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SUMMARY

Historically, land administration systems (LAS) were built to support land markets and land taxation systems. In developed countries, these systems constitute substantial infrastructure provided through government for the benefit of overall public administration, citizens and businesses. These systems are expensive to maintain and increasingly reliant on technology. The design of LAS will become even more complex as they are now being used to assist delivery of a broader range of public policy and economic goals, the most important of which is sustainable development.

The national and historical methods used to incorporate sustainable development objectives into national LAS were examined in an Expert Group Meeting (EGM) in Melbourne in December, 2006 with leading stakeholders and land policy experts from Australia and Europe. Distinctions between approaches used in modern European democracies and in Australia were identified. The European approach showed more integration between the standard LAS activities and measures of sustainability. Australian policy was more fractured, partly due to federation and the constitutional distribution of powers. In contrast, Australian LAS pioneering lay in incorporating market based instruments (MBI) and complex commodities into LAS and revitalization of land information through inventive Web based initiatives.

The EGM developed a vision outlined in this paper for future LAS sufficiently flexible to adapt to this changing world of new technology, novel market demands and sustainable development.

Incorporating Sustainable Development Objectives into Land Administration

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1. INTRODUCTION

In 2004, the Centre for Spatial Data Infrastructures and Land Administration began a project on *Incorporating Sustainable Development Objectives into ICT Enabled Land Administration in Australia*. The project involved a comparison of Australian and European land administration systems (LAS). Australian LAS use the latest information and communications technology (ICT), however, their data is held in agency silos and is focused on information about individual parcels, reflecting historical creation of maps by a "part to whole" approach. They cannot adequately support the management and decision making needed about wider fiscal, environment and social issues. By contrast, European LAS installed a complete map base or cadastre for taxation purposes, and later added land registration functions. Their classic "whole to part" approach assists integrated land management. These comparisons led to a vision to inform future development of LAS in the developed economies to better deliver sustainable development. The major collaborative effort, an Expert Group Meeting, of 9-11 November, 2005 held in Melbourne and attended by European and Australian experts, contributed significantly to this vision (Williamson and others 2006).

The project required a review of trends in information and communication technologies (ICT) as applied to land administration (LA). This background research, and the case studies in Denmark, Germany, The Netherlands and Switzerland in Europe and Victoria, New South Wales and Western Australia in Australia, revealed a much larger capacity for land administration systems (LAS) to service government and deliver sustainability than that identified in existing literature. This anticipated improvement relies especially on three cross-cutting themes for creating and organizing land information. These are –

1 Designing land management systems for sustainable development
2 Building on new technical support in land administration
3 Moving into spatial enablement technologies.

Australian and European responses to these cross-cutting themes are discussed below.

2. DESIGNING LAND MANAGEMENT SYSTEMS FOR SUSTAINABLE DEVELOPMENT

2.1 The Land Management Paradigm

Sustainability is the agreed goal for national governments. The 'triple bottom line' of *economic*, *environmental* and *social* sustainability is now expanded with the inclusion of *governance* standards to ensure institutional and corporate ethical performance in the longer term. The 'quadruple bottom line' of sustainable development requires holistic management of combined activities across the whole of government, the private sector and citizens. Careful management of land related activities on-ground, in organisations and in government is crucial for delivery of sustainability.

Land management is a phenomenon of all societies and underpins distribution and management of their largest asset: their land. For Western democracies with highly geared economies, land management, with a central land administration component, is a major activity of government and the private sector, and the foundation of highly geared land markets and delivery of land. The land management model in **Figure 1** below shows the *sphere of the central land administration component* and how LA institutions relate to the historical circumstances of a country and its policy decisions. The model also provides a stable focus for comparison and sharing of national, regional and international efforts to manage land. More importantly, it provides a framework to facilitate the processes of integrating new needs into traditionally organised systems without disturbing the fundamental security provided by these systems.

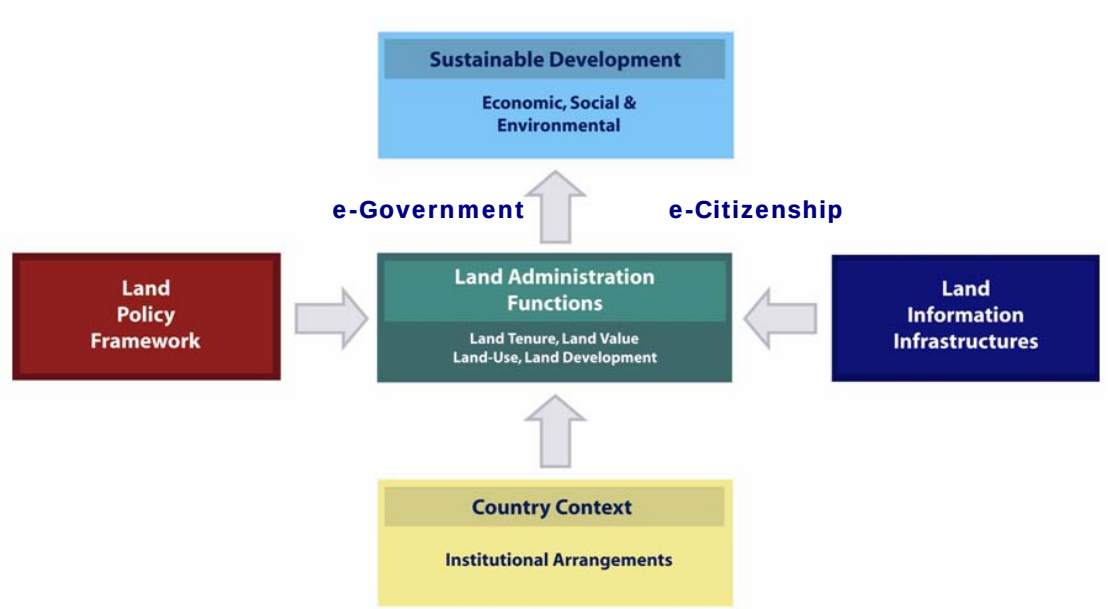

Figure 1 - The land management model (Enemark, Williamson and Wallace, 2005)

No nation can improve land management institutions without thinking about integration of policies, activities and processes. Cost and overheads of technology provide additional

motivations for improvement. The new spatial technologies offer exciting opportunities for new approaches. The question facing modern land administrators is then how to proceed to the future.

2.2 Land Administration in Land Management

Land administration systems (LAS) are essential for land management. They started because governments needed coherent and fair tax collection systems, then they developed to service land markets. Their basic functions are to organise land tenures, values, uses and development. Their primary tools are surveying, registration systems, and databases run by government organisations. The importance of land administration increased after 1990, when LAS in modern democracies emerged from their technical focus to engage professionals from the disciplines of engineering, economics, political and social sciences, law and computer technology. International organisations and national governments used multi-disciplinary approaches based on technical capacities to deliver land and food security and to build land markets.

Modern, multi-discipline, land administration focuses on land management, delivery and organisation; it also provides the supporting framework for trading in complex commodities. Modern land markets are able to invent and support a stream of new commodities because reliable infrastructure supports the prosaic activities of tenure, use, development and value that underpin these wealth accelerating activities (Wallace and Williamson, 2006).

Meanwhile, while LAS functions of land registration and tenure, valuation, planning and development remain the institutional core of successful economies, these functions change as they adapt to the new policies of sustainable development, demand driven processes, accelerated take-up of spatially enabled systems, and historical and cultural realities. Effective management of these changes requires a clear forward vision. The Expert Group Meeting extended the land management model to a more dynamic version of a land management vision in **Figure 2** below, to show the interaction between components and the central opportunities available to land administration, once its processes were spatially enabled. As the improved vision suggests, the response of individual nations to these issues will depend on their local circumstances and country contexts.

This vision incorporates and builds upon the next generation of spatial enablement of government called *iLand* (information about land). The vision and concept of *iLand* is discussed in the other paper presented by Williamson and Wallace (2006) at this FIG Congress.

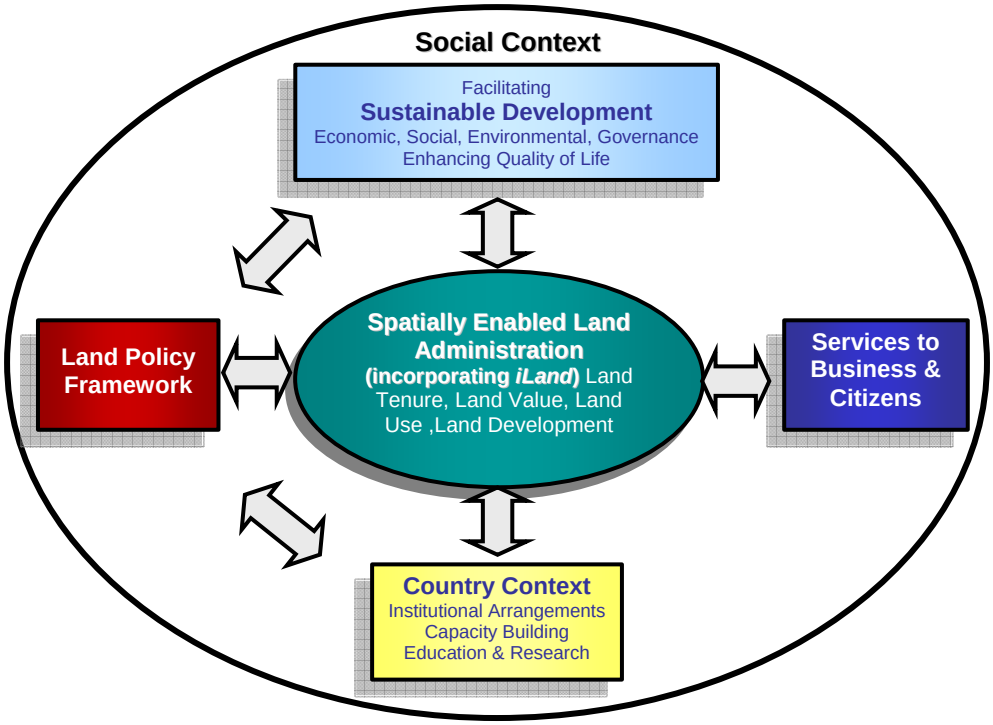

Figure 2 – Land management vision

2.3 The Central Role of the Cadastre

The influence of local circumstances is illustrated by the oldest component of modern LAS, the cadastre. For Australians, the cadastre is a new, but simple to understand, concept: it is a map of the parcels and land arrangements now available in digital form in computers showing how a society organises its land into useable pieces with interconnecting roads and services (**Figure 3**). It was developed by digitising the old paper survey plans and maps, making them fit, and by generating new parcels through much more accurate modern processes. Fitting the old records with the new is ongoing and varies in each state system. In Europe, cadastres are much older and their functionality is much more extensive. Their age makes them understandable to their communities and they include more than parcel boundary information, even, in some cases, buildings, land use and fire insurance information.

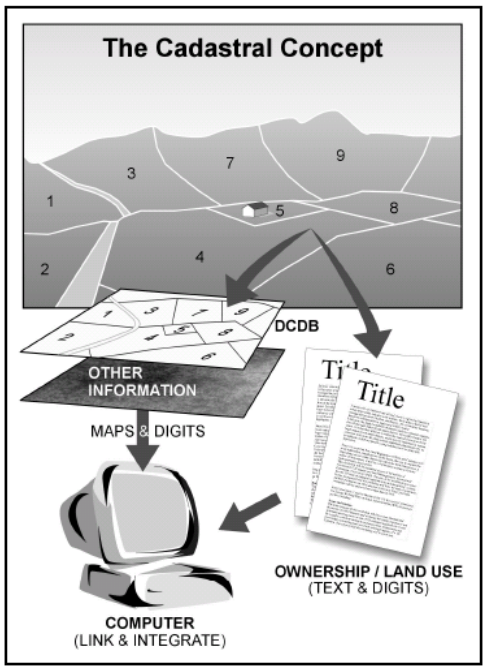

Figure 3 – The cadastral concept (FIG, 1995)

The cadastre is the operational core of land administration systems. Modern digital cadastres are much more central to governments than their paper precursors because they allow computers to accurately identify where a feature, such as a street or a house, is on the globe. They therefore change computerised data into intelligible, people-friendly information and present it in visual (picture and map) formats. By adding geocoded addresses, cadastres can show how each nation arranges parcels of land into properties and businesses. Imposing aerial images (photos or satellite images) in the equivalent scale allows people to look up pictures of their homes and farms to show current and historical uses. In some jurisdictions, cadastres are survey accurate (ACT, south western Western Australia, in urban and peri-urban New Zealand). In others (Victoria, NSW), they are generally not. For Australia, the necessity of survey accuracy in the cadastre is frequently debated because it is expensive, relative to our land mass. In Europe, any debate was ended long ago by the long history of surveying, meticulous standards of on-ground surveying, public respect for and understanding of surveying and close density land uses ended.

In global land management standards, survey accuracy supporting the digital cadastre for high value land, is a national asset. The large scale and on-ground accuracy of the digital cadastral system, combined with open-ended computer capacity and improved software, are no longer merely essential infrastructure of government supporting land administration functions. Even without survey accuracy, the unique capacity of cadastres to provide the people friendly layer of land information makes them the layer that modern computer systems cannot do without. The digital version of parcels, roads, and utilities, and all the laws, institutions and systems that support it, is the foundational information about how a nation's land is distributed, configured, owned, described and used.

3. BUILDING ON NEW TECHNICAL SUPPORT IN LAND ADMINISTRATION

3.1 Technical Support for Land Administration Activities

For Western countries the recent changes in LAS were driven by technology, principally the move from paper records to computerised systems. Technology driven changes will continue to accelerate as new opportunities arise from geographic information systems (GIS), spatial data infrastructures (SDI), multi-purpose information, integration of information about the built and natural environments, and organisation of aspatial information according to location.

The previous concentration in land administration theory on institutions of government will widen as utility providers, spatial scientists, and other businesses are increasingly engaged in the construction of land information products. The transitions in technical capacity to organise information are shown in **Figure 4** below.

Figure 4 - IT in LAS

3.2 Implementing and Understanding Regulations and Restrictions

Land uses over time must be managed to mitigate long term deleterious impacts. Australian problems of erosion, salinity and acidity are well documented. Over time, attempts to manage these shared impacts by regulating tree clearance, water access, chemical use, building standards, and more, led to very great increases in the amount of law, regulation and standards applying to land based activities. The lack of coherent management of restrictions and the information they generate is now apparent. This is a world wide experience. Calls for inclusion of restrictions on land in traditionally organised LAS are common and international. The idea of including "all restrictions in the land register" was a first-grab solution. While modern registries are adapting to manage restrictions within their traditional functions, spatial enablement of governments and businesses offer different solutions.

3.3 Changing the Nature of Ownership

Nations are building genuine partnerships between communities and land owners, so that environmental and business controls are more mutual endeavors. Rather than approach controls as restrictions, the nature of ownership is redesigned to define opportunities of owners within a framework of responsible land uses for delivery of environmental and other gains. This stewardship concept is familiar to Europeans long used to the historical, social and environmental importance of land. For the Europeans, the social responsibilities of land

owners have a much longer heritage, with the exemplar provision in the German Constitution insisting on the land owner's social role. The nature of land use in The Netherlands, given much of the land mass is below sea level, presupposes high levels of community cooperation, and integrates land ownership responsibilities into the broader common good. The long history of rural villages in Denmark and public support for the Danes who live in rural areas also encourages collaboration.

The Australian mining industry provides typical examples of collaborative engagement of local people, aboriginal owners and the broader public. The Australian National Water Initiative and the National Land and Water Resources Audit reinforce the realisation that activities of one land owner affect others. The development of market based instruments (MBI), such as EcoTenders, is an Australian attempt to build environmental consequences into land management. Australia's initiatives in "unbundling" of land to create separate, tradable, commodities, including water, are now established and are built into existing land administration systems as far as possible. As yet a comprehensive analysis of the impact of unbundling land interests on property theory and comprehensive land management is not available.

Whatever the mechanism, modern land ownership has taken on social and environmental consequences, at odds with the idea of an absolute property owner. Australia and European approaches to land management are inherently different. While Europe is generally approaching land management as a comprehensive and holistic challenge requiring strong government information and administration systems, Australia is creating layers of separate commodities out of land and adapting existing LAS as much as possible to accommodate this trading without a national approach. In these varying national contexts, the one commonality, the need for land information to drive land management in support of sustainable development, will remain the universal land administration driver of the future.

3.4 The Changing Market Place

The insurance industry, corporations and banking in nation states developed separately from land administration. This was understandable, given the history of paper-based LAS managed in isolated institutions. However, the computerisation and spatial enablement of land registers, cadastres and related information (valuation, planning and buildings and development activities) will create far more opportunities to build information systems capable of servicing these essential commercial spheres. In European countries, land registration systems provide much more information to mortgage providers than is occurs in Australia. Capacity to provide information to the insurance industry is also underdeveloped.
All developed countries rely on land driven taxation streams. Vigorous land markets and markets in complex commodities require much more sophisticated systems of land taxation, stamp duty on transactions and ownership taxes. These systems depend on information about individual owners, times of purchase and sale, values and prices on purchase and sale, expenditure during ownership, trust interests, land uses, and other variables. While core information is the unchanging information about the land parcel, governments now demand additional information that is highly varied and relative to situation. This relative information

is the key to land tax, income tax, capital gains tax and goods and service tax activities; and to national welfare systems. In Australia, the collection and maintenance of this information depends on self reporting and database organisation. However, new opportunities exist for spatially enabling tax administration systems to manage relative and aspatial information.

Government management of, and assistance to, business has increased since WWII. Information needed by business and the public includes permissions, licences and approvals, as well as restrictions and responsibilities related to land. The key to organizing the information is, of course, the land information embedded in national cadastres. A georeferenced business address file containing registered and operating offices or corporations, business types, and licences, is already under consideration by the Public Sector Mapping Agency (PSMA) in Australia. These initiatives underpin recognition of Australia's capacity to service local business and the nation's place in comparative analysis of regulatory practices (World Bank Report, 2004). The release of information in the cadastre for management and organization of the government's administration and nation's business institutions will continue to drive sustainability.

4. BUILDING COGNITIVE CAPACITY AND COMPETENCIES

The fundamental public role of LAS in reinforcing confidence in the socio-economic organization of land is often forgotten, despite the importance of this consequence of effective administration. The capacity of LAS to deliver services which feed back into the democratic functioning of their nations needs to be recognised. Engagement of beneficiaries in modern land markets requires high levels of understanding about and public trust in activities, products and services. The ability of a nation state to provide administrative systems that achieve public confidence in the operations of land markets is relatively rare. Only about 35 nations of the world (the successful democratically organised economies) do this very well. Achievement of trust and education of participants in land markets are the unrecognised but remarkable outcomes of decades of reliable land administration by modern democracies. In terms of delivery of good governance and civil peace, the comparison between societies in these countries and others in the world is stark. Transparency in LAS operations and sharing of land information are essential to maintenance of public and commercial confidence that support modern markets and governments.

The Internet has significantly improved availability of land information. State, territory and local governments increasingly provide digital information about planning initiatives, citizens' facilities and other activities, through initiatives generically called *eLand*. Nationally, the Australian government increasingly uses Web based systems to provide services in taxation, welfare, information, and other areas.

The major Australian effort in *eConveyancing* is a fundamental shift from mere delivery of information through to *eLand* initiatives, to interactive service provision across sectors of land administration and banking via the Web. The improvement is potentially as fundamental as Internet banking was to the financial sector. However, technology has even greater potential for improving LAS.

5. SPATIAL ENABLEMENT

Australia provides multiple examples of interactive land management programs. The shared land information platform (SLIP) in the Department of Land Information of Western Australian, the major National organisations, especially the Commonwealth Scientific and Industrial Research Organisation (CSIRO), GeoScience Australia, and Public Sector Mapping Agency Ltd, specialize in imaginative and collaborative digital solutions to information and service problems. These are fore-runners of even more remarkable innovations arising out of spatially enabling government.

Understanding spatial enablement requires an appreciation of how it works. On one standard, spatial enablement is just one form of interoperability. It is however far more energetic and offers opportunities for visualisation, scaleability, and user functionality. At the core of any spatial system is the ability of the computer to identify "where" something applies or happens. Capacities of computers to show information in on-screen maps and to allow users to make their own enquiries have raised the profile of spatial enablement. New applications of this technology (mobile phones, vehicle tracking, digital cameras, and intelligent systems of asset management) are developing. In management of information about places, the digital cadastre comes into its own as the means of identifying a geo-code with a position people understand on a computerized map. The spatial information in cadastres and large scale topographic maps (such as the large scale topographic map of The Netherlands) not only provide information about place, but transform the information into consumer friendly addresses and descriptions.

Among the potential benefits of spatial enablement of the core cadastral layer are -

- Maintenance and sharing of the core information layer. Once created it is used many times
- Attachment of information to images of parcel and property configurations
- Accurate identification about the place or location of one activity in relation to other places in ways that are understandable to non-technical people
- Capacity of businesses and citizens to understand, interrogate and manipulate digital information
- Inclusion of layers of geo-referenced information in the computer systems, despite their distinct sources, systems and owners, and lack of interoperability between the layers
- Integration of government information systems, such as SmartTag of the Victorian Government, and SLIP of Western Australia, and the geocoded national address file (GNAF) of PSMA
- Provision of seamless information to institutions and government
- Incorporation of aspatial and relative information into maps permitting the location of that information to be realised and visualised
- Ultimately managing information through spatially enabled systems, rather than databases.

Spatial enablement not only offers land administration a revolution equivalent to the conversion of paper files to digital systems of twenty years ago. It offers far more effective management of information to whole of government.

6. SUSTAINABILITY ISSUES

6.1 ICT

Contextual influences, particularly unbundling land and water interests and development of complex commodities, put conceptual and institutional pressures on Australia's LAS framework. Simultaneously, new technologies for organising information, visualising information and allowing users to build their own versions of systems to suit personal needs, impact on organisation of geospatial and georeferenced information and its source agencies. The core activities of land registration, planning and valuation will have more significance than ever before.

The extensive use of ICT in LAS will not automatically lead to sustainability. Whole of government approaches are needed. The most crucial factor in delivery is the cultural understanding of why sustainability is important and general agreement on how to achieve it. A comparative international focus, reflecting the cross-jurisdictional nature of sustainability issues, requires an agreed vision of land management. The key ingredient of the vision - country context - anticipates the differences between modern European democracies and Australian counterparts.

6.2 Professional, Organisational and Government Issues

The European approach to land is based on social responsibilities of individual land owners. The owners are regarded as temporary managers rather than absolute owners. Australian efforts focus on economic tools, especially "unbundling" of interests in land. By contrast, Europe focuses on holistic management for inter-generational sustainability and for maintenance of a strong and dedicated rural population charged with land management responsibilities. From the European perspective, Australia needs inter-jurisdictional capacity for holistic management, especially because of the scales of its challenges, sparsity of its populations, and hence very limited human capacities. Technical solutions are even more essential to compensate for the relative thinness of human resources.

Europeans use parliaments to create land policy for citizen implementation, in contrast to Australia where governing parties and high level bureaucrats predominate in policy identification and implementation. Protracted, discursive and participatory processes in policy articulation and implementation are familiar to Europeans. The extended role of surveyors in Europe reflects the social value attached to land and related professionals. Surveyors and spatial engineers are among the leaders in national and regional land policy making and, as a result, national LAS institutions have clearly defined national and international roles.

The influence of the European Union as a coordinating agency is evident and has no Australian equivalent. EUROGI and INSPIRE are significant influences on national policy, institutional functions and selection of instrumental tools. Agricultural sustainability is a strong political, social and economic driver in Europe, understood by both urban and rural populations. Cultural absorption of key LAS tools, particularly surveying and the cadastre, and the much broader information base in cadastres, make it easier for European institutions to move into SDIs, than institutions in Australia.

The engagement of senior policy makers in LAS is therefore more difficult in Australia with its constitutional rigidities and three-tiered government structure. Despite this, Australia has made significant national and international advances in the field. Leadership, so essential in shaping the future, is available. The Prime Minister's research priorities (5 December, 2002) identified spatial information as one of the new economic drivers. The launch of the Federal Government's eGovernment strategy on 30 March 2006 included spatial enablement of government as an aim. The role of the private sector in driving spatial information awareness is evident and increasingly recognized. In NSW, for instance, the regulatory framework governing surveyors also covers spatial information professionals.

The Australian academic research heritage is also significant. The Centre for Spatial Data Infrastructures and Land Administration at The University of Melbourne has relied for a decade on project funding from state and federal governments for innovative and successful LAS and technical research. Much of the future design and identification of suitable technological innovations for government use comes out of these and other research activities. In contrast, the European LAS institutions themselves provide significant leadership in future design backed up by academic influence and activities.

In the Australian context, the language of technical discussions substantially inhibits understanding among non-technical people. While land administration is now clearly multi-disciplinary, it still operates in a world of closed semantics. Data models and "authentic" registers (national scale registers for people, businesses, properties, vehicles and so on) need much wider support. Meanwhile, achievements, such as SmartTag of Department of Sustainability and Environment in Victoria and the geo-coded national address file (GNAF), result in a much wider audience for spatial systems simply because of their impressive functionality. These popular innovations underpin further technical efforts, including cadastral modelling as a universal method of facilitating data interoperability, with 3D (height) and 4D (time) dimensions, offering additional potential for seamless presentation of land information.

7. CONCLUSIONS

The idea is that spatial enablement of land administration systems managing tenure and registration, valuation, planning and development will allow the information generated by these activities to be much more useful. Achievement of sustainable development goals will be easier to evaluate. Adaptability and usability of modern spatial systems will encourage much more information to be collected and made available. The map-mashing trend

following Google Earth and other major international applications shows a high public take up and popularisation of spatially enabled systems. Better, more integrated and accessible information will assist governments to design and implement land policy. The services available to business and public sectors, and to community organisations and citizens, should commensurably improve. Ideally these processes are interrelated: with modern information and communication technology, the engagement of users in design of suitable services, and the adaptability of new applications mutually influencing each other. The global initiatives are the starting point, but in a national case, modifications to suit the particular context will be built.

The new land administration systems of the future will be local, regional and global in their capacity. The expense of building and maintaining spatial information has always been a major issue, but, given the new opportunities for using spatial information and location enabling systems in general, the investment is about to deliver not only better land administration but improved land management and government.

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BIOGRAPHICAL NOTES

Ian Williamson's teaching, research and publications cover cadastral, land and geographic information systems, land administration and spatial data infrastructures, in developed and developing countries. He has undertaken research and consultancies world-wide including for AusAID, the United Nations and the World Bank. He is a Member of the Order of Australia (AM), a Fellow of the Academy of Technological Sciences and Engineering Australia (FTSE), a Fellow of the Institution of Surveyors Australia Inc., a Fellow of the Institution of Engineers Australia, an Honorary Fellow of The Mapping Sciences Institute and the Spatial Sciences Institute Australia, and an Honorary Member of the International Federation of Surveyors (FIG). He was Chairperson of FIG Commission 7 (Cadastre and Land Management) 1994-98 and Director United Nations Liaison for the FIG from 1998-2002. He is a member of the Executive of the United Nations sponsored Permanent Committee for GIS Infrastructures for Asia and the Pacific (PCGIAP) and Chair of its Working Group 3 (Cadastre). He is Head, Department of Geomatics and Director of the Centre for Spatial Data Infrastructures and Land Administration, University of Melbourne, Australia. He was awarded the Centenary Medal by the Prime Minister for service to Australian society in research and geomatics engineering and surveying 2003. Also see http://www.geom.unimelb.edu.au/people/ipw.html

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