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**National Mapping, Land Administration and Spatially Enabled
Government – Looking Back, Looking Forward***

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National mapping, land administration and spatially enabled government – looking back, looking forward

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ABSTRACT

This paper discusses some key observations on national mapping, land administration and spatially enabled government. The paper draws on my involvement in United Nations Regional Cartographic Conferences (UNRCC) for Asia and the Pacific and the Americas since 1983 and the Permanent Committee for Geographic Information for Asia and the Pacific (PCGIAP). The paper is not an historic evaluation of trends and developments but identifies some key issues and developments that I believe are important if countries in the region are to capitalise on the potential of spatial information and related technologies.

The paper identifies key technologies and drivers that have impacted on the use of spatial information. Institutional issues such as the relationship between national mapping, land administration and spatial data infrastructures are discussed. In particular I have highlighted the importance of large scale spatial information and the cadastre and associated parcel or street address to a spatially enabled society and in turn sustainable development.

BACKGROUND

I presented my first paper to a UN meeting at the 10th UNRCC for Asia and the Pacific in 1983 on cadastral surveying developments in Thailand while I was working there as part of the Thailand Land Titling Project. Since that time I was active in many UN meetings in both Asia and the Americas. I spent a term as the Director for UN Liaison for the International Federation of Surveyors (1998-2002). My main focus during this 20 year involvement was in the role of the cadastre in spatial data infrastructures and the links between cadastre, land administration and SDI in support of sustainable development.

Since 2001 I have chaired Working Group 3 of the PCGIAP that was initially called “cadastre” and more recently “spatially enabled government”. Working with Mr Ahmad Fauzi from Malaysia and Associate Professor Abbas Rajabifard from Australia, WG3 has been very active as reported by the WG presented at this meeting and previous UNRCC. WG3 has completed successful projects, reports and workshops on topics such as the benchmarking cadastral systems (the Cadastral Template project), marine cadastre and administration, integration of natural and build environmental data,

land administration and sustainable development, and more recently spatially enabled government. All these initiatives resulted in or contributed to resolutions at UNRCC.

Since this UN conference will be my last as Chair of WG3 and as a member of the PCGIAP Executive, I thought it opportune to attempt to highlight some of the key lessons that I have learnt from the 25 year involvement. The summary is not a definitive list of what I believe are important issues or lessons, but those that I consider most relevant to member countries if they are to capitalise on the opportunities offered by the increased availability and use of spatial information.

LOOKING BACK

The primary focus of UNRCC has always been on national programs for small to medium scale mapping and related activities. Cadastral activities which by their very nature are large scale have sometimes been included but were rarely main stream. This has occurred for several reasons.

First, there is historically good justification for UN meetings that focussed on national mapping programs. This was a major focus of most countries after the Second World War when the importance of national mapping coverage was fully appreciated. For many countries national mapping was either closely linked to the military or was administered by the military. It was not until the 1970s or even later that many of the more developed countries completed an initial coverage of their national mapping programs. However it would take another 20 or even 30 years for those same countries to complete their first full coverage of jurisdiction wide cadastral maps or digital cadastral data bases (DCDB).

Second, and arguably more important, is that national mapping agencies were the designated agencies to attend the UNRCC. So when UN invitations came through their foreign affairs agencies, the invitation automatically went to the national mapping agency. Cadastral agencies, being concerned with large scale mapping and often based on a state or provincial level, often did not receive the invitations or else did not see the relevance of UNRCC to their business. There were some exceptions such as Malaysia where cadastral mapping was also the responsibility of the national surveying and mapping agency. In such cases a report on cadastral mapping or large scale mapping was included. The reality is that in many countries there is competition between the national mapping agency and the cadastral agency, with the national mapping agency seeing no reason to include cadastral activities in UNRCC.

Third, since the focus of the UNRCC has been on national mapping, most of the organisers have been from national mapping agencies, and again by their very nature they often do not understand or appreciate the importance or relevance of cadastral or large scale mapping activities nationally. So for the most part UNRCC has focussed on national mapping and has been controlled by national mapping agencies.

When the Permanent Committee on GIS Infrastructure for Asia and the Pacific (PCGIAP) was established in the early 1990s the importance of cadastre was acknowledged with Working Group 3 (Cadastre) being one of the three working groups established. However the focus of PCGIAP continued to be national mapping and related activities with the president always being the head of the national mapping agency or similar.

Even though cadastre was not mainstream to PCGIAP activities, WG3 was very active in promoting cadastral and land administration activities through research, projects and workshops etc. Its activities have been listed elsewhere however key activities have included benchmarking cadastral systems, marine cadastre, SDI and administration, integrating topographic and cadastral data bases, land administration and spatially enabled government. Due to growing interest in and relevance of large scale mapping and information, WG3 was one of the most active parts of the PCGIAP and regularly attracted large attendances at its workshops and seminars.

KEY DRIVERS FOR CHANGE

While the concept of UNRCCs was relevant when they were established in the latter part of the 20th Century, from a spatial perspective, the world has changed dramatically with the UNRCC concept losing momentum. The SDI concept did give it some renewed energy in the short term in the later part of the 20th Century and early part of the 21st Century. The UN endeavoured to update the concept with the establishment of the PCGIAP in the 1990s driven by the SDI concept with parallel changes in the Americas, Europe and Africa. However the concept of UNRCCs can now be considered an anachronism. The problem for the spatial industry is that there is nothing to replace it within the UN system, yet the need for such an organisation to share, discuss and debate spatial issues is arguably more important than when the UNRCC concept was established, albeit with a very different focus. The result is that the spatial leadership within the member countries continues to strongly maintain the UN mandate (and rightly so) even though it has long since become an anachronism. There are many options to incorporate spatial activities within the UN structure – but that is a discussion for another day.

There are many drivers that are influencing spatial developments in the Asia and the Pacific region, with some of the key ones being:

- Technology – including ICT, remote sensing and high resolution mapping satellites, GPS, GIS, sensor networks
- Development of spatial data infrastructure (SDI) concept
- Sustainable development (economic, environmental, social and governance dimensions)
- Growth of mega cities and urbanisation
- Global warming and climate change
- Disaster and emergency response

One of the most significant results of economic and technology development is that most countries now have reasonable small and medium scale mapping but more importantly the more developed countries have complete large scale mapping coverage. Tools like GOOGLE MAPS and VIRTUAL EARTH have revolutionised access to large

scale data. While SDI development in the past focussed on national mapping (small to medium scale data) the focus has rapidly changed to large scale data that by its nature is people relevant – this is where the action is now happening. For example in GOOGLE MAPS in Australia every land parcel is shown based on the integrity of the land registration system and is supported by a unique geocoded

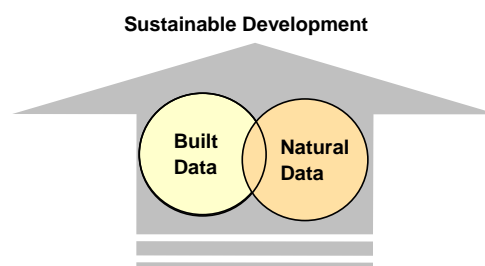


Figure 1. Integration of datasets to facilitate sustainable development

street address. This has taken “spatial information” to the masses in a ubiquitous and transparent manner. The focus on large scale data also means a focus on the cadastre and land administration system within country and regional SDIs. This is where most of the SDI activity is occurring in the more developed countries and where most of the spatial related opportunities lie.

This focus on large scale data is requiring both natural (topographic) and built (cadastral) spatial data to be integrated – or put simply traditional mapping/ GIS and cadastre/land administration functions to be increasingly integrated or amalgamated (Figure 1). This is a global phenomenon and is now at the heart of the challenges facing UNRCCs and PCGIAP. These organisations or activities are still clearly focussed on their historic or anachronistic national mapping background. This backward looking focus will limit the potential of many countries in the region to capitalise on the opportunities that developments in spatial technologies offer, and particularly the opportunities presented by spatial enablement of government and more broadly society. I consider this the major challenge facing the organisers of UNRCCs and PCGIAP.

Another important challenge, albeit I believe easier to achieve, is the ability to incorporate a marine dimension into SDIs. Several countries in the region have embraced a national SDI concept that includes a marine dimension (Figure 2), but at a practical level, and especially at a large scale and cadastral level, the divide between land based and marine based systems and institutions appears to be as wide as ever. Importantly issues such as disaster response to tsunamis and rising sea levels demand a smooth continuum between all land and marine systems, data and activities.

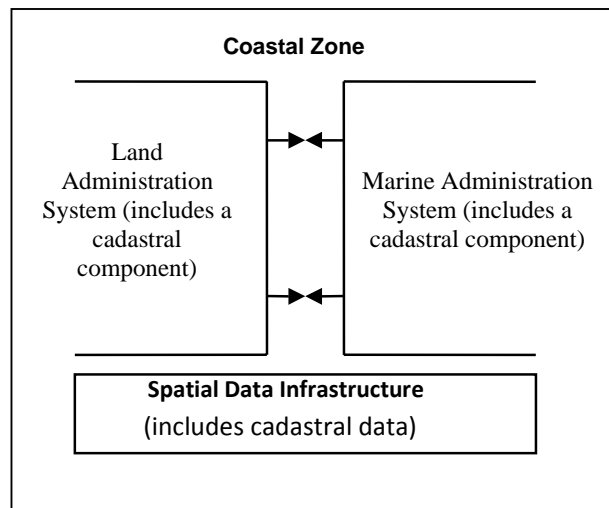


Figure 2. Seamless land administration system

(PCGIAP 2004)

LOOKING FORWARD

I believe that the future of our discipline(s) being concerned with the spatial sciences (mapping, GIS, surveying, cadastre, cartography etc) and spatial information lies in the use of spatial information to

spatially enable society. This will require the re-engineering of our traditional surveying and mapping institutional silos (particularly the mapping/GIS and the cadastre/land administration/ land registry silos). Historically these two areas operated independently using different systems, institutions and administrations, and different cartographic projections for their spatial data. This independence is no longer sustainable as evidenced by the global trend for the organisations or systems to be amalgamated or operate seamlessly. Simply national organisations can now access **national** large scale people relevant data sets (cadastre, land use, land value, geocoded street address, land ownership as well as literally 100s of other rights, restrictions and responsibilities that have a spatial footprint in any country). These data sets are now a central part of the business of government for human and health services, immigration, security, taxation, fiscal and economic policy, land markets, education and many others without mentioning the more traditional roles such as in managing our cities and the environment.

The above scenario presents a big challenge to the UNRCC and PCGIAP. I believe the current model for these organisations is anachronistic and will restrict many countries capitalising on the potential of spatial enablement. Over the last four or five years there has been a growing demand from several countries in the region for the UNRCC and the PCGIAP to embrace large scale cadastral data and related issues as well as provide a forum to share land administration experiences in the region. This has occurred as more countries amalgamate their mapping and cadastral activities. Unfortunately to a large extent they are excluded because the UN invitations go to the traditional national mapping agencies and never get to the large scale cadastral agencies. PCGIAP, through WG3, has provided leadership on such an initiative and significant progress has been made. The time is right for the UN to now take a much more proactive leadership role in the area if it wishes to remain relevant in this area in the decades head.

“Spatially enabled society” is an evolving concept where location, place and other spatial information are available to governments, citizens and businesses as a means of organising their activities and information. In particular spatial enablement is usually used in a ubiquitous and transparent manner by a wide cross section of society. By its very nature spatial enablement demands a “whole-of-government” approach. Popular uses of spatial technology involve displaying imagery, then tracking assets and inventory through an increasing array of devices, the most common being the ubiquitous mobile phone. Remarkable as these applications are, spatial technology can be used in even more dynamic ways. Transformational use of spatial technology occurs when it is used to improve business processes of government, including equitable taxation, allocation of services, conservation of natural resources, and planning for rational growth.

A good discussion on the role of the cadastre as part of a national SDI supporting spatial enablement of society and in turn sustainable development is found in a just released (October, 2009) book titled “Land administration for sustainable development” by Ian Williamson, Stig Enemark, Jude Wallace and Abbas Rajabifard published by ESRI Press in the USA. The book also presents a vision for a spatially enabled society based on a spatially enabled land administration system. The following “butterfly diagram” (Figure 3) and discussion are drawn from the book. The diagram shows how the cadastre plays an integral part of modern SDIs and by bringing together cadastral and mapping activities, spatial enablement of society can be facilitated and in turn sustainable development promoted. The diagram highlights the usefulness of the large scale cadastral map as a tool by exposing its power as the representation of the human scale of land use and how people are

connected to their land. The digital cadastral representation of the human scale of the built environment, and the cognitive understanding of land use patterns in peoples' farms, businesses, homes, and other developments, then form the core information sets that facilitate a country building an overall administrative framework to deliver sustainable development in a country.

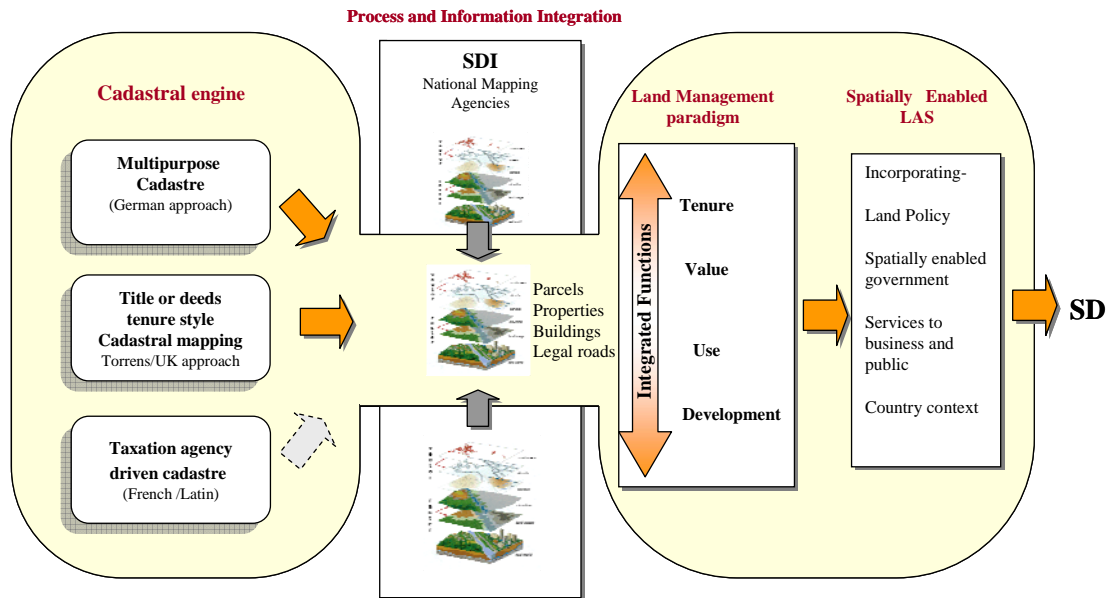


Figure 3. The cadastre as an engine of LAS
The "butterfly" diagram
 (Williamson, Enemark, Wallace and Rajabifard, 2009)

The diagram demonstrates that the cadastral information layer cannot be replaced by a different spatial information layer derived from geographic information systems (GIS). The unique cadastral capacity is to identify a parcel of land both on the ground and in the system in terms that all stakeholders can relate to, typically an address plus a systematically generated identifier (given addresses are often duplicated or are otherwise imprecise). The core cadastral information of parcels, properties and buildings, and in many cases legal roads, thus becomes the core of SDI information, feeding into utility infrastructure, hydrological, vegetation, topographical, images, and dozens of other datasets.

The diagram is a virtual butterfly: one wing represents the cadastral processes, and the other the outcome of using the processes to implement the land management paradigm. Once the cadastral data (cadastral or legal parcels, properties, parcel identifiers, buildings, legal roads, etc) are integrated within the SDI, the full multipurpose benefit of the LAS, so essential for sustainability, can be achieved.

The body of the butterfly is the SDI, with the core cadastral information sets acting as the connecting mechanism. This additional feature of cadastral information is an additional role, adding to the traditional multipurposes of servicing the four functions. This new purpose takes the importance of

cadastral information beyond the land administration framework by enlarging its capacity to service other essential functions of government, including emergency management, economic management, effective administration, community services, and many more functions. In advanced systems, integrated cadastral layers within a jurisdiction's SDI ideally deliver spatially enabled LAS to support the multipurposes of tenure, use, value and development. However building this kind of interaction between these four functions is not easy. The historic institutional silos, separate data bases, separate identifiers, and separate legal frameworks need to be reorganized. For most countries this presents another major land administration challenge. These challenges could and should be a key focus of UNRCCs and PCGIAP in the years ahead.

CONCLUSION

This paper is not meant to detail the historical development of the UNRCC and PCGIAP. However I have looked back over more than two decades of my involvement in UNRCC to identify trends and lessons that I believe are essential understanding for spatial organisations as they look forward to take advantage of the new and emerging spatial technologies and systems.

While each country is different, the biggest issue I have identified in the region is the lack of appreciation of the move in focus away from small to medium scale national mapping to large scale data sets that are a combination of built (cadastral, street address etc) and natural (topographic) data sets. This necessitates the re-engineering of spatial institutions to look at spatial data holistically, especially at a large scale. Simply the institutions that manage large scale spatial information are on the ascendency while those that manage small to medium national mapping data are on the decline (unless they change and embrace large scale data). Without systems and institutions in each country that seamlessly manage all spatial information it will be difficult for countries to capitalise on the opportunities offered by spatial enablement in the decade ahead.

Arising from this is also the challenge for the UNRCC and PCGIAP to change anachronistic structures to look to the future and build organisations that allow large scale cadastral and land administration institutions to play an equal role as the traditional national mapping agencies. At this point in time many if not most are restricted or discouraged from participating.

The future for our discipline is in the transparent use of spatial information as a technology and infrastructure to change the way governments and society operate. The potential of spatial enablement is only limited by our ability to create a shared vision and implement it.

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