

Published in The Australian Surveyor, Vol. 4, No. 1, 46-54 (1999)

Cadastral Trends: A Synthesis

LISA TING

PhD Candidate

Department of Geomatics

The University of Melbourne

IAN P. WILLIAMSON

Professor of Surveying and Land Information

Department of Geomatics

The University of Melbourne

Abstract

An understanding of the human history behind cadastral systems is essential to understanding the dynamism of the humankind to land relationship and how this has driven and will drive cadastral reforms.

The cadastral concept has developed significantly over the past few decades. During this time these systems, whether developed from a land market or land taxation perspective, have increasingly played a multi-purpose role.

Since the time humankind learned to settle on land, cadastres have developed and evolved to suit society's needs. Changes in the relationship of humankind to land have invoked matching evolutionary changes in the function of cadastres. The most recent examples are current world concerns of environmental management, sustainable development and social justice. Due to this, multi-purpose role cadastres are increasingly seen as fundamental to economic development, environmental management and social stability in both the developed and developing worlds.

This paper reviews the trends in the humankind/land relationship and how these have affected the development and applications of cadastres.

Introduction

The relationship between humankind and land will always be dynamic (see Figure 1) [Ting et al., 1998a] and has changed at different rates across countries and regions as a result of varying pressures and priorities in society.

This paper will explore the major phases of the relationship between humankind and land and draw correlation with the major evolutionary steps in the cadastral systems that supported those major phases. There are four major phases:

- Human settlement during the agricultural revolution through to the feudal system, tied human beings to land in a physical way. Land was the primary symbol and source of wealth. In this phase, the cadastral system's role was to publicly record ownership as well as for fiscal purposes.
- The industrial revolution began a process of breaking that strong physical tie to the land by turning land into more of a commodity, albeit the most valuable commodity and primary source of capital. This environment gave birth to land markets and so cadastre took on another focus – a tool in land transfers.

- The post-World War II reconstruction and the population boom saw an increasing awareness of land as a scarce resource that may not be sufficient for the needs of a growing world population that was also increasingly mobile. With this came the increased interest in planning, particularly urban and regional planning. This in turn created another important application for cadastre.
- The 1980s have seen a different twist in the concern for the scarcity of land. The focus has turned to wider issues of environmental degradation and sustainable development, as well as social equity. All of these issues have the probable effect of tempering short-term economic imperatives. Planning issues have widened to include more community interests and deepened to address more detailed issues of land use. This has created a growing need for more detailed information about land and land use. The impact of these has been manifested in the desire for multi-purpose cadastres.

Figure 1

Cadastre: An Evolving Concept

"Cadastral systems are the foundation and an integral component of parcel-based land information systems (LIS) that contain a record of interests in land. These systems are a central component of the land administration and land management systems in a state or jurisdiction" [Williamson, 1990]. This statement shows how far the application of cadastral systems has evolved.

Land as Wealth and Cadastre as Basic Record and Fiscal Tool

As Grant stated in his paper on territoriality:

"Territoriality is the primary expression of social power. Its changing function helps us to understand the historical relationship between society and space.

..."Perhaps, throughout history, one of the strongest drivers for territoriality and associated expansionist claims is the desire for commercial growth..." [Grant, 1997].

In the early stages of human settlement, land was undisputedly the primary source of wealth and power. In that context, cadastre's primary function was as a record of ownership and as a fiscal tool. It is important to note that the point of the record was to provide some security of ownership as against the world and to do so, required a record which was publicly acknowledged and respected. Among primitive tribes, occupation of land had to take place in the presence of the chief and elders [Larsson, 1996].

The earliest records of land ownership date back to the Royal Registry of Ancient Egypt that was created in about 3000BC whilst in China in 700AD the taxation system was based on crop yields and land survey records [Larsson, 1996]. The Romans carried out a survey in 300AD to create a register of what lands the Romans

controlled as well as using it as a basis for fiscal records [Larsson, 1996].

The feudal system was extended and developed by the Normans after the Conquest of England in 1066. All land was owned directly or indirectly by the king and he granted use of these lands to his subjects (and their heirs) in return for the rendering of military or other services [Ting et al., 1998a]. The remnants of that concept lie in the fact that land in modern-day England continues to be classified freehold or leasehold – both terms describe a form of "tenancy". Karl Marx commented in "The German Ideology" that:

"The chief form of property during the feudal epoch consisted on the one hand of landed property with serf labour chained to it, and on the other of the labour of the individual with small capital commanding the labour of journeymen" [Arthur, 1974].

Power in the feudal system vested in the institutional and legal structures that were put in place by the combined interests of landholders and the sovereign [Davies and Fouracre, 1995]. The Domesday Book was created after the Norman Conquest to develop a land register (there were no maps) that stated the owner's name, tenure, area and particulars for assessment of the land for the purposes of extracting feudal dues. In other words, the cadastral register existed for fiscal purposes and as a record of the territory of the kingdom. Henssen considered that the philosophy behind the establishment of fiscal cadastres throughout continental Europe in the early eighteenth century was the Physiocrat movement which held that land was the basis of all wealth and therefore land tax would be the basis for raising funds to maintain society [Henssen, 1975].

Mapping was not common until 1807 when Napoleon Bonaparte established the foundations of European cadastre when he ordered the creation of maps and cadastral records. During the Napoleonic era, particular bodies were given the task of registering transfers and deeds of ownership. The records showed the physical location of parcels of land as well as ownership across France, arranged by parcel numbers, area, land use and land values per owner. It was this combination of registry records and maps that lay the foundations for modern-day cadastral systems.

Accurate cadastral records were very important for proving ownership of land that in turn earned people substantial privileges such as citizenship. The concept of citizenship in the classical period introduced to Ancient Greece the idea that property ownership should be linked to citizenship, as defined in its earliest forms by Aristotle and Plato in the thirteenth and fourteenth centuries [Manville, 1990:94-96]. "It is the ownership of property which confers full citizenship since it is property which meant that the citizen did not require manual labour to survive; the propertied citizen could thus devote himself to public service without the distraction of labour [Turner, 1986:14]. By 500BC, Emperor Servius Tullius conferred citizenship on the Pleb (unprivileged aliens domiciled in Rome) [Heater, 1990:16], but implementation was another matter. Even in the Dutch Republic of the 1700s, the forces of oligarchy continued to draw a distinction between 'citizens' and the 'populace' or 'rabble'[Heater, 1990:29]. The contrary attitude to linking property and citizenship was not really fully developed until the twentieth century because prior to that it was generally agreed that citizens should possess an adequate amount of property to bring on a tangible stake in maintaining stability [Heater, 1990:167-170].

These basic record and fiscal tool rationales continued to be the basis for cadastral records until the development of land markets around the time of the Industrial Revolution.

Land as Commodity and Cadastre as Land Market Tool

The usurping of land's position as the primary source of wealth began with the Industrial Revolution and the rise of capital. This in turn created a further important function of the cadastre as a tool to support the growth of land markets and land transfers.

The Industrial Revolution came at a time of agricultural change as well as industrial invention [Ting et al., 1998a]. There were significant land management changes which led to improved productivity such as the enclosure movement of the 1700s across Europe and the United Kingdom (UK) to create larger and more productive plots. In the UK, for example, about 7,000,000 acres of land were enclosed between 1760 and 1845; these were made more productive by mixed agriculture, which included crop rotation and alternating arable/pasture use [Toynbee, 1884]. The importance of land as the source of all wealth changed in the face of the rise of capital. Land became an important source of capital and thus the emphasis moved away from the

physical ownership of land to the conversion of land to capital that could facilitate mobility. The land administration and property law systems which were designed to preserve attachment to land into perpetuity, became too cumbersome and unwieldy. All manners of methods were used to overcome those limitations by re-interpreting existing instruments such as the Statute of Uses [Ting et al., 1998a].

Deeds of ownership were now important not only to prove ownership so a person could remain on the land as against others, but became the cornerstone of the land market. Cadastral records, including deeds, served to provide some proof of ownership that then established the necessary trust to transact the sale of land.

The Torrens System, which suited 19th century paradigms in a young country such as Australia with large tracts of unsurveyed and untitled land, is interesting because in a sense, it is an example of legal change responding to society's needs, then propelling further changes in the land markets and land administration, including surveying methods [Ting et al., 1998a]. The Torrens System was revolutionary for its ability to deliver certainty as well as cheaper and speedier land registration. The pre-existing Deeds method required that lawyers trace the trail of documents back as far as possible to determine whether there was good title to be passed on [Ting et al., 1998a]. The intended effect this had on the cadastre was to create a land register and maps that would state unequivocally the description of every parcel of registered land and its owner. Together with the government guarantee of accuracy, the cadastre and land administration system developed based on Torrens greatly assisted the development of the land market and fulfilled colonial society's desire to rapidly settle the vastness that was Australia.

In short, cadastre now existed to facilitate land transfers (land markets) as well as serving the purposes of recording ownership and land taxation.

Land as Scarce Resource and Cadastre as Planning Tool

The post WWII reconstruction period and subsequent population boom saw the need for better spatial planning, particularly in urban areas. There was an increased need for land administration laws and systems to address broadacre subdivisions. Land title systems had to evolve to accommodate the desire to own a piece of property within a high-rise building – condominiums or strata subdivisions [Ting et al., 1998a]. To achieve this also required a cadastral system that could describe ownership of space in three dimensions.

The growth of urban satellite cities with high-density housing and the increasing pressure on infrastructure by the sheer numbers of the urban populations necessitated better urban planning. Regulation of land use in the community involves more than the recognition of spillover effects on contiguous land; the other objective is to provide public amenities that are unlikely to be privately produced and the other is to increase efficiency by guiding development and redevelopment of land for desirable purposes [Courtney, 1983:153]. The cadastre, as the record of land parcels and registry of ownership, became a useful tool (when teamed with large-scale maps) for city planning and the delivery of vital services like electricity, water, sewerage and so forth. Thus a focus on planning was added to the pre-existing applications of cadastre as a fiscal and land transfer tool.

Land as Scarce Community Resource and Cadastre as Land Management Tool

As today's society faces continuing land shortages and resource scarcity, the imperative exists to better manage and plan land use. The concerns about sustainable development and the environment are evident from such international instruments as Agenda 21 and the Habitat II Agenda. There are also concerns for social equity such as indigenous and women's rights. Thinking has moved beyond giving more people the possibility of ownership of space over the same parcel of land (strata title).

Concern now focuses on how the land can be better managed in a variety of circumstances, whether for town planning purposes or for rural agricultural development. For example, the solution to problems faced by low-value agricultural lands in New South Wales, Australia, must include: sustainable land-use; comprehensive integrated datasets to allow for better decision-making; simplified cost-effective operation of the cadastre; and clearly defined, easily relocatable parcel boundaries supported by an appropriate low-cost cadastral survey system [Harcombe and Williamson, 1998].

Now society needs multi-purpose cadastres to answer its fiscal requirements, land transfer needs as well as

facilitating land management [NRC, 1983].

The achievement of a useful multi-purpose cadastre is made possible by the potential of the information revolution and the technology that has continued to evolve with it. The more difficult hurdles are the fundamental legal and institutional reforms that will facilitate the data-sharing necessary to develop, support and maintain information for a multi-purpose cadastre.

In both the Australian and European contexts, cadastral systems are now closely linked with land valuation systems. In the European context, cadastral systems were originally concerned with land valuation for taxation purposes and later were linked to land registration systems. In Australia, the reverse was usually the case although the end result, which is a close relationship between land registration and land valuation, is very similar [Williamson, 1985].

Figure 2 shows the cumulative evolution of the humankind/land relationship and the consequent developments in the evolution of cadastres and the functions of cadastres.

Figure 2: Main Phases in the Humankind/Land Relationship and Cadastral Evolution

Trends for the Future

One of the key trends is concern for the environment. This demonstrates an increasing desire on the part of society to temper short-term economic imperatives with other priorities. This shift in thinking towards longer term economic planning is exemplified by Agenda 21, the seminal document that encapsulated the deliberations of the 1992 United Nations Conference at Rio de Janeiro and the 1997 United Nations Summit in Japan on Global Warming [Ting et al., 1998*b*]. As the World Bank stated:

"Economists have long recognised pollution to be a negative externality. Without some form of regulatory protection, the environment can become an innocent victim of bad business practices" [World Bank, 1997].

Increasingly, the trend is to define environmental concerns more widely and to inject them earlier into the planning process [Ting et al., 1998*b*]. One example is the Habitat II Agenda and Istanbul Declaration on Human Settlements (1996) at the Second United Nations Conference on Human Settlements where one of the major chapters (Chapter 5) was headed "environmentally sustainable, healthy and livable human settlements". The section on shelter delivery programs clearly states the necessity for a legal framework of land use that addresses society's need to promote efficient land markets as well as sustainable land use (at Article 77):

"To promote efficient land markets and the environmentally sustainable use of land, governments at the

appropriate level should develop a legal framework of land use aimed at balancing the need for construction with the protection of the environment, minimizing risk and diversifying uses."

Social equity concerns, particularly with respect to women and indigenous peoples, have been highlighted in international instruments such as the UN Social Summit 1995:

"Commitment 4(f): Recognize and respect the right of indigenous people to maintain and develop their identity, culture and interests, support their aspirations for social justice and provide an environment that enables them to participate in the social, economic and political life of their country;

Commitment 5(e): Remove the remaining restrictions on women's rights to own land, inherit property or borrow money, and ensure women's equal right to work;"

Obviously, to facilitate planning at that detailed level, there is a necessity for a multi-purpose cadastre that provides reliable information for decision-making. It should be noted that the need for sustainable development planning occurs increasingly on a global level. Apart from the obvious environmental initiative of Agenda 21, there are other particular issues of a global nature that multi-purpose cadastres could help to address, and there is an increasing acknowledgement that cadastres have a significant role to play in planning on land as well as off-shore [Hoogsteden and Robertson, 1998]. One example of an off-shore issue is the world fisheries crisis [PANOS, 1995]:

"Around 100 million people in developing countries are dependant on fisheries. They are its largest and poorest stakeholders. But their livelihoods are further under threat from the general stagnation in world catches and from the large trawlers which overfish their waters...Nine of the world's 17 fisheries are in serious decline with four depleted commercially, according to the FAO...The global catch is of less value – both in terms of money and nutrition – than it was."

In the same vein but closer to the traditional issues of land-use planning is the importance of land for food production. FAO research in 1995 showed that from a global perspective, there are serious inequities in the use of resources:

"The world, as a whole, is getting steadily wealthier. By the early 1990s, about 20 percent of the world's population most of it in the developed world - received over 80 percent of the world's income, while the poorest 20 percent received only 1.4 percent. The developed countries consume 70 percent of the world's energy, 75 percent of its metals, 85 percent of its wood and 60 percent of its food" [UNFAO, 1995].

In the lead-up to the 1996 World Food Summit, the FAO had stated:

"although the world can produce enough food for everyone, 800 million people in developing countries are chronically undernourished...The vast majority of the undernourished live in countries that do not grow enough food for their populations and cannot really afford to fill the gap with imports...At the same time, bilateral and multilateral assistance to agriculture in developing countries is declining." [IPS, 1995].

The trends towards developing multi-purpose cadastres to address planning for sustainable development issues as well as fiscal and economic imperatives is evident in a range of Western nations such as:

- Australia [Williamson, 1996];
- Canada [MacLauchlan and McLaughlin, 1998];
- Denmark [Enemark, 1994];
- Germany, Austria and Switzerland [Hawerk, 1995];
- New Zealand [Robertson, 1996].
- USA [NRC, 1983];

Across Europe, one of the significant drivers of the multi-purpose cadastre is the 1992 European Community Programme of Policy and Action in Relation to the Environment and Sustainable Development "Towards Sustainability", the so-called Fifth Environmental Action Programme (SEAP).

The Central European countries are grappling with more fundamental issues of institutional revolution in land administration that can restore the concept of private ownership and land markets first. That requires restoration of the traditional Land Cadastre and Land Registry before it can even contemplate moving on to land market and land management functions. As was written about the Czech Republic experience:

"The restoration of Land Cadastre and Land Registry after more than forty years can be neither quick nor cheap, as the first steps the missing parcels and other data to be completed. It represents a large amount of highly skilled manual work distributed by extremely extensive request for cadastral information required for restitution and privatisation process" [Pesl, 1997].

In Latvia, the experience is similarly one of restoring the legal right to private land ownership and use, followed by restoration of rights. The latter of course is dependent on the establishment of necessary cadastral and land registry offices [Eglitis and Balodis, 1994].

The Meeting of Officials on Land Administration (MOLA) which was established in 1996 by the UN's Economic Commission for Europe, stated regarding countries in transition in Central and Eastern Europe: "privatisation of land and security of ownership is increasingly stressed as a prerequisite for a successful introduction of market economy" [Onsrud, 1998]. Land reform in Eastern Europe in recent times has aimed to establish land markets by developing a coordinated national land policy, institutional and legal reform, simplifying property information systems, marketing land information held by government departments and assessing the effectiveness of farm consolidation schemes [Harris and Land, 1998].

In addition to country examples, there are a number of international instruments that can provide guidance on trends for the future. All of these indicate the emphasis on sustainable development, the environment and/or social equity and establish the need for multi-purpose cadastres:

1. **The FIG Statement on the Cadastre**

"A Cadastre...may be established for fiscal purposes (e.g. valuation and equitable taxation), legal purposes (land transfers), to assist in the management of land and land use (e.g. for planning and other administrative purposes), and enables sustainable development and environmental protection."

2. **Bogor Declaration: UN Interregional Meeting of Experts on the Cadastre**

- A Cadastral Vision: Point 4.1: The vision of the future shared by the meeting was to:
- develop modern cadastral infrastructures that facilitate efficient land and property markets, protect the land right of all, and support long term sustainable development and land management.
- facilitate the planning and development of national cadastral infrastructures so that they may fully service the escalating needs of greatly increased urban populations. These will result from the rapid expansion of cities that is already taking place and which is projected to continue into the 21st century.

3. **Commission 7**

- Commission 7 of the International Federation of Surveyors is tasked to promote international goodwill, cooperation and understanding in issues of cadastre and land management. Its terms of reference reflect the essence of the FIG Statement and the Bogor Declaration:
- Land Management and administration.
- Cadastral reform, multi-purpose cadastres, parcel-based land information systems and computerisation of cadastral records.
- Cadastral surveying and mapping.
- Land titling, land tenure, land law and land registration.
- Urban and rural land consolidation with emphasis on environmental and economic issues.
- National and international boundaries.
- Land and marine management.

There is a specific working group of Commission 7 dedicated to Land Management issues (refer <http://www.geom.unimelb.edu.au/fig7/group3.html>).

1. Cadastre 2014

- Cadastre 2014 is a comprehensive Land Recording system developed by the FIG's Commission 7 Working Group 7.1 (1994-1998) that can replace the traditional institutions and the justifications for it included the need to support sustainable development, deliver certainty of rights and peaceful coexistence as well as the wider economic aims of internationalization [Kaufmann and Steudler, 1998]:

"Cadastre 2014 is a methodically arranged public inventory of data concerning all legal land objects in certain country or district, based on a survey of their boundaries. Such legal land objects are systematically identified by means of some separate designation. They are defined either by private or by public law. The outlines of the property, the identifier together with descriptive data, may show for each separate land object the nature, size, value and legal rights or restrictions associated with the land object."

- Studies by Kaufman and Steudler pointed to six principles for Cadastre 2014 [Kaufmann and Steudler, 1998]
- Show the complete legal situation of land, including public rights and restrictions.
- Separation between 'maps' and 'registers' will be abolished.
- Cadastral mapping will be defunct; it will be replaced by modelling.
- "Paper & pencil cadastre" will be replaced by modern technology.
- Cadastre will be highly privatized with public and private sector working closely together.
- Procedures for definition of private and public land objects will be identical.
- Kaufmann and Steudler also stated that the surveyor would "play the role of localizing all legal land objects" and not only with private property parcels [Kaufmann and Steudler, 1998].

The Facilitating Role of Information Technology

Multi-purpose cadastral systems feed into and require spatial data. The Australian and New Zealand Land Information Council (ANZLIC) analyzed the benefits of land and geographic data across Australia and found that cadastral data comprised 25% of all spatial data produced by spatial data suppliers. The report also found a cost-benefit ratio of 4:1 for overall data usage and the benefits:

"took the form of improved business and strategic planning, increased productivity, the development of new business opportunities, improved scheduling and coordination of investment projects, and improvements in the utilization, pricing, maintenance and disposal of fixed assets. These benefits were distributed across the broad spectrum of economic activities ranging from the operation of electricity, gas and water utilities to the development of projects involving agriculture, mining and environmental management" [ANZLIC, 1995].

The push for multi-purpose cadastral systems has been made possible by the availability of technologies to capture spatial data. The advancement in technologies such as the Global Positioning System (GPS), satellite imaging and total stations have all made the capture of digital spatial data a relatively quick and easy process. So there is now a vast amount of spatial data in digital form, stored by several organisations at various locations across the globe [Phillips et al., 1998]. The Vice President of the USA said in relation to LANDSAT images:

"In spite of the great need for the information, the vast majority of those images have never fired a single neuron in a single human brain. Instead, they are stored in electronic silos of data" [Gore, 1998].

The integration, and subsequent querying of spatial datasets, the locating and obtaining of datasets across a network, and the transfer of dissimilar spatial datasets across networks are all concepts that have arisen in an attempt to better utilize the spatial datasets that are in existence [Phillips et al., 1998].

Aside from the availability of data, it has been the introduction of user-friendly desktop GIS in the last few years that has stimulated interest in using GIS technology in government and industry [Lee, 1997]. It is appropriate here to also mention the three fundamental components that the US considered important to establish a multi-purpose cadastre over twenty years ago [NRC, 1983]:

1. A geodetic reference framework;

2. A base map;
3. A cadastral overlay.

The US report also stated that these technical components were fundamental to the development of a cadastre that could:

"eventually support permanent linkage mechanisms among real-property title, fiscal, and administrative records. Moreover, only where these technical components are adequately provided can the multi-purpose cadastre eventually be expanded to a multipurpose land-data system incorporating natural resource base and land-related socioeconomic data" [NRC, 1983].

Some of the major cadastral reforms being introduced or being considered for introduction into Australia include [Williamson, 1991]:

- the development of complete computerised indexes of land parcels at a state level updated by the title registration system
- the development of automated and fully computerised land title systems
- the development of statewide digital cadastral data bases updated by digital subdivision data
- the reform of the institutional arrangements for the management of the cadastre reforms to land transfers and title registration procedures often instigated by Law Reform Commissions
- reforms to the registration of surveyors and the statutes and regulations concerned with the performance of cadastral surveys
- the introduction of coordinated cadastral surveys
- the introduction of coordinated cadastral survey systems where the mathematical coordinates have "legal" significance in that the mathematical coordinate over-rides monumentation on the ground the move from a cadastral surveying system, to a cadastral mapping system supported by cadastral surveys
- the incorporation of the core computerised cadastral system as part of a broader LIS or multi-purpose cadastre
- systems to improve the delivery of cadastre information whether this information is textual or graphical. This includes imaging systems and the use of remote terminals and fax machines.

What is certain is that Australian cadastral systems are rapidly moving to multi-purpose systems much more akin to their Western European and North American counterparts, for similar reasons of increased complexity of decision-making about land (land use) due to concerns about sustainable development and social justice. Central to the success of this next evolution will be the capacity to facilitate a dynamic relationship between society, information technology systems and the decision-making of policy-makers as well as the land markets (as illustrated in Figure 3):

Conclusion

Throughout history, the relationship of humankind to land has been dynamic. This dynamism has had a direct impact on the creation of cadastral systems and the subsequent evolution of their function.

It is important to note that the process of evolution of the humankind/land relationship and the resultant changes in cadastral functions have been cumulative (refer Figure 2). Over time, the humankind/land relationship has built up layers of complexity: land as wealth was extended to include a perception of land as commodity, then as a scarce resource and then as a scarce "community" resource. In other words, the original view of land as wealth moved to include a more capitalist view of land as an individual's commodity. As land became increasingly scarce, some countries decided that State ownership of land based on communist ideology would resolve the problem. Other countries in the West preferred to address the scarcity with better planning (particularly urban planning). Now there is an increasing awareness that land planning has a wider community and even global imperative.

Each of these phases in the humankind/land relationship elicited a corresponding layer of complexity in the function of cadastral systems from a simple record of ownership and fiscal tool, to a cornerstone of land markets and then increasingly detailed land-use planning.

The world is at different points in the continuum. Many developing countries are only just establishing more formal cadastral records for fiscal and also land market purposes. The command economies in the Eastern Bloc in Europe have crumbled in recent times and are attempting to re-establish cadastres for fiscal and land market purposes while the Western nations are rushing to create multi-purpose cadastres that take a community approach to sustainable development issues whilst maintaining private ownership. Linked to this trend is the growing need for multi-purpose cadastres that have been made possible by the information revolution.

The challenge as we enter the globalization era will be to achieve the coordinated planning objectives that serve respective societies whilst countries are at different stages of the continuum of the humankind/land relationship and which therefore have cadastral systems tuned to different agendas.

Acknowledgments

The authors wish to gratefully acknowledge Land Victoria and the Surveyor-General's Department of New South Wales for assisting in supporting the preparation of this paper and the associated research. However, the views expressed in the paper are those of the authors and do not necessarily reflect the views of Land Victoria or the Surveyor-General's Department of New South Wales.

References

- ANZLIC (1995). *ANZLIC Benefits Study*. Canberra, AUSLIG.
- Arthur, C.J. (1974). *The German Ideology*. London, UK, Lawrence & Wishart.
- Courtney, J.M. (1983). "Intervention through Land Use Regulation". *Urban Land Policy: Issues and Opportunities*. Dunkerley, H. B. Washington D.C., Oxford University Press: 153-170.
- Davies, W. and Fouracre, P. (1995). *Property and Power in the Early Middle Ages*. Cambridge, Great Britain, Cambridge University Press.
- Eglitis, M. and Balodis, J. (1994). "Surveyors and Land Reform in Latvia". Proceedings of FIG XX International Congress, Melbourne, Australia, Commission 7, International Federation of Surveyors: 709.4/1-709.4/10.
- Enemark, S. (1994). "Evaluation of the Cadastral reform in Denmark - Training the old lady for the skateboard". Proceedings of FIG XX International Congress, Melbourne, Australia, Commission 7, International Federation of Surveyors: 703.3/1-703.3/11.
- Gore, A. (1998). "The Digital Earth: Understanding our Planet in the 21st Century" *The Australian Surveyor* **43**(2): 89-91.
- Grant, D. (1997). "Territoriality - Concept and Delimitation". Proceedings of First Trans-Tasman Surveyors Conference, Newcastle, New South Wales, Australia.
- Harcombe, P. and Williamson, I. (1998). "A Cadastral Model for Low-Value Lands: The New South Wales Western Lands Experience". Proceedings of FIG XXI International Congress: Developing the Profession in a Developing World, Brighton, UK, Commission 7, International Federation of Surveyors: 569-579.
- Harris, D. and Land, N. (1998). "Land Reform in Eastern Europe: Where Now?". Proceedings of FIG XXI International Congress: Developing the Profession in a Developing World, Brighton, UK, Commission 7 International Federation of Surveyors: 622-630.
- Hawerk, W. (1995). "Grundbuch and Cadastral Systems in Germany, Austria and Sweden". Proceedings of Seminar on Modern Cadastres and Cadastral Innovations, Delft, The Netherlands, Commission 7, International Federation of Surveyors: 13-23.
- Heater, D. (1990). *Citizenship: The Civic Ideal in World History, Politics and Education*. London, UK, Longman.
- Henssen, J.L.G. (1975). "Cadastres, including some aspects of assessment of real property" *The Canadian Surveyor* **xxix**: 1.
- Hoogsteden, C.C. and Robertson, W.A. (1998). "On Land-Off Shore: Strategic Issues in Building a Seamless Cadastre for New Zealand". Proceedings of FIG XXI International Congress: Developing the Profession in a Developing World, Brighton, UK, Commission 7, International Federation of Surveyors: 32-48.
- IPS (1995). "World Food Summit Set for 1996" *D&C (Development and Cooperation)*(No4/1995): 30.
- Kaufmann, J. and Steudler, D. (1998). *Cadastral 2014: A Vision for a Future Cadastral System*. Switzerland, Working Group 1, Commission 7, International Federation of Surveyors.
- Larsson, G. (1996). *Land Registration and Cadastral Systems*. Essex, UK, Addison Wesley Longman.

- Lee, Y.C. (1997). "Desktop GIS Implementation" *Geomatics Info Magazine* **11 No 3**(March): 33-35.
- MacLauchlan, W. and McLaughlin, J. (1998). "Environmental democracy and stewardship through land and resource information: The Case of the Land Gazette". Proceedings of International Conference on Land Tenure in the Developing World, Cape Town, South Africa, 390-403.
- Manville, P.B. (1990). *The Origins of Citizenship in Ancient Athens*. Princeton, New Jersey, USA, Princeton University Press.
- NRC (1983). *Procedures and Standards for a Multi-Purpose Cadastre*. Washington D.C., USA, National Academy Press.
- Onsrud, H. (1998). "MOLA - A United Nations Land Initiative for Europe". FIG XXI International Congress: Developing the Profession in a Developing World, Brighton, UK, Commission 7, International Federation of Surveyors: 10-17.
- PANOS (1995). "The World Fisheries Crisis" *D&C (Development and Cooperation)*(No4/1995): 6.
- Pesl, I. (1997). "The Re-establishment of the Land Cadastre in the Czech Republic". *Concepts of Cadastral Systems: General overview and examples from around the world*. Enemark, S. Aalborg, Denmark, Aalborg University.
- Phillips, A., Williamson, I. and Ezigbalike, C. (1998). "The Spatial Data Infrastructure Concept" *Submitted to The Australian Surveyor*.
- Robertson, W. (1996). "Sustainable Resource Management and the Cadastre". Proceedings of International Symposia on Developing the Profession in the Developing World, Buenos Aires, Argentina, International Federation of Surveyors: 214-225.
- Ting, L., Williamson, I., Parker, J. and Grant, D. (1998a). "The Evolution of Western Land Administration Systems". Proceedings of International Conference on Land Tenure in the Developing World, Cape Town, South Africa:536-548.
- Ting, L., Williamson, I., Parker, J. and Grant, D. (1998b). "Understanding the Evolution of Western Societies' Land Administration Systems: a basis for cadastral reform" *Submitted to Survey Review*.
- Toynbee, A. (1884). "Lectures on the Industrial Revolution in England" http://www.berkeleycentral.com/DrPseudocrytonym/TOYNBEE_Industrial_Revolution.html.
- Turner, B.S. (1986). *Citizenship and Capitalism*. London, Allen & Unwin.
- UNFAO (1995). "A Family of Nations: 'Haves' and 'Have-nots'" June 1998, http://www.fao.org/inpho/vlibrary/u8480e/U8480E0m.htm#A_family_of_nations.
- Williamson, I.P. (1985). "Cadastrals and Land Information Systems in Common Law Jurisdictions" *Survey Review* **28 No 217**(July 1985): 114-129.
- Williamson, I.P. (1990). "Why Cadastral Reform?". Proceedings of National Conference on Cadastral Reform 1990, Melbourne, Australia: 10-15.
- Williamson, I.P. (1991). "Cadastral Reform - A Vision for the 1990s". Proceedings of Fourth Southeast Asian Survey Congress, Kuala Lumpur, Malaysia: 19.1-12.
- Williamson, I.P. (1996). "Appropriate Cadastral Systems" *The Australian Surveyor* **41**(1): 35-37.

World Bank (1997). *World Development Report 1997*. Washington D.C., USA, Oxford University Press.