



Why
geospatial
data is
integral
to the
wellbeing
of nations



Helping geospatial professionals meet the needs of developing economies

Leveraging data is the key to success in today's digital world. The Fourth Industrial Revolution – driven largely by the Internet of Things and big data – has led to a huge rise in the production of data, as well as an unprecedented increase in its uptake.

On the basis that 'everything happens somewhere', location is inevitably a critical information source and a major driver for public sector policy and decision-making. In this context, location information underpins all information. But to be a truly effective tool in driving prosperity and development for a whole nation, it is essential that location information is understood with reference to an authoritative, up-to-date set of geospatial data within a National Spatial Data Infrastructure (NSDI).

Today, the formation of a NSDI is a goal that almost all countries aspire to, and that many are actively pursuing, alongside the modernisation of their physical infrastructure and efforts to ensure the sustainability of their environment. Largely because geospatial data underpins so many aspects of economic and social wellbeing.

For most developed nations, the sophistication of their geospatial infrastructure is increasing rapidly, encouraged by the introduction of new technologies, rapid digitisation and government investment. The data element of an efficient land registration system is a major contributor to any NSDI, one part of a sophisticated

data stack which integrates layers of geospatial data into one multi-dimensional information source. The result is information for a decision-maker that is data-centric in comparison with the traditional map or text-centric systems of the past.

With the United Nation's Sustainable Development Goals and the World Bank's Twin Goals setting the global agenda, high-quality geospatial data is crucial. And at the forefront of this 'location data revolution' are national mapping and cadastral authorities, who are the key players in the move to a data-driven future for all decision-makers in the public and private sectors.

The data age we are living through is fast-paced and ever-evolving – and the scope of its impact is far-reaching. Data has the power to change lives by tackling poverty, improving social cohesion, and even securing the environment for future generations. While modern geospatial frameworks can provide the infrastructure to do this, many nations struggle to create an NSDI and keep it up-to-date with accurate reliable information. That is why geospatial professionals must focus on how to gather this information – in more effective ways and often in partnership with others – to provide what is needed for their nation.



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Fit-for-purpose land administration

According to FIG (International Federation of Surveyors*) and the World Bank's 2014 report Fit-For-Purpose Land Administration, '75% of the world's population do not have access to formal systems to register and safeguard their land rights'. The authors of the report identify the growing, perhaps even urgent, need to develop systems that identify the way land is occupied, used and managed, particularly in developing nations.

The report highlights the fact that conditions in emerging or developing nations lead to investment in geospatial data infrastructure being much more pressing than in developed nations – and especially in the underlying spatial frameworks of large-scale mapping. Highly developed nations have long benefitted from sophisticated land administration and sustained investment in geospatial infrastructure – and they are now economically assessing the value of these investments. Two such countries are Australia and Denmark. A PwC report Surveyors and the Value of Cadastral Integrity supports this.

AUSTRALIA

The value of land in Australia has grown in the last decade, and in 2015 was estimated at being worth c. AUS \$4,722.2 billion. Central to that valuation is the Australian cadastral system, which brings with it multiple socio-economic benefits.

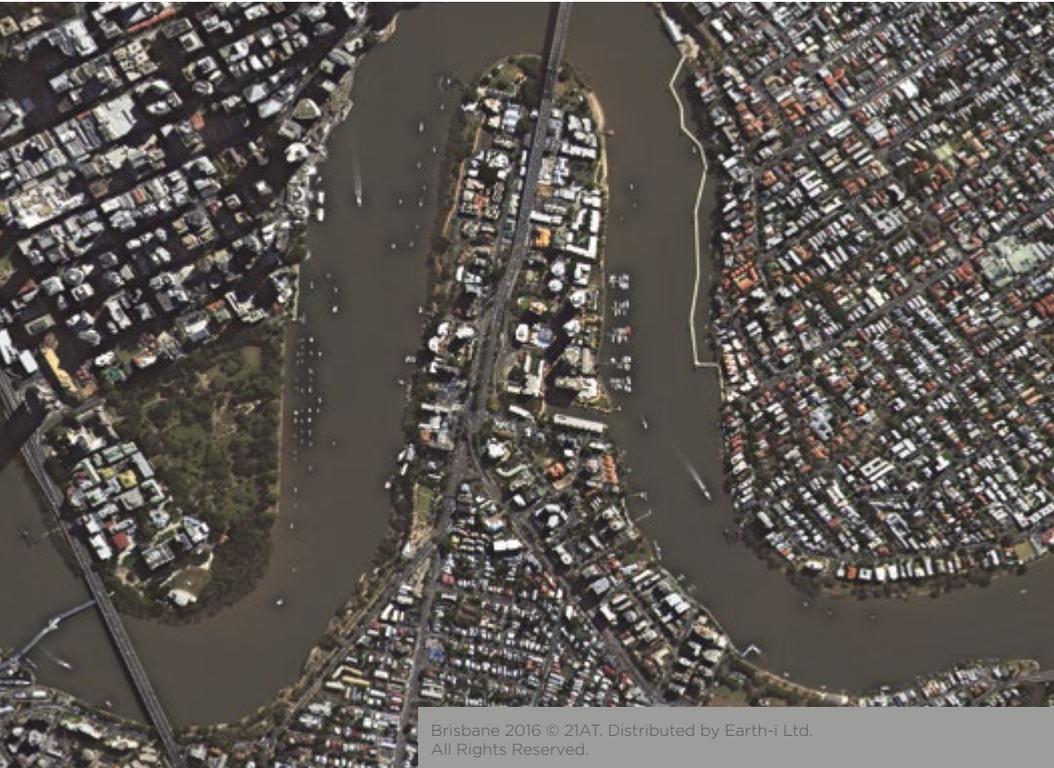
In 2015-16, it's estimated that 2,700 cadastral surveyors carried out 338,000 surveys. The accuracy of those surveys has been so vital to Australia's continuing confidence in economic activity. It's estimated that benefits of c. AUS \$926.8 million are felt through surveying regulations and between AUS \$85.6 and AUS \$171.3 million is saved in avoided investigations due to more accurate surveying, all of which supports the on-going efficiency of the Australian economy.

DENMARK

In Denmark, publicly available geospatial data has a significantly positive effect on the economy, helping to increase growth rates and productivity, and helping public sector organisations to create more value and be more efficient. In 2016, the socio-economic value of this open data was estimated at c. DKK 3.5 billion. And beyond that value, open location data also brings exponential welfare gains, like improved environmental and health conditions.



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Denmark and Australia are both forward-thinking, innovative nations with developed economies that have invested in modern land registration and cadastral systems for many decades. The issue for those in the developing world is that, despite the urgent need, the methods, policies and technologies being invested in by developed countries are less affordable. Land-based surveying can be expensive and time-consuming, and is not likely to be a viable point of entry to geospatial data for less economically advanced nations. Remote-sensing, meanwhile, is more cost-effective but less accurate. As such, developing nations need a different way of addressing the foundation of the geospatial data stacks to underpin the mapping of national territory, and establishment of a viable land registration system.

FIG and the World Bank call this a 'fit-for-purpose' approach. It works by providing the spatial framework on which land administration, governance and use management sits, and from which core land administration strategies can be implemented. It is called 'fit-for-purpose' because it can meet the needs of a given region or society today, while being open to incremental improvements over the coming years.

The concept demonstrates a level of common sense and is of great importance for geospatial professionals who work with developing nations. Land is very closely linked to wealth and well-being, and the poorer sections of society often have few land rights or ownership, greatly impacting their security and economic bargaining power. Given the significant benefits that an effective land administration system can bring in exposing

and measuring such land issues and inequalities, the report's authors argue that the 'fit-for-purpose' approach is fundamentally a human rights one. It supports developing nations in their goal of implementing sustainable, affordable land mapping and administration systems that will facilitate not only security of tenure for all citizens, but also more effective management of land use and natural resources that will benefit everyone - rather than just the elite.

Moreover, the approach is very much in line with the UN's Sustainable Development Goals (SDGs), which cite the impact of effective geospatial frameworks and the use of spatial data as a fundamental enabler for at least 13 of the 17 goals.



The data for the framework

Beyond understanding the best approach to geospatial data collection, there remains a question around how best to obtain it. In the last decade, the methods for acquiring, processing and analysing geospatial data have changed quickly. New technologies have entered the field and added improved capabilities at a rapid rate, with aerial survey, UAVs (Unmanned Aerial Vehicles, also known as drones), free low-resolution satellite data and very high-resolution Earth Observation (EO) satellites all having an impact.

FIG and the World Bank's paper cites the limitations that traditional data-collection techniques have placed on the development of effective land administration services, stating "the key bottleneck" as being "the use of traditional, high accuracy, expensive land surveying techniques to record land rights". But it is not just traditional techniques that have limitations – newer technologies can also have drawbacks. For example, UAVs come with fairly high costs attached, which limits their usage as part of a 'fit-for-purpose' approach for developing nations (even in some highly developed nations, drone usage poses certain problems and they remain excluded from many operational scenarios).

Limitations such as these are precisely why the availability of very high-resolution data (VHR) from EO satellites holds significant advantages for any national mapping body seeking to understand more about its land.

The clear advantage provided by recent innovations in this area is in the levels of resolution now available for EO data and the cost of acquiring that information. VHR data at sub-one metre dramatically improves the level of actionable detail that can be derived from satellite images, making the data analysis opportunities created by VHR data at this level the real advantage. The actionable insights – i.e. the specific operational benefits driven by EO data – can drive a wider range of analysis and outcomes in geospatial, environmental and industrial fields.

Indeed, while very high-resolution data was once the preserve of a small number of sophisticated and expensive government-owned satellites, the launch of a new generation of commercial EO satellites has literally opened up a whole new world of spatial data acquisition. Until now, the challenge has been that acquiring this level of data quality has come at a high monetary price. However, the reduction in the complexity, size and cost of EO satellites, and the wider range of affordable launch options, have now combined to make VHR data financially accessible.

As a result, access comes at a lower cost. There are more tasking opportunities due to there being more available satellites, and many more opportunities for wide-area coverage at very high-resolution. So much so that many nations are now implementing annual data collection processes that use high-resolution satellites for repeatable up-to-date monitoring and much improved

analysis of land use in these countries. This approach is not only an effective contributor to the development of a NSDI but is also much more affordable – not just for the initial data collection, but for regularly repeated data acquisitions as part of a spatial framework that can be updated annually.

The result is that mapping organisations from any corner of the globe can now build a process based on the 'Four Core Land Administration Strategies' and a data framework based on the regular and sustained acquisition of VHR satellite data.

'It is estimated that compared to satellite/orthophoto imagery, field surveys are about three times more costly in rural areas and about five times in urban areas. Furthermore, the mapping methodology using imageries provides (...) the general topography of land use and buildings and infrastructure, that is fundamental for the planning and land development functions of the land administration systems.'

FIG and World Bank

Source reference: Published by International Federation of Surveyors (FIG)/World Bank Publication No. 60





THE FOUR CORE LAND ADMINISTRATION STRATEGIES

Understanding the four core strategies of the spatial data framework, along with the criteria this data must meet in order to be effective, is key to making effective decisions on how and when to source that data. For developing nations, this means that sourcing decisions can be made in a way that is primarily fit-for-purpose.

THE STRATEGIES:

- **Land tenure** – securing rights to land and natural resources, and managing the process of transferring those rights between parties (a cadastre)
- **Land value** – establishing the value of land and property, and enabling such value to be taxed
- **Land use** – planning the utilisation of land and its natural resources, and monitoring the impact of such activities
- **Land development** – the planning, implementation and regulation of infrastructure, utilities and construction projects

Each of these strategies is fundamental to successful development, whether in economic, social or environmental terms, and each depends upon geospatial information that is:

- **Inclusive** – covers all of the territory within a nation, facilitating comprehensive decision-making and underpinning fairness across society
- **Accurate** – data that's as accurate as possible, or at least enough to meet the fit-for-purpose criteria and therefore be deemed reliable by users
- **Attainable** – data that can be realistically collected, and within actionable timeframes, for both the original collection and subsequent updates
- **Affordable** – costs proportionate to the benefits to government and society, and within the scope of budgets available



Look up for better data

As the Fourth Industrial Revolution gathers pace, and the United Nation's Sustainable Development Goals and the World Bank's Twin Goals influence the global agenda, we all have the responsibility to manage data well and to ensure its usage benefits as many people as possible. Particularly when it comes to land administration, which is integral to the economic, social and environmental wellbeing of all nations. But with many strategies not being fit for developing nations, who are perhaps most in need of modernised systems of land administration, there must be a new approach.

Today, the rapid advancement of space-based Earth Observation presents an opportunity for developing nations to achieve a fit-for-purpose spatial data framework. As well as an opportunity for a 'technology leap' using very high-resolution EO satellites. Taking this leap will result in the ability to go beyond traditional, highly-expensive, ground-based survey techniques, and doing so without the operational limitations and costs of drone or aerial survey, whilst still achieving a spatial framework that is inclusive, accurate, attainable and – crucially – affordable.

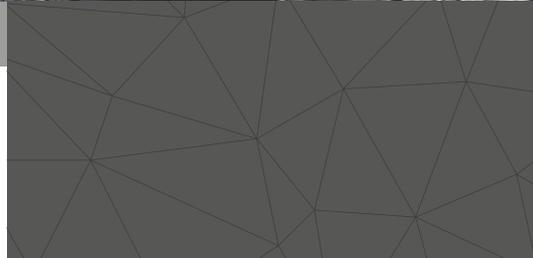
This is the future for 'fit-for-purpose' land administration; and for the place location data holds in enabling efficient governance, economic growth and human rights. It is down to mapping and cadastral organisations and professionals to realise this for the benefit of their societies.



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Find out how Earth-i can help you access VHR EO satellite data at a frequency and cost that delivers on a fit-for-purpose land mapping strategy.

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