AAA Land Information: Accurate, Assured and Authoritative

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SUMMARY

Online spatial data[1] are being widely used by citizens, government and the private sector in a variety of applications and domains such as business, navigation, properties/parcels and street addresses. Public and private businesses often assume online spatial data are just maps and these maps are accurate. They do not appreciate how and by whom this spatial data are created, collected, maintained and updated. In the past this has not been a critical issue since spatial data have generally been produced and updated by authoritative government agencies.

This landscape is changing dramatically with the introduction of crowd sourced and volunteered geographic information (VGI) whereby members of the public or wider society can collect and contribute to collections of spatial data. This VGI phenomenon enabled a wealth of free spatial information such as street address, land parcels/properties and road networks to be created and maintained by an untrained public at various levels of integrity and accuracy. As a result, companies (e.g. Google) that maintain online maps, tend to use free crowd sourced spatial data instead of authoritative sources of spatial data. Government and particularly land administration agencies such as by the Public Sector Mapping Agencies of Australia usually produce authoritative spatial data however they are commercially expensive, reflecting the efforts needed for their construction, maintenance and further development.

Recognising this changing environment of the spatial industry, we highlight the significant impact of land administration systems (LAS) on spatial data quality and emphasise the importance of tenure, ownership, property boundary and street address data, created usually in land registries in government LAS, in the world of growing crowd sourced and VGI. Spatial data created in LAS is defined as AAA rated land information that is Accurate, Assured and Authoritative. Importantly AAA land information has a documented and legally valid audit trail that is a key to good land governance and information management.

[1] The term "spatial" encompasses geospatial, spatial, geographic and land data/information

We then introduce a continuum that starts with VGI with lower quality and ends with AAA land information with the best possible quality. The continuum also highlights the advantages and disadvantages of VGI and AAA land information. The data in VGI is sourced from citizens and AAA land information is sourced from government LAS. In between, spatial data is created by the private sector, non-government agencies, local government and mapping agencies that have different levels of quality and integrity.

1. INTRODUCTION

The concept of AAA land information described in this paper arose from research from an Australian Research Council Linkage Project titled "A National Infrastructure for Managing Land Information (NIMLI)". The project is being undertaken by the Centre for SDIs and Land Administration at The University of Melbourne. Project partners include the land registries of the Australian states of New South Wales, Victoria, and Western Australia, and the Public Sector Mapping Agencies of Australia Ltd (PSMA). The research focuses on the role of land registries in underpinning macro-economic management, housing provision, and the organization of rights, restrictions and responsibilities (RRRs) information. The NIMLI project can be seen as another starting point for enabling a national approach for land registries and better use of their collected information in Australia.

The project describes the needs of a modern information society that can be summarized as:

- Having national drivers – the economy, the environment, a just society, defence, governance, emergency response and many more
- The ability to model and manage both the natural and built environment
- The creation, recording and managing all RRRs (rights, restrictions and responsibilities) relating to land
- Building a virtual model of any jurisdiction or country

Central to a modern information society is a spatially enabled society (SES) and spatially enabled government (SEG) that can be described as:

- 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
- Simply, SES is about *managing information spatially, not managing spatial information*
- *Transparent or ubiquitous* use of spatial information, so much so that the vast majority of users do not know they are "spatially enabled" – and don't care!

And with spatially enabled government being:

- A concept with the same principles as SES but applied to *management and delivery of government services* - part of e-government initiatives
- Applied in a *"whole of government"* approach

- Vertically through *all levels of government*, local, county, state or provincial and federal (where countries are federations of states)

- And meeting organisational and institutional challenges where *large scale parcel level data* is managed at either local, county or state level, but needed for national scale activities and institutions

The key to SES is the property base or, for the initiated, the cadastre. The property base connects people to land. However a holistic approach is required to integrate the cadastre, land administration, national geocoded address files and spatial data infrastructures. Importantly the cadastre is the core of large scale SDIs.

As background online spatial data[2] are being widely used by citizens, government and the private sector in a variety of applications and domains such as business, navigation, properties/parcels and street address. However public and private businesses often assume online spatial data are just maps and these maps are accurate. They do not appreciate how and by whom this spatial data are created, collected, maintained and updated. In the past was not been a critical issue since spatial data were generally produced and updated by authoritative government agencies.

This landscape is dramatically changing with the introduction of crowd sourced and Volunteered Geographic Information (VGI) whereby members of the public or wider society can collect and contribute to the sources of much spatial data. This VGI phenomenon has enabled a wealth of free spatial information such as street address, land parcels/properties and road networks to be created and maintained by an untrained public at various levels of integrity and accuracy. As a result, companies (e.g. Google) that maintain online maps, tend to use free crowd sourced spatial data instead of authoritative sources of spatial data. Government and particularly land administration agencies such as by the Public Sector Mapping Agencies of Australia usually produce these forms of high quality and high integrity spatial data however they are commercially expensive, reflecting the efforts needed for their construction, maintenance and further development.

Recognising this changing environment of the spatial industry, we highlight the significant impact of land administration systems (LAS) on spatial data quality and emphasise the importance of tenure, ownership, property boundary and street address data created in these government LAS usually within land registries, in the growing world of crowd sourced and VGI. Spatial data created in LAS is defined as ***AAA rated land information*** that is Accurate, Assured and Authoritative. Importantly AAA land information has a documented and legally valid audit trail that is a key to good land governance and land information management.

[2] The term "spatial" encompasses geospatial, spatial, geographic and land data/information

Importantly land professionals (surveyors, valuers, building surveyors, planners and land administrators) create, maintain, manage and provide access to this information as part of their routine activities. They have key responsibilities of creating, recording, maintaining and improving AAA land information.

2. CROWD SOURCED OR VOLUNTEERED GEOGRAPHIC DATA

Crowd sourced maps are known as volunteered geographic information (VGI), that is, the geographic data in the maps is provided voluntarily by individuals. VGI is the user-generated geographic data content being created in web based maps to satisfy a variety of needs within industry, government, and the public. In recent years there has been a very rapid expansion in the number and size of Web sites devoted to gathering geographic information supplied by users on a voluntary basis. This phenomenon of VGI is part of a more general trend of user-generated content facilitated by technologies such as Web 2.0, smart phones and GPS. VGI complements the traditional components of spatial information collection by drawing upon the collective observations and abilities of citizens in their everyday lives. The more than six billion intelligent humans living on the planet are all potential contributors of useful information about their immediate surroundings (Goodchild, 2007, Goodchild and Li, 2012).

Worldwide only about 25% of land parcels are registered in cadastres. Many slum dwellers are living in uncertainty with regard to where they live. Further the increasing global population and the rush to urbanisation is negatively impacting on the capacity of governments to catch up with formal recognition of how citizens use land. One potential solution involves establishing a partnership between land professionals and citizens that encourages and supports citizens to directly capture and maintain information about their land rights by crowd souring it (McLaren 2011). However the strengths and challenges in use of VGI for this purpose need to be fully understood and a context for collection and interpretation of claims and rights evidenced by the information must be established.

3. THE PROBLEM

The key message from this paper concerns the growing importance of spatially enabled AAA land information that is accurate, authoritative, assured particularly at a national and federal level. In the Australian context there is a problem that land registries or land titles offices focus on state and territory processes as a result of the Australian Constitution. They struggle to provide the integrated information needed by policy makers, government, businesses and community stakeholders at a national level. The objective of our research project is the integration of state and territory based information to meet *national needs*.

There are many needs for national large-scale land information databases such as:

- Human services

- Taxation
- Federal governance including monetary policy
- Adherence to national treaties
- Banking and insurance
- Natural resource management including water, minerals and oil and gas
- National law enforcement, disaster management and emergency responses
- Land and property markets including complex property markets
- Government scheme implementation and compliance
- .... And many more

The key questions in solving this problem include understanding:

- the needs of modern information societies
- what is AAA land information (accurate, authoritative, assured), particularly in countries that are federations of states
- the role that AAA land information plays nationally within a modern information society
- a national vision to capitalize on spatially enabled AAA land information in support of government, business and wider society

At a practical level a secondary set of issues also includes:

- A better understanding of land information and large scale people relevant spatial data
- Current land registry activities and their statutory arrangements
- The role of land administration in supporting sustainable development
- Awakening the sleeping land registry giants
- A multipurpose vision for our land registries

For practical reasons we draw on Australian experiences to highlight the message in this paper. In summary we believe it will be very difficult for any modern country, and particularly countries that are federations of states, to promote economic growth, environmental sustainability, social justice and good governance, unless they can *access and manage spatially enabled AAA land information at a national level*.

The problem and solution is further complicated since Australia's land registries or land titles offices focus on *state and territory processes*. They struggle to provide the integrated information needed by policy makers, government, businesses and community stakeholders at a *national* level. The objective is integration of state and territory based information to meet *national needs*. To put the problem in context, to our knowledge no country that is a federation of states has access to or manages AAA land information nationally in an effective manner. This certainly is the case for the USA, Canada, Australia, China and Germany to name a few.

4. SO WHAT IS AAA LAND INFORMATION?

In order to fully understand AAA land information it is useful to remember the traditional roles of land registries, that delivered the land administration functions of registration and parcel identification that produced high quality and high integrity information, often guaranteed by government (AAA land information). However land information within land registries is usually not spatially enabled, especially nationally. The tools to spatially enable land information nationally (geocoded national address files and national cadastral data bases) are not key tools in land registry administration. In addition owner information in land registry data must be improved – name changes, address changes and identity checking are relatively poor and need to be thoroughly upgraded on a national scale. There is no doubt that within the traditional land registries, land information is an underutilized public asset.

A key objective for all countries and especially those that are federations of states is to awaken the land registry "sleeping giants". However land registry data is different from most spatial data. It is:

- Essential for land markets and the wider economy
- Legally authoritative
- Insured by government
- Spatially accurate (cadastral verification)
- Highly dynamic
- Maintenance intensive
- Large scale
- Central to the business model of the registry
- Sensitive in terms of privacy

- In high demand

These characteristics make spatial enablement and SDI involvement challenging for land registries.

In summary the business of land registries can be summarized as producing "OPIT information", meaning **O**wner, **P**arcel/**P**roperty, **I**nterest and **T**ransaction information generated by land tenure functions in land administration systems. This information concerns attributes to a parcel/property and relates to the space in the parcel, but it is not spatially enabled at registry levels. In most countries, including Australia, OPIT information is AAA land information.

So what is AAA land information? It is:

- ***A****ccurate* – with on-ground truthing
- ***A****uthoritative* – created within a regulated legal environment
- ***A****ssured* – government guaranteed
- Importantly provides an ***authoritative audit trail*** for other land information data sets and services
- Add to AAA land information the power of spatial enablement and the vision of a spatially enabled society and government becomes a reality.

Today in Australia many players are not getting timely access to accurate data relating to tenure, value, planning, and development. Duplication is rife and citizen access in many cases is non-existent, partial and not spatially enabled. Many of the important restrictions that alter use of land or impose penalties for non-compliance with a legislated standard require diligent and frustrating enquiries. Simply AAA land information is underutilized both in its source state and territory governments and through the vertical tiers of governments, especially at a national level. *It is an under utilized public asset.*

5. AAA LAND INFORMATION AND VGI

All land data, especially if spatially enabled, is useful for multiple purposes. The purposes are defined by the quality, reliability and management of the information. Our argument is not about whether AAA land information is better or worse than VGI. It is not about accuracy, precision and reliability so much as fitness for purpose. The argument is that AAA information is quintessentially fit for purposes of evidence based decision-making and policy formation in government, business and civil society. The following table describing Australia's land information attempts to explain the differences among the disruptors and

enablers of information sets so information users might better discriminate among the data offerings available. It is a work in progress. The key aspect of fitness for purpose of AAA information lies around its audit trail. An important difference is also that AAA is state and national in scope (even the EU cannot take AAA across national boundaries). But VGI is happily international.

In the table below the enablers and disruptors are both POSITIVE: the remarkable energy of VGI lies in its lack of formality and regulation, which widen opportunities for use (and misuse alas) to unlimited potential. We accept the misuse issues because it, like the Internet at large, is great fun. Land registries and the information they generate, by contrast, have different roles in government and society.

Australia's land information

AAA		VGI	
Enablers	Disruptors	Enablers	Disruptors
Accuracy defined	Stale, not current	Real time	Inaccurate and disorganised
Authoritative			Not authoritative
Reliable			Unreliable
Clear provenance Author known			Provenance not disclosed Author unknown
Clear audit trail available		Marginal efforts to build trails	Most is without a trace
QA* applied			QA not available
QC+ applied			QC not applied
Refined audience management	Not widely used	Widely available and used	No audience management
Capable of fitting with official systems	Not widely used in government		Poor fit with official systems
Text and parcel based	Best available digital parcel file boundaries	Anything goes	
National parcel information	Usually not spatial	Parcel file can be integrated with	

available		VGI spatial information	
Risks are managed			Risks are not managed
National address file available	Accuracy is increasing	Geocoding available	But not verified
Boundaries based on earth measured geodetic framework	Expensive and based on survey standards	Location based on device geocoding and GPS	
Strong historical pedigree		Pedigree based on novel technologies and popularity	
Standards announced	Variable take up of standards	Standards partially available	Most has no standards
	Not integrated with visual information	Integrated with visual information	
National level focus	No international coverage	International coverage	Across multiple platforms
Custodian agency identified			Custodian missing

* QA Quality assurance is systematic provision of accuracy standards of data

+ QC Quality control is post mission proof to clients of information accuracy

6. THE SPATIAL INFORMATION CONTINUUM

Another way of understanding the differences between AAA land information and VGI is with the use of the spatial data continuum from a quality and fitness for purpose perspective as shown below. The continuum starts with VGI with lower quality and ends with AAA land information with the best possible quality. The continuum also highlights the advantages and disadvantages of VGI and AAA land information. The data in VGI is sourced from citizens and AAA land information is sourced from government LAS, primarily land registries. In between, spatial data with different levels of quality and integrity is created by the private sector, non-government agencies, local governments and mapping agencies.

The continuum is informed by a set of criteria for evaluating spatial information including

lineage, positional accuracy, attribute accuracy, logical consistency, completeness, semantic accuracy, usage and temporal quality (van Oort, 2005). Among the criteria, lineage plays a significant role in helping the users in assessing the suitability for a particular use. Even though the spatial data quality can be improved, understanding its fitness for use is a significant challenge for the users. As a potential solution, a well-compiled metadata that explains lineage plays a critical role in describing its fitness for use (Kalantari et al., 2010).

Spatial Data Continuum from a fitness for purpose and quality perspective

CONCLUSION

In the long run (which is likely to arrive much sooner than expected given the pace of change), distinctions between information categories will cease to matter. In their place, the pedigree, content, custodian agency, and characteristics of information will be transparent and will determine fitness for users' purposes. AAA standards are offered as a means for users to discriminate amongst the offerings, and to challenge registries around the globe to enter the information trade with confidence of their special responsibilities and opportunities to provide evidence for good policy making, sound business and investment decisions and inclusive public participation in using land information.

Importantly it is the land professionals who will need to provide much of the leadership if

society is to fully benefit from AAA land information and the spatial information revolution.

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