functions).
Replacement of Gunters Chain and Circumferentor with the long steel band and theodolite (1880s)	Improved accuracy and efficiency of cadastral surveys.
Registration or licensing of surveyors (1840s)	In response to the need for rapid alienation of land, a private sector was established under tight government regulation.
Establishment of Institutes of Surveyors in separate Australian colonies (1870s)	Development of a separate surveying profession having a strong cadastral focus.
Very high quality large scale urban mapping in major urban areas (1870-1910)	Growth of government surveyors in support of urban management, especially for water, sewerage and drainage applications. Urban mapping scaled down due to recession in 1890 and ceased about 1910.
Reciprocating Boards of Surveyors for Australia and New Zealand established (1890s)	Registration or licensing of surveyors becomes professional qualification for surveyors. Boards set and assess professional examinations.
Expansion of the triangulation network and state mapping (19th Century)	Considerable activity but still ad hoc approach since Australia comprised separate colonies until 1900. Promoted growth of cartographers and geodetic surveyors.

World War 1 (WW1) (1914-1918)	Expansion of surveying technology with growth in use of aerial photography for mapping.
Urban expansion after WW1 (1920s)	Expansion and consolidation of cadastral surveying profession in support of urban development.
Great Depression (1930s)	Contraction of profession, particularly in private sector.
World War 2 (WW2) (1939-45)	Very significant technological influence with emphasis of geodetic surveying and photogrammetric mapping. Many trained surveyors returned from the war to influence the technological expansion in the profession.
Institution of Surveyors Australia (ISA) established as a national body (1952)	Provides the profession with a national focus and voice, but still only a federation of often competing state or territory interests.
National mapping after WW2 (1950s -1970s)	Golden era of national mapping. Focus on geodetic survey and photogrammetric mapping. Cadastral surveying, land development and land management have low profile even though there is great activity in these areas.
Establishment of separate university degrees for surveying to meet demand after WW2 for development and national mapping (1950s - 1970s).	Major emphasis on geodetic surveying, photogrammetry, instrumentation and engineering surveying. Minor emphasis on cadastral, land development and land management. Consolidation of professional status for surveying.
	Major influence on technological development especially for engineering surveys. Many

Snowy Mountains Hydro-electric Scheme and other major engineering projects (1950s-1960s)	experienced non cadastral surveyors immigrated to Australia having a strong influence on development of university courses. Promoted technical expertise and standing of profession and started to diminish the influence of the cadastral surveyor.
Major growth in surveying in government departments to service and support post-war economic growth (1950s - 1960s)	To service the rapid expansion after WW2, government departments grew rapidly although they did not compete with private sector. Not an issue with private sector due to almost unlimited work for all sectors.
Rapid urban expansion after WW2 allowed town planning to split away and develop as a separate profession (1950s - 1980s)	Surveyors kept busy with extensive cadastral surveying, land development and national mapping work. Town planning profession established separately to fill need for urban planning to serve expansion.
Electromagnetic Distance Measurement (1960s - 1980s)	Start of electronic era. Surveying less labour intensive. Greater efficiency. Non professional surveyors increasingly using 'surveying' technology.
Portable calculators (1960s - 1970s)	Revolution in surveying computations. Increased efficiency and productivity.
Association of Consulting Surveyors (1970s)	Private surveyors form separate body with an important role to lobby government for government officials to cease undertaking surveying and mapping.
Doppler satellite positioning (1960s - 1970s)	Start of revolution to speed up and improve efficiency of providing geodetic control.

Major engineering projects are reduced Australia wide (1980s)	Results in reduced demand for surveyors.
Surveying increasingly becoming an IT 'office based' discipline (1970s -)	Surveying starting to lose its macho image with women moving into the profession, although women tending to move into non traditional surveying areas.
Remote Sensing and small scale satellite mapping - LANDSAT (1970s)	Start of satellite mapping revolution, even though it had only a marginal impact on the traditional surveying profession.
Focus on land information management (1980s)	Growth in use, availability and power of computers permits both the spatial (particularly digital cadastral data base) and textual components of land information to be efficiently integrated. Some surveyors become land information managers.
Universities assume responsibility for most examinations previously undertaken by surveyors registration boards	University surveying programs 'come of age' and accepted as mainstream education institutions for surveyors. The profile and influence of surveying programs in universities increases.
Law of the Sea, 200 mile EEZ, growth in hydrography (1980s)	International and national initiatives, and economic imperatives gave increased emphasis to marine resources, resulting in hydrographic surveying and related activities becoming an increasingly important part of the surveying profession.
	Allowed digital spatial data to be integrated with digital textual data. Provided an integrating mechanism between surveying disciplines

Development of GIS and spatial information environment (1980s - 1990s)	especially major areas of measurement science and land management. With GIS increasingly becoming part of mainstream IT, surveying profession is becoming important component in the IT revolution. Government and academic sectors strongly embrace GIS. Traditional surveying profession slow to adopt GIS but adopting increasingly in 1990s.
Surveying discipline moves strongly into the spatial information area while retaining traditional areas such as engineering and cadastral surveying, and land development (1990s)	The ISA continues primarily as a 'cadastral surveying and land development club' as reflected in the backgrounds of most of the ISA federal councillors and the membership of the controlling bodies of the state divisions. Professionals in spatial information discipline tend to associate with the Australasian Urban and Regional Information Systems Association (AURISA) or similar learned societies
GPS (1980s - 1990s)	Satellite positioning technology increasing rapidly giving significant increases in efficiency and productivity. Obtaining coordinates at the press of a button becomes a reality.
Medium scale satellite mapping - SPOT, MOMS (1980s - 1990s)	The new generation of satellites together with digital photogrammetry provides potential to automate and improve efficiency of small and medium scale mapping.
Australian Government supported by Australian surveyors increasingly focuses overseas aid on cadastral and land titling projects (1980s - present)	The surveying profession starts to take an international focus but majority of profession still focussed on state cadastral and land development system.
ISA plays an active role in	The profession moves to

promoting South East Asian Survey Congresses (1980s to present)	internationalise and develops stronger links with Asia.
The ISA strengthens links with the International Federation of Surveyors (FIG) and breaks links with the Commonwealth organisation CASTLE (1980s)	The ISA hosts the 1992-95 Bureau of the FIG, hosts the 1994 FIG Congress in Melbourne and chairs a Commission for the first time (Commission 7 - Cadastre and Land Management)
Digital photogrammetry (1990s)	Technology to automate mapping from digital imagery leading to significant increases in efficiency and productivity.
Micro-economic reform and economic rationalism. Governments 'downsizing', privatising and out-sourcing (1990s)	Major impetus to private surveying sector. Universities becoming more business-like and more entrepreneurial. In all sectors the strong have got stronger and the weak weaker. Provided an environment in government to re-engineer century old surveying and mapping structures and processes.
Environmental and social awareness, sustainable development(1990s)	Provided an impetus for the surveying profession to use new technologies (especially GIS and remote sensing) to re-establish an important role in land management and natural resource management.
Growth of free market economy world-wide (1990s)	Issues of property, land markets and cadastral systems are recognised as keys in economic development, environmental management and social stability. Providing further impetus for the surveyors' role in cadastre and land information management.
Geocentric Datum (1990s)	Facilitate easy integration of position or location (via GPS) into spatial data bases.

IT developments especially in data base design (1990s)	Spatial attributes are becoming transparent in large data bases. Places pressure on traditional structures and policies which historically separated spatial (surveying and mapping) and textual (land use, value and title) data.
Growth of 'geomatics' focus and engineering accreditation (1990s)	As a result of perceived poor public esteem of 'surveying' and difficulties in attracting students, imperative for many academic institutions to embrace a new image, new opportunities and new strategic alliances, while still retaining 'surveying' as core business.
Reduced government funding for higher education together with major higher education reform (late 1990s)	Low public esteem for land surveyors and perceived low salaries or remuneration results in lower student numbers. The nine separate surveying/geomatics programs coming under increasing threat with many programs being amalgamated with other disciplines such as civil engineering, planning or architecture.
ISA strengthens links with the New Zealand surveying profession (1990s)	Published the first edition of the Trans Tasman Surveyor (1996), ran the first Trans Tasman Survey Congress (1997) and established Trans Tasman commissions (1997)
National competition policy and de-regulation of professions (1990s)	Governments withdrawing from the regulation of professions. Boards of Surveyors no longer provide professional accreditation but focus on quality assurance of the cadastral framework. Opportunity for professional surveying and engineering bodies to provide professional accreditation.

Emerging information society and Global Village (1990s)	The 'on-line' economy, the digital revolution and the wide range of enabling spatial information technologies present almost unlimited opportunities for the surveyors to assume the role of 'spatial information brokers' and to enhance their traditional roles of land development, and land and environmental management.
Spatial data infrastructures (SDI) (1990s)	SDIs have given the surveying profession a golden opportunity to consolidate their role in providing a key component of the infrastructure for the emerging information society. Enlightened politicians and senior government officials are increasingly recognising the importance of SDI in supporting the growth of IT, multi-media and communications technologies.
Internet and WWW (1990s)	The Internet and WWW present the profession with an opportunity which may outstrip the importance and impact of EDM, GIS and GPS. The impact on all professions, government structures and processes, and educational institutions will be significant, with many consequences and opportunities not yet even conceived.

The above review of events which have influenced the profession in Australia shows that it has changed significantly over the last 150 years with institutional changes, technological changes and increases in efficiency being very significant, while the underlying philosophy or 'raison d'etre' has not changed - that is measurement science linked to land management. Interestingly this was the strength of the profession in the 19th Century and the early part of the 20th Century but due to the technological impact of two World Wars and the golden era of national mapping, geodesy and photogrammetry, the land management focus was over shadowed in the 1950's to 1980's. However with the completion of national digital spatial data sets in many countries, the development of enabling technologies such as satellite positioning systems (GPS), digital photogrammetry, geographic information systems (GIS) and remote sensing, and the trend to move away from large infrastructure projects to institution and infrastructure building and environmental projects (in a similar manner to the trend in world aid organisations), the balance between land and environmental management, and measurement science in the profession is returning in Australia.

The review also clearly shows the expansion in the spatial information discipline, but that the

professional body representing surveyors, the ISA, is still primarily a 'cadastral surveying and land development club' (even though it is taking an international perspective) and is increasingly serving a contracting segment of the discipline. This is being exacerbated due to the considerable impact that technology has had on cadastral surveying and related activities, making these and related activities more efficient and productive. The move of many surveying and geomatics graduates into the spatial information sector is increasingly leaving them in a professional vacuum.

Another important development has been the reducing influence of Boards of Surveyors on the surveying discipline and the educational programs. This has occurred for two reasons. First, due to trends towards de-regulation and the policy of governments to shift the regulation of professions away from government to the relevant professional bodies, Boards of Surveyors have increasingly focussed on issues of quality assurance in the cadastre. Secondly, with the expansion of the surveying discipline and the reducing number of graduates seeking registration with a Board of Surveyors, the Boards have had reducing influence on the curricula of surveying or geomatics degrees, in marked contrast to their influence in the past. This has meant that for the last decade or more, there has been little or no review or accreditation of surveying degrees by the profession or Boards. This is in sharp contrast to the engineering profession which rigorously accredits engineering programs. This has left a vacuum in surveying education in Australia.

The changes in the numbers of graduates over the last 40 years also indicate some disturbing trends. The profession, and particularly the education sector, expanded dramatically in the 1970s and 1980s by increasing the number of institutions offering surveying degrees three-fold and the number of graduates six-fold at one stage. This growth is not sustainable unless the profession and programs diversify into new areas, and particularly into the spatial information sector.

With regard to the profession, maybe the most difficult influence to quantify is the impact of politics, even though politics has often had the greatest impact. Due to the unlimited ways and means that politics can influence the profession and discipline, often the only way to understand the impact is through case studies - some examples are described in Williamson (1992). The key lesson to remember from such reviews is that every development or change in the profession includes an element of politics and to ignore this or not to plan for it, is naive.

Importantly the above historical review shows that change in the surveying discipline and profession has been constant, with the rate of change increasing. While the profession has been flexible, creative and adaptable in coping with this change in some quarters, when the pressure has been great, in others it has stubbornly refused to change.

Ten Year Vision

Assuming that there will be an ongoing requirement in society for expertise and professional services in the measurement science and land management areas, it is valuable to attempt to describe the environment in which the profession will be operating in the future and what impact this will have on the profession. In looking to the future the paper draws on a report prepared to determine a ten year land information vision for the State of Victoria, Australia (Williamson, 1996) (it should be noted that this was only one of six 'visions' concerned with the development of a holistic vision for the management of spatial information in the State).

The vision attempted to describe the technological, economic and political environment in which society would be operating within ten years, even though it recognised that many components of the vision are already implemented or are being implemented. It took into account trends in micro-economic reform such as de-regulation and privatisation. Input to the vision was received across all sections of government, the private sector and academia in Australia and internationally. Importantly this is an Australian vision which recognises that some other

countries or jurisdictions are well on the way to achieving a similar vision. At the same time it recognises that other countries may take several decades to move in this direction. The vision contained a users' perspective, a technical perspective, an institutional perspective and the integrated perspective shown below:

> *Within the next ten years land information will form an integral and core component of a model of our man made and natural environment. The model will build on the core cadastral, image and topographic data sets which will be complete across the State and kept up-to-date.*
>
> *It will provide both textual and spatial data from a virtual data base using the distributed data warehouse concept in a transparent manner to the vast majority of the population remotely across the State and elsewhere in real time using sophisticated broad band communications networks such as the Internet. The data will be provided by government (core data sets) and the private sector (value added data sets).*
>
> *The focus will be on providing land information to a mass market to support the land market, financial and business sectors, environmental management, land administration, urban systems and community information systems - basically the information required to support a modern western economy in the 21st Century. The system will support the needs of the wider public, as well as government and private sector interests, and will ensure that social and public good requirements are adequately met.*
>
> *Many components of the system (the 'doing') will be highly privatised albeit it will be coordinated by a single government unit having a purchaser focus, being a single cost centre and having budget independence to ensure appropriate investment in technology and research with the intellectual property of the core data sets being retained by Government.*
>
> *The Government will have in place legislation and regulations to ensure the integrity, currency and completeness of the State's spatial data infrastructure, the quality of private sector provided data and to ensure social and public good requirements of land information.*
>
> *This core land information will support an active spatial information industry producing products and services for the State, the nation and for export.*
>
> *Simply within ten years all tiers of government, the private sector and the wider public will have controlled access to a standardised, complete, nation-wide, current, on-line land information system in real time, which is efficient, economically justified and compatible with other information systems.*

Arguably the most important technological development which will influence the surveying profession over the next decade, and which is central to the above vision, is the impact of the Internet or similar communications technology, which in turn is closely linked to internationalisation and the development of the 'Global Village'. Whether the Internet will simply improve the efficiency of traditional surveying practices in a similar manner to digital theodolites, electronic distance measuring equipment and even GPS, or fundamentally change the role and structure of the profession, only time will tell. It will most definitely have an increasingly dramatic impact on the way we browse, access and update spatial data. There is no doubt however that the Internet will affect many of our government and social institutions, such as the growth of virtual universities and the place and mode of work, and will increasingly impact on our lives in ways not previously envisaged.

The above vision recognises that there will be many social, legal, economic and institutional

hurdles to be overcome before the vision can be achieved however it does present a framework in which government policy can develop. More importantly from the perspective of the surveying profession, the vision is useful in proposing the environment in which the profession will operate and thereby helping identify major trends and developments in the profession.

Some conclusions which can be drawn about the Australian surveying profession by looking into the future based on the above vision include:

- the profession will operate almost wholly within the private sector although still within a government regulated framework
- the profession will be closely aligned with the information technology and information systems disciplines, and the engineering profession
- many surveyors will become spatial information managers and spatial data vendors
- the profession will play a central role in maintaining spatial data infrastructures at various administrative levels in a state or country
- the profession will become increasingly aware of the economic, legal, environmental and social consequences and benefits of their skills and services
- stronger and closer relationships and partnerships will develop between the government, private and academic sectors of the spatial information industry (and the surveying profession)

The Impact of Internationalisation

The legislative blanket which surrounds the surveying profession was beneficial in the past to society and the profession, especially when Australia was being settled and 'opened up'. It ensured the operation of effective and secure land markets which supported economic development resulting in a stable professional base which meant a secure and life long remuneration for those within the profession.

The negative aspect was that the profession developed a very narrow, parochial and conservative view of the operation of cadastral systems focussing usually on one state or territory. Australian surveyors considered their individual cadastral systems without peer. Criticism and change were not encouraged and were often ridiculed. During the Golden Era of national mapping, geodesy and photogrammetry of the 1950-1970s, Australian cadastral systems took a low profile and undertook little change with almost no government interference.

The 1980s and more importantly the 1990s have left many in the surveying profession unable to understand or not wanting to understand the dramatic changes that are affecting Australian society and in turn their profession. Micro-economic reform, information technology, telecommunications, AGENDA 21 and internationalisation have changed and are continuing to change the profession in ways not even dreamt possible in the past. While these are challenging the very existence of our traditional profession they are also presenting unlimited opportunities.

At the same time the increasing focus of the Australian Government on Asia and on cadastral, land information and land titling projects in developing countries, has given the profession a new focus and allowed many surveyors to better understand our own systems by working overseas. This focus of the Government started in the late 1970s with a project in Fiji, then Thailand in the 1980s with the result that projects or investigations have been undertaken or are being undertaken in the Philippines, Indonesia, Laos, Vietnam, Papua New Guinea, Zimbabwe and China. At the same time this has allowed Australian surveyors to become involved in cadastral reform projects with the United Nations, the World Bank and many other institutions in a great number of countries around the world.

AGENDA 21 and the international move for better environmental management and sustainable development are also questioning our traditional cadastral concepts. The Torrens System is increasingly recognised as a 19th Century paradigm focussing on trading individual land rights.

It has had great difficulty coming to grips with restrictions and responsibilities on land. Its relevance in the 21st Century is in question.

Meetings such as the joint United Nations and FIG meeting on cadastral reform in Indonesia in 1996 which resulted in The Bogor Declaration (FIG, 1996) have promoted a range of principles which are a key if an international view is taken of cadastral reform (also see Williamson, 1997):

1. A successful cadastral system is one where the three main cadastral processes of adjudication of land rights, land transfer and mutation (subdivision and consolidation) are undertaken efficiently, securely and at reasonable cost and speed, in support of an efficient and effective land market.

2. The importance of having a cadastral vision which:

- is simple and effective,
- is adaptable to different rates and patterns of population change,
- facilitates access to land, security of tenure, trading in land rights,
- allows a vast array of cadastral options,
- includes all state and private lands, and
- is part of a national or state spatial data infrastructure.

3. The Declaration recognised that western countries, countries in transition and developing countries all have different priorities and different capacities for development i.e. human, technological and financial. For example in some countries a simple low cost manual cadastre is ideal, while for others a fully computerised multi-purpose cadastre is more appropriate.

4. In re-engineering systems to support cadastral reform it is desirable to focus on users and landowners, not just government needs. The focus should be on improving the efficiency of cadastral *processes* (i.e. land adjudication, land transfer and mutation) not the separate components (ie the cadastral surveying or land registration system).

5. There are a vast array of options to support cadastral reform (which could be considered a 'cadastral toolbox') which fall under the following categories:

- Land policy options
- Legal options
- Institutional options
- Technical options

6. The key cadastral issues identified in the meeting included:

- clear identification and recording of ownership rights
- restrictions and obligations to land
- access to land information
- recognition of informal tenures
- speed and keeping up-to-date
- integration of cadastral and land registry systems
- cadastral systems not ends in themselves

7. The success of a cadastral system is not dependent on its legal or technical sophistication, but whether it protects land rights adequately and permits those rights to be traded (where appropriate) efficiently, simply, quickly, securely and at low cost.

Trends in Surveying Education in Australia

Trends in education are also a good indicator of future directions within the profession and industry. Educational institutions in Australia have greater flexibility than the professional institutes, such as the ISA, which tend to be more conservative. The changes in surveying (within the Bachelor of Geomatics) at the University of Melbourne are indicative of the changes which have occurred around Australia (also see ISA, 1994):

- name - Department of Surveying (1948 - 1987)
- name - Department of Surveying and Land Information (1987-1994)
- name - Department of Geomatics (1994 - present)
- professional engineering accreditation (1996 - present)
- from one or two women each year up to the early 1990s to over 50% women in 1996
- over 50% of students enrolled in five year combined degrees between geomatics and computer science, information systems, environmental science, geography, archaeology
- emphasis on the science and management of spatial information
- balance between measurement science and land management maintained
- cadastre and land management taught from an international perspective, rather than just focussing on how to do cadastral surveys in Victoria
- GIS is a core discipline
- geomatics increasingly a part of IT but with close ties to land management applications
- in 1990 there were eight separate surveying or geomatics schools in Australia, today there are four with the potential for further amalgamations in the near future

At the same time the curricula in the basic surveying or geomatics degrees have been changing as follows:

- basic sciences constant
- cadastre, land and environmental management and land development constant
- measurement science reducing significantly but still core content
- IT and information systems increasing
- GIS and curriculum concerned with spatial data infrastructures increasing
- professional development constant or increasing

The developments outlined above confirm the very significant changes which are occurring in the discipline. It also highlights that the Boards of Surveyors and the ISA are only representing part of these activities, and with that part reducing.

The Rate of Change Accelerates

The pressure on the Institution of Surveyors Australia is indicative of the pressures on many institutes representing professional surveyors world-wide. It is at a watershed. If it does not change in line with technological, economic, international and political trends it will increasingly lose relevance to the discipline and wider society.

Cartographers, and mining and engineering surveyors are still in different institutes in Australia after decades of failed negotiations to bring the spatial information industry together. At the same time the Australasian Urban and Regional Information Systems Association (AURISA), which is a learned society representing GIS and broad spatial information interests, is moving from strength to strength. In addition the Institution of Engineers Australia (IEAust) has opened its doors to professional surveyors and has already accredited two surveying (geomatics) programs in universities.

ISA cannot depend for its existence by being a 'cadastral surveying and land development club' with surveyors registration boards providing broad professional support. Boards of Surveyors are losing their influence through government efforts to de-regulate the professions while the

number of surveying graduates entering the cadastral and land development area is reducing.

The increasing loss of control of the management of spatial information by surveyors in government in some states is also weakening the role of the ISA in being the 'spatial' profession in the community. Governments in Australia increasingly look to AURISA for industry views and feedback on spatial and GIS related policies.

The 'clock is ticking' for the ISA due to:

- a relatively poor public image,
- a declining public interest in surveying, as evidenced by the reducing numbers of students interested in entering a surveying or geomatics career Australia wide,
- fragmented and competing state divisions within ISA,
- a move to 'geomatics' in the academic sector,
- professional engineering accreditation, and
- with the discipline rapidly expanding into spatial information management.

However the future presents almost unlimited opportunities if the profession and the ISA embrace change and adopt an appropriate 'blue-print' for the future. This blue-print could include:

- a re-structured professional body catering for the needs of all spatial information professionals, while maintaining a secure home for the cadastral surveying and land development sector,
- a focus on the Asian and Pacific region as the profession's backyard as distinct from a parochial state focus traditionally taken by each ISA state division,
- the introduction of a national accreditation system for all spatial information professionals and surveying/geomatics educational programs, and
- the establishment of a truly national body as distinct from the current competing state and territory divisions.

Ironically this is almost exactly what all ISA investigations and reviews have recommended over the last five years or so, but the conservative nature of the ISA membership, particularly in the most populous State of NSW, has precluded any major change to date. Unfortunately a vote at the annual general meeting of ISA in April this year to amalgamate ISA with the Institute of Engineering and Mining Surveyors (IEMSA) was lost (since at least a 75% vote is required to change the constitution). History will record this as a black day for the ISA and the profession.

The completion of the core spatial data sets across the nation in particular and the recognition of the importance of spatial data infrastructures in promoting an information society, are now a major impetus for the growth of a spatial information industry. With the declining role of traditional Boards of Surveyors, this could well be the key opportunity for ISA to become a national accreditation body for surveyors and the wider spatial information industry. This could be the catalyst for the profession to greatly increase its area of interest and influence, particularly in the Asian and Pacific regions.

Conclusion

The surveying profession has a sense of history which allows it to appreciate the inevitability of change. The brief historical review in this paper highlights the continual changes to the profession in Australia over the last 150 years or so. It also shows that the profession has sometimes been flexible, creative and adaptable as a result of technical innovation, political changes and economic influences, but just as often it has resolutely resisted change.

However the underlying principle which provides the basis of much of the surveying profession has not changed. That is the synergistic relationship between measurement science or more

recently spatial information science and land management. This relationship provides strength to the profession by giving it a strategic advantage and competitive edge in the wider community and market place. It is this strength which should allow it to withstand the turbulent times which inevitably lie ahead, but more importantly the ability to capitalise upon them. The importance of keeping a balance in future between these two often competing strengths cannot be over-estimated.

Recent technological developments are causing many sectors of the profession to increasingly align themselves with the information technology, information systems and engineering disciplines. This trend, the growing importance of spatial data infrastructures, together with our emerging information society, presents the profession with some threats but also almost unlimited opportunities.

At the same time the profession's strength in environmental management, the cadastre, land tenure and the broader operation of land markets is having a resurgence. Governments are increasingly appreciating the central role that the surveying discipline plays in economic development, environmental management and social stability. The profession is gradually moving away from its parochial view of cadastral systems with many surveyors understanding the principles and concepts applicable in a global context.

But the profession will have great difficulty grasping these opportunities within its traditional image and structures. Technology, economic reforms, internationalisation and political changes have pushed our discipline well ahead of the professional infrastructures which support it - that is the professional and academic institutions and government structures supporting the surveying profession. Without change to these structures, the ISA will continue to have a contracting membership and will increasingly consolidate itself as a 'cadastral surveying and land development club'. At the same time the growing number of spatial information professionals who do not have an affinity with the ISA will increasingly search for another professional home.

This paper discusses the future of the Australian surveying profession while drawing on many international trends and influences. It would be presumptuous to suggest that many of these issues are directly relevant to Southern Africa. However from many years of reading about the South African surveying profession and cadastral system, from a brief period in Zimbabwe and Ghana, and from being an avid follower of the changes which have occurred in this part of the world over the last decade, I suspect many of the lessons from Australia are relevant to Southern Africa.

Therefore while there should be great optimism about the future of our discipline and profession in both Australia and Southern Africa, such a vision will only be achieved by those who understand our history, recognise change is inevitable and reach out and grasp the opportunities.

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