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Shedding Light on the Land Sector

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The front cover of this June 2017 issue of GIM International shows a Landsat (15m) satellite image of Wadi As-Sirhan, Saudi Arabia, revealing crop circles in the desert. Saudi Arabia has been steadily developing agricultural land using centre-pivot irrigation. The country has modernised its cadastral registration system over the past couple of years. A digital system has been developed in order to provide accessibility to the country's online cadastral records from any location. (Courtesy: NASA/USGS)

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From Yesterday to Tomorrow

The overall theme of the FIG Working Week, which is being held this year in Helsinki, Finland, from 29 May to 2 June, is 'Surveying the world of tomorrow – From digitalisation to augmented reality'. To tie in with this annual event, *GIM International* traditionally publishes an edition dedicated to recent developments in land administration. This year we've once again put our contributing editors Rohan Bennett and Chrit Lemmen in the driver's seat when it comes to selecting the feature articles and scope for this dedicated issue. I hope you'll agree with me that they've done a great job.

To get this edition underway, let's take a closer look at the theme of this year's FIG Working Week. First of all, 'Surveying the world of tomorrow' implies that surveying the world of yesterday and today is already done and dusted. We all know that's not the case...not by a long shot. However, it may well be that the second part of the theme description, 'digitalisation and augmented reality', will enable us to capture yesterday, today and tomorrow all at once. As the organisers state, we are witnessing the early beginnings of a development leading towards services which not only describe the visible world around us, but also simultaneously bring up other

information connected to our place of interest. The first step is to become fully digitalised and to use the digital information in the right way; the next step is to combine information and be able to collect the data intelligently before then taking further steps towards the smart use of digital information.

The amount of data that we are gathering overall, and certainly also the amount of geodata collected by surveyors, is staggering. Equally immense is the challenge to store relevant data in the right way in a spatial data infrastructure, especially on a national level. It takes a lot of strategising beforehand, followed by close monitoring all the way along the process and changing course whenever necessary. Even if the system is perfect, it will still be a case of 'garbage in, garbage out' if the data quality is poor. Likewise, inputting good and relevant data into a not-so-perfect system will corrupt the data. But if you get both aspects right, you will end up with the best system to enable governments to optimally analyse the present situation and make better decisions for the future. Sooner or later, every government – wherever they are in the world – needs to transition to an e-government environment in which data plays a leading role in making decisions and shaping policies.

In the countless sessions and presentations during the FIG Working Week, thousands of professionals and thought leaders will discuss the transition to e-governance, good land administration systems and how they can be embedded into spatial data infrastructures, day-to-day data capture activities and surveying the world of tomorrow, and they will learn about the state-of-art hardware and software that can help to make it all happen. We'll bring you an update on all the news from Helsinki in an upcoming issue of *GIM International*.



▲ Durk Haarsma, publishing director.

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Taxation: a Blessing

A general election in my country, The Netherlands, is followed by a curious spectacle: the political parties have to negotiate to form a majority coalition cabinet. To steer this process in the right direction, Parliament appoints a 'highly esteemed person' to investigate whether such a cabinet formation can succeed. At that stage, lobby groups seize the opportunity to make claims on the future government budget to safeguard their interests. Of course, these interests are put forward as interests of absolute national importance and are communicated loudly and forcefully. The industry lobby wants lower corporate taxes, otherwise the economy will stagnate. The environmental lobby wants all coal-fired power stations to be closed down, otherwise the country will fail to meet the Paris Agreement obligations. Universities want more money, otherwise the quality of education will decline. Automobile associations want more money for infrastructure, otherwise traffic jams will hinder business activity. Transgender groups want more money for gender-neutral public toilets, and so on. According to the media, the 'highly esteemed person' has received 250 claims this year. Remarkably, these lobby groups never address the question of who has to pay for their claims. As you and I know, it's us – the humble taxpayer. Admittedly, we get a lot in return for our contributions to the

government budget: healthcare, education and social security are all quite well organised, to name but a few. I would not like to live in a country where I pay no tax but also get nothing in return. That is the case in many countries in the world, unfortunately. For example, Angola levies taxes to the amount of 6% of the GDP, and Nigeria levies only 3%. Luckily these countries generate income from natural resources rents, remittances and aid. However, falling oil prices spell trouble for them. Nepal levies 13% but can spend a bit more because of remittances and aid. But if a country has no additional revenues, no taxation means no government budget. I feel it is of the utmost importance for emerging countries to generate government revenues through fair and simple taxation. Taxation is mainly a matter of data; taxation requires a tax administration, which basically and logically consists of a register of citizens (this is the list of individual taxpayers), of legal bodies (this is the list of corporate taxpayers), of properties (this is the list of taxable objects) and an address mechanism (this is the list of addresses for performing the tax assessment and collecting the taxes). Based on this foundation, more relevant data can be linked in an evolutionary process (e.g. ownership, income, profits, values). Conceptually, this is simple. Proven modelling and technology is available. Surveyors especially can make a valuable contribution because they are skilled in data collection and data management. Sometimes, for example within FIG, colleagues express their fear that technological advancements are making surveyors redundant. Given the fact that the tax administration system in probably upwards of 100 countries in the world still requires further development, I beg to differ.



▲ Paul van der Molen.

Photogrammetric Week 2017 Programme Announced



Schlossplatz, Stuttgart.

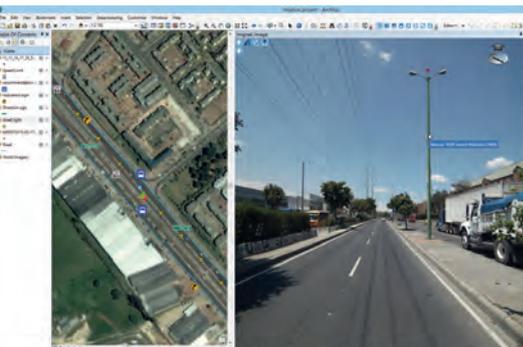
The 56th Photogrammetric Week in Stuttgart, Germany, will be held from 11-15 September 2017. The biennial Photogrammetric Week (PhoWo) event was initiated by Carl Pulfrich as a "vacation course in photogrammetry" in 1909; since 1973 it has been held at the University of Stuttgart. Over the years remote sensing and geoinformatics together with photogrammetry have become the major subject areas of this conference. Today, Photogrammetric Week enjoys international recognition as an upgrading seminar and a platform for the exchange of knowledge and experience.

► <http://bit.ly/2rgEUzE>

Imajing Provides Esri Users with Online 3D-enabled Images

Developed by Imajing, Imajnet enables transportation infrastructure managers to host and share, within their organisation, georeferenced 3D images surveyed with the Imajbox mobile mapping system. Imajing has developed extensions to enable Imajnet integration in ArcMap with a plug-in, and ArcGis Online with a widget. Imajnet is a web service providing multipurpose information to transportation network managers. Hosted in the Imajing cloud or deployed on public organisation servers, Imajnet provides common references and data for field teams, engineering and management professionals to facilitate the recurrent monitoring of transportation networks. Recognised as a concrete solution for managing nationwide networks, Imajnet enables full interaction between an Esri environment and 3D images collected by the Imajbox mobile mapping system.

► <http://bit.ly/2r80iH4>



Imajnet integration in ArcMap.

Viametris Introduces vMS3D for Vehicles



Viametris vMS3D.

Viametris, a leader in mobile scanning technology, has announced the introduction of its new mobile scanning system for vehicles, the vMS3D. The mobile mapping system is dedicated to outdoors, roads and urban areas utilising innovative localisation technology not tightly dependent upon GNSS receivers. As a result, poor GNSS reception quality is no longer a problem. Based on unique technology and years of expertise in indoor mobile scanning, Viametris has become a leading expert in mobile scanning in GNSS-denied environments. Mobile mapping systems allow rapid measurements, faster than any other technologies. But one main issue remains: what happens in urban canyons and poor GNSS cover areas? Thanks to post-processing software PPIMMS and improved trajectory using simultaneous localisation and mapping (SLAM) technology, Viametris has now addressed the issue of poor or no GNSS coverage.

► <http://bit.ly/2pAYWZi>



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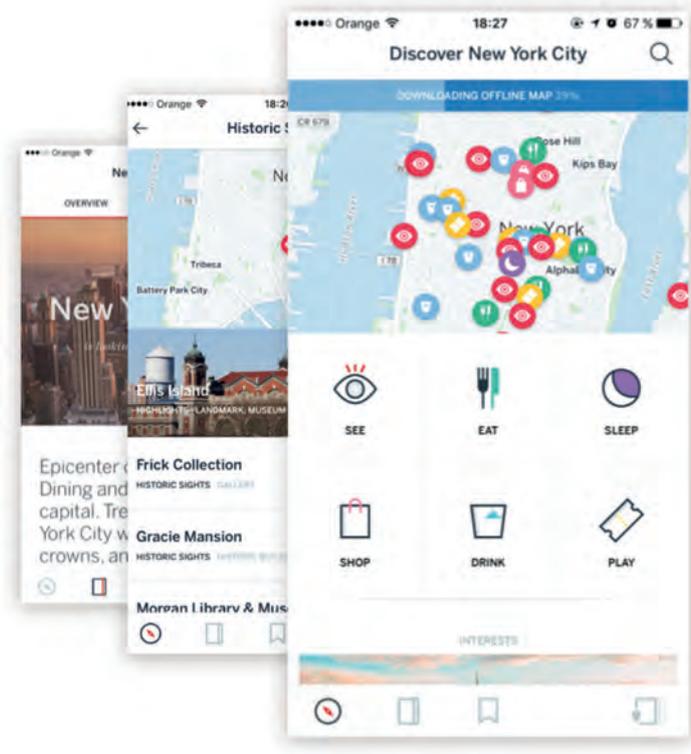
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CARTO Delivers Advanced Offline Maps with New Mobile SDK

CARTO, a leader in location intelligence, has released its first open-source software development kit for mobile following last year's acquisition of mobile software company Nutiteq. CARTO Mobile SDK 4.0 makes location analytics, real-time visualisation and offline services accessible for native mobile application developers. The SDK creates applications focused on fast online and offline services as well as location analytics. One of the biggest obstacles for mobile application development has been the required online connection for location services and map rendering, said Jaak Laineste, head of mobile at CARTO. The open source CARTO Mobile SDK addresses this and extends offline capabilities.

The new release allows for uninterrupted mapping displays and services such as geocoding, routing and searching, even in offline environments. This is key for developing professional applications in industries such as agriculture, and development and humanitarian efforts in areas with limited cellular coverage. In addition to these offline features, the SDK allows for more support for spatial data types, 3D modelling, vector basemaps and the ability to easily render millions of features.

► <http://bit.ly/2pMxuDQ>



CARTO Mobile SDK.

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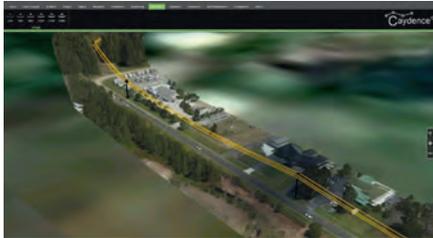
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Energy Distributor to Use Lidar Technology to Manage Vegetation



Caydence 3D environment.

Australian energy distributor Essential Energy has contracted NM Group to map, analyse and report on vegetation risks which could pose future safety and reliability issues across its overhead electricity network. The programme will use innovative remote sensing and 3D modelling technologies around nearly 85,000km of powerline. This will enable improved prioritisation and planning of vegetation management activities around the powerline network.

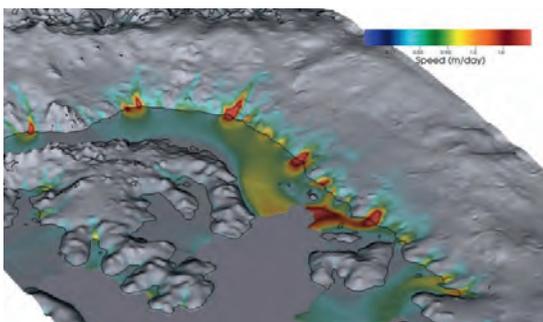
The project will use aerial Lidar survey to collect and process data across an area of almost 160,000km², spread across regional and rural New South Wales. A range of powerful techniques turn network data into intelligent 3D models, facilitating precise measurements and reporting – such as any location where a tree has the potential to grow into powerlines and present a safety or power-outage risk. This information is presented in an immersive 3D environment called Caydence, which is accessed via a web browser, enabling Essential Energy employees to make informed decisions from their desktops.

► <http://bit.ly/2pAW3aG>

Radar Satellites Show Antarctic Ice Loss

More than two decades' worth of observations by five radar satellites show the acceleration of ice loss of 30 glaciers in Western Palmer Land in the southwest Antarctic Peninsula. The study in Geophysical Research Letters combines over 24 years of radar data from satellites including ESA's Envisat and ERS missions, as well as from the Copernicus Sentinel-1 mission. Radar is particularly suited for monitoring polar regions that are prone to bad weather and long periods of darkness because it can collect information regardless of cloud cover, day or night. After mapping 30 glaciers in the region, the research team found that between 1992 and 2016 most of the glaciers sped up by between 20 and 30cm per day. This is equivalent to an average 13% increase in flow speed across the area as a whole. The team also combined their satellite observations with an ice-flow model to fill in gaps where no satellite data were available. This allowed the scientists to estimate that the glaciers' speed increase has led to the discharge of 15km³ of ice per year into the surrounding ocean.

► <http://bit.ly/2r7zLxq>



Visualisation of the Antarctic ice loss.

Making Linear Mapping Projects More Efficient

senseFly has launched senseFly Corridor, a new platform enhancement that vastly simplifies the mapping of linear infrastructure and sites using an unmanned aerial system (UAS or 'drone'). senseFly Corridor recently made its debut at AU/VI Xponential in Dallas, USA. Corridor mapping is a common task for many geospatial professionals and crucial for the effective planning, design and analysis of linear infrastructure, as well as the monitoring of rivers and coastlines. However, using drones to carry out corridor projects – as an alternative to hiring expensive manned aircraft – has, until now, been a relatively complex job that contained some frustrating inefficiencies. senseFly Corridor overcomes these hassles, providing a geometrically and logistically efficient method of mapping linear routes. This release is also future-friendly, as more operators gradually look towards gaining EVLOS and BVLOS permissions.

► <http://bit.ly/2qijuVi>



senseFly Corridor.



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Ultimate compact network RTK receiver



Ultimate compact design



BD970 GNSS engine



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The Necessity of a Modern Cadastral System

A well-functioning land administration system, or cadastre, is the foundation of national stability and social welfare. A government can make a thousand promises or grandly announce a comprehensive vision to boost the country's economy, but without an efficient and effective cadastral system the authorities will never be able to deliver. When considering the economic status of a country, it is wise to zoom in on the progress of its land administration policy. The relationship between land administration and prosperity/growth is evident.

In 2000 the renowned Peruvian economist Hernando de Soto, globally recognised for his work on the informal economy and an evangelist of property rights, published a book titled *The Mystery of the Capital*. In his book, he outlines the struggle of poor people in developing countries to obtain legal titles to property. De Soto, who *Time* magazine named as one of the 100 most influential people in the world, considers land titling as a fundamental factor in shaping household capital for people living in poverty. Former UN Secretary-General Kofi Annan praised him for his new insights into how we capture economic growth and development.

As Klaus Deininger, Harris Selod and Anthony Burns describe in their excellent publication titled *The Land Governance Assessment Framework*, there are plenty of reasons that justify land administration and policy responses to strengthen tenure security and to create the preconditions for investments and economic development. Ongoing migration from rural areas to cities is resulting in overpopulated slums with little perspective for the dwellers, for example. Meanwhile, unclear land rights are causing escalating disputes on land ownership. How can this cycle of poverty and conflicts be broken? There is no one-size-fits-all solution, but establishing a well-functioning land administration system is a proven concept.

But why is a modern cadastral system so vital? Why should a good land administration policy

be regarded as the backbone of a nation that wants to end poverty and shake off the label of 'developing' or 'less-developed' country? The answer: because land administration systems manage ownership and secure tenure. Another key reason is that a cadastre supports the land and property tax system, which is a precondition of running a modern country efficiently. Greece provides a recent example of the importance of a well-functioning cadastre for a country's economy. Greece is the only European country without a digital land ownership registry. The lack of a good land administration system strongly affects the country's attempts to modernise its economy and forms a major obstacle for the Greek government in finding a way out of the debt crisis.

There are plentiful examples of countries that have recently managed to take a substantial step forwards (e.g. Chile, Ghana, Jamaica, Mongolia, Namibia and Nigeria). It is important to note that not every solution can be directly applied in another country, since factors such as the population and social and cultural norms may differ. However, some kind of framework is certainly a necessity when developing a cadastral system that meets the country's needs. The World Bank and the International Federation of Surveyors (FIG) have developed the fit-for-purpose approach as a pragmatic, flexible and accessible way of implementing a land administration system – one that starts with a simple yet sensible structure and gradually evolves through a dynamic process.

Good land governance is a catalyst for economic development, for creating sustainable growth and a better outlook for future generations. The fit-for-purpose methodology entails building and sustaining land administration systems that are basically good enough to achieve the ultimate objective, instead of involving top-end technological solutions and complying with rigid regulations for accuracy. What many countries need is a solution that enables them to build affordable,

flexible systems that can be completed within a reasonable time frame. The Land Administration Domain Model (LADM) is a helpful instrument in realising this. It combines social drivers and the opportunities created by technological advances, and provides a standardised global vocabulary for land administration. The Social Tenure Domain Model (STDM) is a sub-version of the LADM that presents a generic and inclusive solution for building flexible land administration systems. The next step is then to develop the established system into a more sophisticated cadastral system.

Land registration offers countries a means of escape from poverty, and the fit-for-purpose approach enables them to start taking decisive action by building a cadastre sooner rather than later. Or, in the words of De Soto: "All developing countries will achieve a land recording system over the next 80 years, but why don't we do it in 20?" ◀

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▲ Wim van Wegen.

Blue Marble Launches New Academic Licensing Programme



Blue Marble Global Mapper.

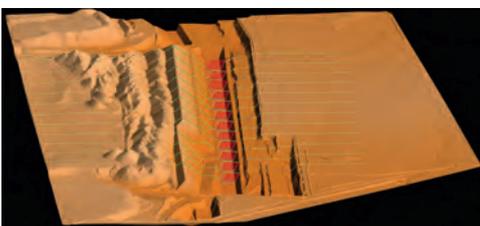
Blue Marble Geographics has announced the launch of its new academic licensing programme with a new web page now available with detailed information and an online application form. This pilot programme allows institutes of higher education in the US and Canada to deploy both Global Mapper and Geographic Calculator free of charge for classroom teaching, hands-on lab instruction and personal student use. Since the preliminary announcement of the academic licensing programme at the annual Association of American Geographers conference in Boston in early April, the response from college course administrators and faculties has been overwhelming. Unshackled from budgetary constraints and technical limitations, college instructors and lecturers can now build a hands-on curriculum that allows students to experience the practical application of spatial technology instead of countless hours of software instruction.

► <http://bit.ly/2r7Y3r0>

Global Release of Maptek Mining Software Solution Suite

Mining technology developer Maptek has delivered Vulcan version 10.1, together with Eureka version 4.0, to customers globally. Vulcan and Eureka are both accessed and operated through the Maptek Workbench, offering users the first instalment in a continuum of integrated technical software applications, data and workflows dedicated to mine planning, measurement and operations. Vulcan has been a household name in the field of geological modelling and mine planning for almost 40 years. Vulcan 10.1 features new functionality to streamline design and planning, optimise drill & blast and improve reporting and analysis. Maptek continues to develop Eureka as a dedicated exploration, drilling and geophysical analysis package for visualising and interrogating 3D spatial data associated with mining and exploration projects. The core functionality and drillhole tools in Eureka 4 are free to use for Vulcan customers on a timed trial until the end of June 2017.

► <http://bit.ly/2qliISx>

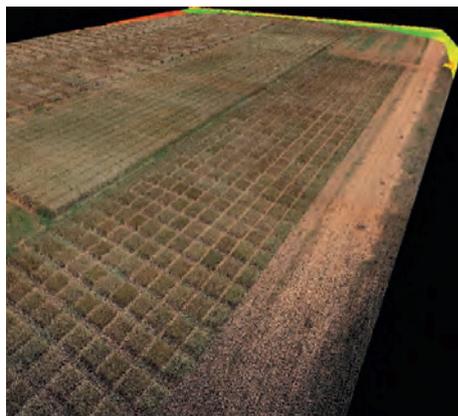


Maptek Vulcan 10.1.

Terra Drone Invests in Lidar Technology

Terra Drone has announced an enhancement of its Lidar capability spanning the agricultural, construction and mining sectors. This follows the appointment of Lidar specialist Jeremy Sofonia, previously of Rhino Imaging, as Terra Drone's business development/ executive manager, based in the company's Australian office in Brisbane. A Certified Environmental Practitioner and a specialist in the application of remote sensing techniques, including unmanned aerial vehicles (UAVs) and aerial Lidar, Sofonia has more than 16 years' academic and professional experience, including working on a wide variety of marine and terrestrial projects worldwide. Utilising Mr Sofonia's extensive local experience, Japan's leading UAV provider is now offering a range of enhanced services for its expanding client base in Australia.

► <http://bit.ly/2qiryFL>



UAV Lidar image of wheat fields.



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Need for New Players and Leaders to Enter the Land Sector

Dr Robin McLaren is a widely known and recognised authority with more than 30 years of experience in the profession. Having developed GIS technology for a number of years, Robin set up his independent consulting company, Know Edge Ltd, in Edinburgh in 1986, providing for GIS solutions for governmental and utilities clients across the United Kingdom. Following an introduction to international land administration and management during a UN-FAO mission to North Yemen in 1989, this became a major market for the company. GIM International interviewed Robin to learn more about his involvement in many innovations and to hear his insightful opinions.

You have been very much involved in the development of fit-for-purpose approaches in land administration. Why is such an approach needed?

It was a pleasure to co-author with Stig Enemark and Christiaan Lemmen (one of the interviewers, Ed.) to create the recently published Fit for Purpose Land Administration Guiding Principles, sponsored by the Global Land Tool Network. My motivation to be involved was threefold: first of all, to reduce the poverty I had witnessed in slums around the world – some two billion people are currently forced to live in such environments. Second, to define a methodology to solve the security of tenure gap that is participatory, quickly scalable, affordable, incrementally upgradable and flexible to accommodate different types of land tenure. And third, to promote a channel for adopting innovative, participatory approaches using mobile technology. And of course, the Sustainable Development Goals and the Global Agenda cannot be achieved without having good land governance in place, including the operational component of land administration systems. Fit-for-purpose land administration is the only show in town to deliver!

Your company is a so-called small to medium-sized enterprise (SME). What role do you foresee for SMEs in the fit-for-purpose world?

SMEs are the engines of many economies and the source of many innovations that are

further commercialised. Within the context of fit-for-purpose land administration, there are key roles for SMEs to play. Think of developing country-specific fit-for-purpose land administration strategies, or formulating economic cost/benefit studies to justify the investments, assessing current capacity in the public and private sectors and developing capacity-development strategies. Or working with land professionals within a country to define their new, enhanced roles within the land administration regime and supporting the development of a network of trusted intermediaries, including training and independent monitoring and evaluation of fit-for-purpose programmes. SMEs add significant value through their independence and inject a combination of innovation and pragmatism.

We're now seeing layered dwelling developments in slum areas. Old derelict building blocks or incomplete towers are being occupied by squatters in some contexts. Is there a fit-for-purpose approach for dealing with this third dimension?

I understand the need to introduce the third dimension into cadastral systems, especially in high-value, urban areas. However, in 2011, when I introduced the concept of crowdsourcing land rights with a focus on innovative solutions for global insecurity of tenure issues, many of the top universities in our domain were focusing their research on Western cadastral systems and the third

dimension. Fortunately, their research is now more balanced across the developed and developing worlds' land problems. Let's create security of tenure around communities at risk and then later solve the intricacies of the internal rights.

During the annual Land and Poverty Conference that was held recently in Washington, you launched together with Prof Stig Enemark a global campaign to eradicate insecurity of tenure. We've seen this type of campaign for diseases such as AIDS, but why now for tenure security?

We are all well aware of the high-profile and well-coordinated campaigns to eradicate infectious diseases. Some have been successful. Smallpox affecting humans was officially eradicated in 1980. Several global campaigns to eradicate AIDS, polio, guinea worm disease, yaws and malaria are under way. Although insecurity of tenure is not a disease, its impact is nevertheless devastating in terms of trapping people in poverty, displacing communities, reducing food security and creating hunger. So why not raise the profile of the insecurity of tenure 'disease' and initiate a global campaign that is high profile and maybe celebrity-led. Leonardo DiCaprio is a champion for climate change and even raised the issue in his Oscar acceptance speech. I strongly believe that land sector communities have a key role in collaborating to solve the 21st-century global problems and need to be encouraged to be

more ambitious in their goals. They need to seek out new partners to support innovation, adopt highly scalable approaches, collaborate more effectively under this common objective to eradicate this scourge on the Earth – and create land rights for all. This proposed global campaign could well be the necessary catalyst for change to finally deliver this human right. If we don't, then others will quickly step into the vacuum.

It's a very ambitious campaign; you talk about achieving 80 percent global security of tenure by 2030. Earlier this year, you said in a column in GIM International that land professionals have been guilty of designing and implementing land administration solutions that are inappropriate and non-sustainable for developing countries. How do you envisage involving those professionals? Or are you looking to new partners and communities to achieve results?

Over the past 20 years I have been an active member of the International Federation of Surveyors (FIG) and my 'campaign' has been to take FIG members – land professionals, as I call them – out of their comfort zone and encourage them to start to adopt innovative approaches and technologies that can deliver more meaningful services to citizens at scale. This has included NSDIs (national spatial data infrastructures, Ed.), crowdsourcing of land rights and most recently fit-for-purpose land administration. However, the more traditional factions of the profession are trapped in the past, fighting radical change and defending their fiefdoms – I am perceived as the heretic!

The need for radical change is obvious if we look at our track record in attempting to reduce insecurity of tenure in developing countries. Governments, aid agencies, development banks and non-governmental organisations have made significant investments in the land sector. However, I would argue that they've not been successful in truly scaling up their solutions to make a major impact on implementing this human right in developing countries – with the exceptions being the fit-for-purpose approaches adopted in Rwanda and Ethiopia and now being initiated in Indonesia, for example. This lack of success has resulted from delivering inappropriate and unsustainable solutions and is compounded by broadcasting different and confusing messages to the recipients of aid from a very

fragmented and diverse set of land sector communities – just look at the number of NGOs! I am not witnessing a ground swell of support across the land sector to rethink our approaches and to better coordinate our resources. I believe that a new set of partners – service providers and technology companies – is required to inject new innovation and energy into our sector to achieve the ambitious goals of this proposed global campaign. And of course we need to take the majority of the land professionals with us. There are great opportunities ahead.

So as-yet-unknown innovations and solutions may be needed – not only for the polygons representing spatial units, but also for the identification of people. How can it be done?

Before mentioning the advances in technology, I should emphasise that building sustainable land administration systems is not just a technical fix. New technical solutions will play a key role, but crucially this global campaign will only succeed if it's driven by adopting the fit-for-purpose land administration approach and generating strong political support. Enough evidence of innovative technical solutions is emerging, especially from Earth observation applications, to predict that they will be game changers to accelerate the capture of land rights and to achieve the campaign's objectives and time frame. Examples of emerging innovative technologies include DigitalGlobe's Tomnod platform, which is using artificial intelligence powered by crowdsourcing to automatically identify features of interest in satellite and aerial imagery. Meanwhile, Facebook recently used artificial intelligence software to scan about 15 billion satellite images to identify human-built structures, through automatic feature extraction, in 20 countries across Africa. And its4land is researching the semi-automated extraction of parcel boundaries from airborne laser scanning data.

Can we use and trust global platforms as Google, Microsoft Virtual Earth, Facebook and LinkedIn?

These global companies and their platforms are increasingly supporting, influencing and shaping our lives and commercial ventures. In many ways it's scary just how much power and influence they have. We need to trust them. So it's good that they can be challenged. In Europe, for example, Google stands accused of using its influence as a



search engine to extend its power to adjacent businesses. As these global companies grow and become even more influential and powerful, then they will inevitably attract the regulator's attention. For example, Amazon's cloud computing arm, Amazon Web Services, powers its operations as well as those of other firms, including many involved in the land sector. If Amazon does become a utility for commerce then the calls will grow for its regulation. This can only build more trust.

How can we avoid situations in which land owners living in poverty sell their land for a very low price? How can they be protected?

Land rights initiatives that do not support communities in establishing systems for transparent, just and equitable administration of those lands will inevitably invite mismanagement, corruption and local elite capture. To address these concerns, registration of land rights must be accompanied by authentic land governance changes that help communities to establish intra-community mechanisms to ensure good governance, intra-community equity, sustainable natural resource use and authentic community approval for all transactions with outside investors. I like Namati's approach which has been successful in places like Liberia, Uganda and Mozambique.

Another innovative approach to avoid this unintended consequence has been adopted by Landmapp for their target customers of

only has around 30 registered land surveyors. So the fit-for-purpose approach advocates the use of a network of locally trained land

administrative in nature rather than an integral part of the judicial process. This will remove one of the bottlenecks and free up court time to resolve the considerable number of land disputes.

THE LAND ADMINISTRATION PROCESS SHOULD BE ADMINISTRATIVE IN NATURE RATHER THAN AN INTEGRAL PART OF THE JUDICIAL PROCESS

smallholder farming families. They not only provide official titles, but also create a profile with which smallholders can access technical and financial services precisely tailored to their circumstances. Packaging land rights with other services to improve livelihoods must be the way forward.

Does this involve considerable human resources such as surveyors and lawyers? Or can people do it themselves?

This is a key issue: we do not have sufficient land professionals to quickly scale up land rights programmes. For example, Uganda

officers acting as trusted intermediaries and working with communities to support the identification and adjudication process. This approach builds trust with the communities and allows the process to be highly scalable. In Rwanda, over 100,000 people were employed over the programme lifecycle and 800 local trusted intermediaries were employed at any one time. Land professionals need to effectively engage and support this new type of resource and maybe FIG should officially designate this new genre. And then there are the lawyers! Wherever possible, the land administration process should be

Who will pay? Can investors be involved here? They don't want to be associated with headlines about land grabbing, do they?

You are correct. Land is perceived to be a high-risk agenda topic for politicians and potential investors, and this compounds the lack of interest and investment in land solutions. The fit-for-purpose land administration approach and the global campaign for security of tenure will only work once there is political will within countries. We need to work harder at obtaining this political understanding and desire to solve countries' land issues. Once the political will is strong enough, then the risk for investors will decline. We also have to adopt more sustainable business models to support the scaling up of land rights programmes.



▲ Views of Scotland, Robin McLaren's beloved homeland.

There is wide support for the idea that you should not initiate land administration without a maintenance organisation. How will this be included in your idea?

It is essential in the fit-for-purpose approach to land administration that processes and resources to validate and maintain the land rights information are an integral part of the initial programme design and these should be in place from the first day of operation. The importance of this is often neglected and, once initial titles are issued, there is often little pressure to keep the registry information up to date. A network of trusted intermediaries must be retained to adopt this crucial role. It is estimated that an average five percent of all land rights will require maintenance annually. Mobile technology is ideal for this activity.

What have been the reactions to your initiative so far?

Deafening silence! I thought that the World Bank, DFID and USAID as the major players in the land sector would comment. But no, not even the Global Donor Working Group on Land has reacted. This lack of response has

just emphasised the need for new players and leaders to enter the land sector.

What is your message to our readers?

This challenge of initiating a global campaign provides an opportunity for land professionals to rethink their strategy for coordinating,

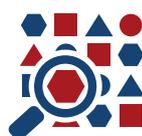
designing, communicating and solving global land issues. Inward-looking politicians must not sideline the global land issues, and land professionals need to retain their global perspective and values. So wake up, land professionals, and become part of this revolution and global campaign! ◀

ABOUT ROBIN MCLAREN



Dr Robin McLaren is director of Know Edge Ltd, a UK-based, independent management consulting company formed in 1986. The company supports organisations to innovate and generate business benefits from their geospatial information. Robin has supported national governments in formulating national spatial data infrastructure (NSDI) strategies. He led the formulation of the UK Location Strategy and has supported similar initiatives in Kenya, Hungary, Iraq, Western Australia, Kuwait and Canada. He has also supported the implementation of the EU INSPIRE Directive in the UK and was a founding member of the UK Location Council. Robin is recognised as an expert in land information management and has worked extensively with the United Nations, World Bank and EU on land policy/land reform programmes to strengthen security of tenure and support economic reforms in Eastern and Central Europe, Africa, the Middle East and the Far East. He has co-authored the FIG/World Bank publication on fit-for-purpose land administration and the more detailed Fit-For-Purpose Land Administration Guiding Principles for the Global Land Tool Network, providing legal, spatial and institutional guidance aimed at developing countries. His recent research explores the innovative use of crowdsourcing to support citizens in directly capturing their land rights. His current interests are focused on integrated land management strategies and how to convince decision-makers to adopt fit-for-purpose land administration approaches.

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HOW OPEN DATA FOR CADASTRAL RECORDS IS GAINING TRACTION

Shedding Light on the Land Sector

Despite the enormous importance of good land governance for sustainable economic growth and social justice, land administration remains a sector that is lacking openness and transparency in many parts of the world. Land registry and cadastral records are often deemed too sensitive to share, unless acquired for a fee, or the records themselves may be unreliable or in formats that are not easily accessible. In geographies where the rule of law may not be strong, this presents opportunities for government abuse and corruption.

A 2013 study by Transparency International found that one in five people around the world reportedly had paid a bribe for land-related services. In Kenya the average bribe paid for land-related services was found to be more than USD100. When this is added on top of the normal transaction fees, the total transaction costs can exceed ten percent of the average annual household income. Against this backdrop, it is no surprise that many households refrain from registering their property.

OPEN DATA

The idea of open data is not new, but traction in the land sector has been slow. Both the Open Data Barometer and the Global Open Data Index rank land ownership information as being far behind in its level of openness as compared to other datasets such as government budgets and national statistics. Open data often refers to data that can be freely used, reused or redistributed – usually with the only restriction being to give attribution to the originator of the information.

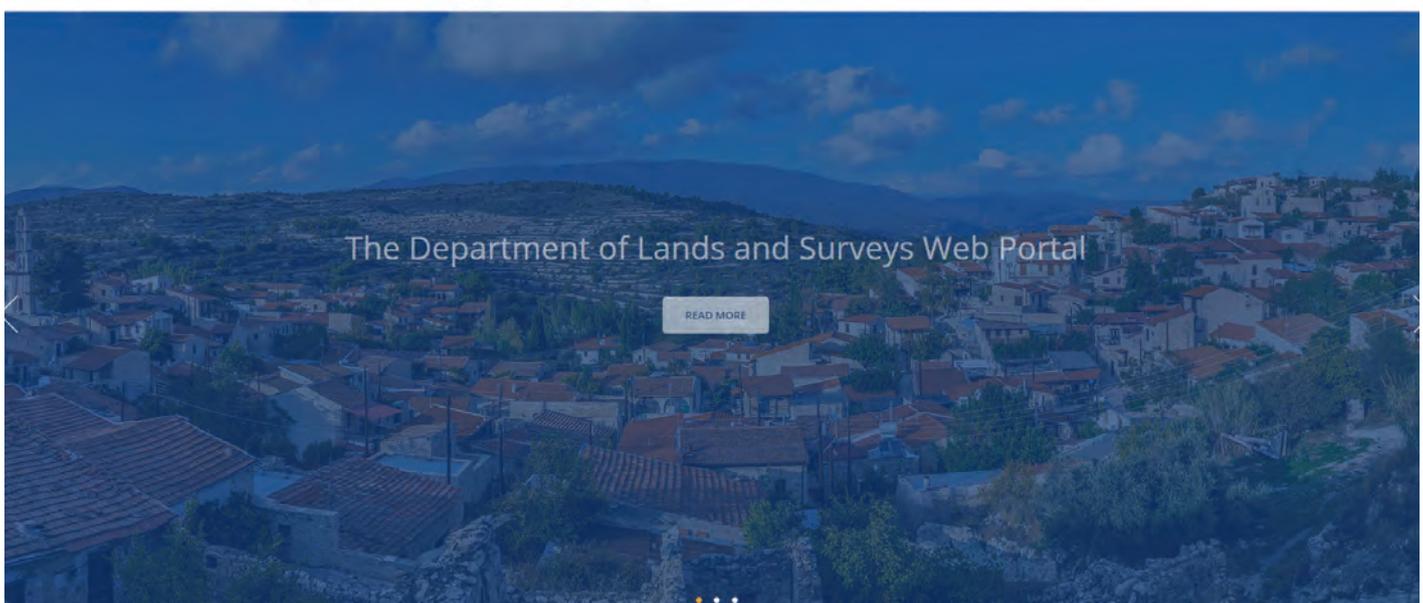
From a government perspective, opening up access to public data can help facilitate transparency, accountability and public participation. Increasingly, governments are also recognising how open data strategies can support innovation and generate economic value. According to a 2016 Gartner report titled *Market Guide for Government and Open Data Management Platforms*, 80 percent of organisations will be incorporating open data sources into their analytic solutions by 2017. A further 15 percent of global organisations



REPUBLIC OF CYPRUS | MINISTRY OF INTERIOR
DEPARTMENT OF LANDS AND SURVEYS



CITIZEN PORTAL | ELECTRONIC APPLICATIONS | INTERACTIVE MAPS | INSPIRE GEO-PORTAL



▲ Figure 1, The Cyprus Department of Lands and Surveys Web Portal.

will be using linked data methods to create applications to generate alternative revenue streams.

LAND SECTOR

When it comes to open data in the land sector, one question that arises is which data to share. In many countries, there may be legal or cultural restrictions on the level of personal data that can be released. As a result, most open data initiatives in the land sector have focused on publishing some combination of parcel and administrative boundaries, addresses, tenure type, parcel ID numbers, parcel size, property values and land use. Although not complete, this information holds tremendous value for

real estate professionals, utility companies, homeowners, planners, insurance companies, fire and emergency response, entrepreneurs and citizens. The inability to easily access such information in many parts of the world increases risks and drives up costs for anyone trying to acquire, lease, develop or service a property.

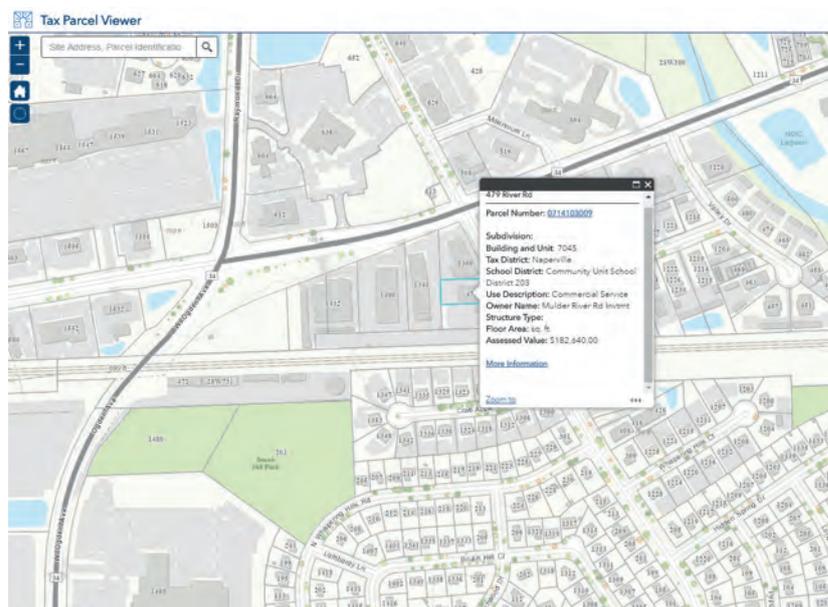
CYPRUS

Regardless of the slow pace at which governments are sharing their land administration data, there do appear to be some encouraging trends. The European Union's INSPIRE Directive requires member states to publish the geography of cadastral parcels. This has served as an

impetus for many European Union states to increase access to their cadastral data. One example is Cyprus, which recently launched a web-based portal for different sets of geographic data (see Figure 1). It is accessible to government staff and the public and consists of an easy-to-use website where all information regarding the department and its operations can be found. It also includes a public-facing GIS page that serves cadastral, topographic and hydrographic data, and an e-Applications Dashboard with various online applications such as Property Search, Provision of Vector GIS Data, e-Discharge of Mortgages, Sales Information to Valuers, Vector Information to Private Surveyors and more. In addition, a dedicated INSPIRE GeoPortal platform is integrated inside the Department of Lands and Surveys (DLS) Web Portal [<http://portal.dls.moi.gov.cy/en-us/homepage/pages/default.aspx>], helping to fulfil the requirements of the INSPIRE Directive for Cyprus. The DLS portal is now the one-stop shop for Cyprus relating to all real property information. Before implementation, the department collected a plethora of land record data, some of which was over 100 years old. Whereas it was once time-consuming and inefficient to manage, the process for organising and sharing the data is now quick and a routine part of daily operations. This has helped decrease turnaround times for common information requests, improving service delivery for the public and reducing operational costs for the department.



▲ Figure 2, Community Cadastral Map of Canada portal.



▲ Figure 3, Example of a Tax Parcel Viewer Web Application and the property data made available.

CANADA

In addition to enhancing service delivery, publishing land-related data can improve emergency response, increase public participation in planning, and provide standardised access to land and property attributes that may have previously been spread across multiple jurisdictions. For example, the Community Cadastral Map of Canada [CanadaCadastral.Maps.ArcGIS.com] provides a single, online national cadastral map that aggregates and standardises cadastral data from federal, provincial and municipal sources (see Figure 2). The map includes information on parcel boundaries, identifiers for registered titles, assessment, survey and zoning parcels, and direct access to additional data from the systems of participating jurisdictions. The Community Cadastral Map of Canada is based on the Community Map of Canada, which is a single, standardised national topographic

and imagery map aggregated from multiple levels of government. The Community Map of Canada currently serves more than 200 million map requests per month from users across government, the private sector and academia.

WEB GIS

Both the Cyprus and Community Cadastral Map of Canada websites leverage the web GIS pattern. This allows organisations to securely share authoritative cadastral maps, applications and other geographic information over the internet with groups both inside and outside of an organisation. In the case of Cyprus, ArcGIS for INSPIRE was utilised, which provides a powerful and modern web GIS solution to help organisations meet current INSPIRE requirements for supporting data, services and metadata. The Community Cadastral Map of Canada is based on ArcGIS Online, which is Esri's cloud-based mapping platform. These portal websites are configurable, allowing organisations to easily adjust the appearance of their web pages and set which services, applications and basemaps are available.

PUBLIC ACCESS

Through its work with governments across the globe, Esri has learned that providing access to data is only the first step in terms of supporting an open data initiative. Open data can also be brought to life through creation of tools and applications such as the Residential Comparable Sales Finder, which is a free application that lets the public compare recently sold properties and evaluate their characteristics. Another application called Parcel Viewer (<http://statalocaltryit.maps.arcgis.com/apps/webappviewer/index.html?id=e03ee104d0d34c32990a731e2014f2f9j>) (see Figure 3) enables quick and easy public access to cadastral maps and related parcel attributes through a modern look and feel. These are just a few examples of the free applications that could be deployed using a replica of authoritative data. In addition to these existing industry apps, online resources facilitate fast, free and configurable web application development that can help meet the needs of government, business and the public (see Figure 4).

HACKATHONS

Providing tools and applications for stakeholder use and data analysis is part of the process of getting smarter about open data. It is not only about how much data is posted, but also



▲ Figure 4, Web AppBuilder for ArcGIS.

which datasets are best and which have value. In addition to prioritising the data to release, it is also important to keep it up to date, usable and interoperable. Utilising standards can help ensure that an organisation's data can be enriched with other sets of information, which is where one derives valuable insights. Hosting hackathons can be a constructive way for developers, designers and entrepreneurs to leverage open data for the resolution of real-world problems. By integrating cloud, web and mobile technologies with publicly available property information and analytics one can create applications that can serve a various stakeholders, ranging from real estate developers to citizen journalists and the general public.

CONCLUDING REMARKS

Whereas publishing geospatial data used to be a time-consuming and costly endeavour, it is now becoming a routine part of daily operations for many cadastral organisations. Initial fears over the loss of revenue from the provision of data have been replaced by the potential return on investment associated with improved data management. The cost savings from eliminating the workload associated with redundant requests from multiple government agencies, fulfilling data orders and collecting and accounting for related fees are substantial. Governments also stand to gain from increased land market activity, tax collection and the broader economic development that can be spurred by making cadastral data more readily accessible. A 2016 study carried out by ConsultingWhere Ltd. examined the financial

costs and benefits of address and street data for local authorities in England and Wales and found a net benefit of approximately GBP86 million in savings between 2010-2015. These returns were largely driven by reduced data duplication, improved tax revenues and route optimisation in waste management. Similar studies in other geographies have found similar returns on investment. The business case and technology platform for open data is there. It is now time for cadastral agencies to reposition themselves at the heart of their respective nation's spatial data infrastructure. ◀

ABOUT THE AUTHOR



Tim Fella is the global business development manager for land administration at Esri. He has broad experience with land tenure and land administration issues from around the globe. Just prior to Esri, Fella led new business development and consulting for the land and natural resources sectors at Indufor North America. Before that, he spent approximately ten years with the U.S. Federal Government (Millennium Challenge Corporation & USAID) where he led the design, management and evaluation of large land administration reform projects for national governments in more than 20 countries across Africa, Southeast Asia and Latin America. During his final year at USAID, he was nominated to chair the working group on land rights for the White House National Action Plan for Responsible Business Conduct. Tim Fella has a master's degree in social sciences for international development and a bachelor's degree in international relations.

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Heritage BIM on the Move

Building information modelling (BIM) is becoming a useful approach in the documentation and enhancement of historical structures in a system termed historical BIM (HBIM). It is not easy to convert point clouds into a 3D model since the buildings concerned often have very irregular geometry. Therefore, more semi-automatic parameterisation tools are needed. Portable, user-navigable HBIM databases offer interesting potential to broaden the use of cultural heritage information.

Historical building information modelling (HBIM) can be defined as a semantic-aware database of historical buildings, in which the geometric model is connected to descriptive multi-source information. Historical buildings are usually examples of stratified artefacts with non-regular and complex geometry, unlike modern constructions which commonly have regular geometry. Reality-based spatial data from advanced geomatics

3D modelling techniques can provide an accurate reproduction of those buildings, with all the information connected, although the heterogeneous characterising shapes are a big challenge when modelling the geometry. Most of the time these shapes have to be remodelled manually, since effective automatic recognition is not yet sufficiently developed. The aims, structure and scale – and thus the expected level of detail of the

model – greatly influence the approach to data acquisition (sensors, accuracy) as well as data processing.

SHAPE MODELLING

Architectural shapes – surfaces (planes, curves or extrusion), volumes and complex objects – have to be recognised and segmented from the raw 3D data to be embedded in the HBIM. Geometric shape



▲ Figure 1, The Hall of Columns in Valentino Castle. The architectural elements were segmented into groups with different levels of shape recognition difficulties, and treated accordingly. The final HBIM structure includes all elements.

modelling is based on: 1) manually modelling volumes and shapes from scratch; 2) making cross sections and surface extrusion using semi-automatic procedures; and 3) automatically fitting primitives to the point clouds through feature extraction. The choice depends on the feasible level of parameterisation for each individual element.

The first step in the BIM structuring workflow is the modelling of shapes. The next step is the semantic modelling: recognition and categorisation of objects. The final step is the modelling of relationships between objects. One area of interest in the geomatics field is the availability of effective tools for the acquisition of suitably dense point clouds. Also high on the research agenda are processing algorithms for the geometric modelling and model segmentation, without the loss of non-metric information closely connected to the geometry of the artefact.

Besides the from-scratch shaping, an as-built point-cloud-based model could be made from several types of objects. Standard objects comparable to simple shapes (regular floors or walls) can be easily identifiable by algorithms implemented into modelling tools using commercial software. Complex objects (columns, frames, niches, mouldings, pilasters, stucco, roofs) require

local modelling to define parametric rules from adapting constraints on metric data by processing the point cloud. When custom libraries are inadequate, local objects (irregular shells, vaults, ornaments) should be designed, making use of ad-hoc feature extraction and adaptive complex surfaces with B-rep algorithms or via non-uniform rational basis splines.

VALENTINO CASTLE

One example comes from a historical building in Turin, Italy: Valentino Castle, headquarters of the Architecture Department of Politecnico di Torino (see Figure 1). The HBIM model was conceived for the ground floor of the Hall of Columns. An integrated 3D survey was performed using Lidar and close-range photogrammetry. With the output, a historical model based on the optimised point cloud was calculated and parameterised. This point cloud has been segmented into architectural elements that have different shape-recognition difficulties. For example, the walls and floor were easily identifiable by fitting algorithms; the columns and frames could be modelled as parametric local families. However, since standard vault creation has not been effective in BIM platforms, creation of the vaults needed an ad-hoc modelling approach. This was realised by the extraction of the groins starting from cross sections of

the vault surface. The final HBIM structure included all the architectural elements.

PORTABLE NAVIGABLE DATABASES

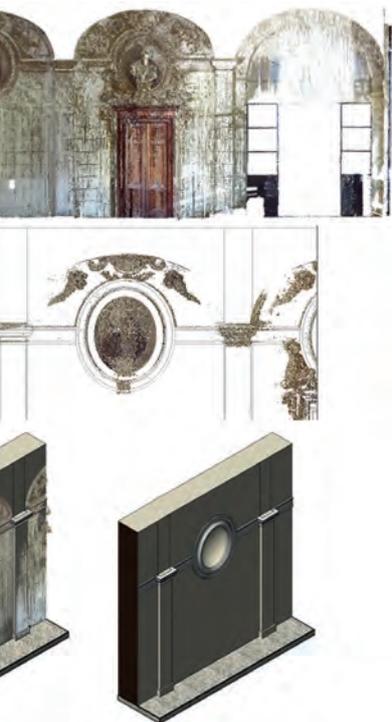
The 3D BIM models facilitate information sharing and ongoing updates. Moreover, BIM databases on portable devices offer very interesting potential for an applied use of models in the building conservation

(H)BIM WORKFLOW AND TOOLS

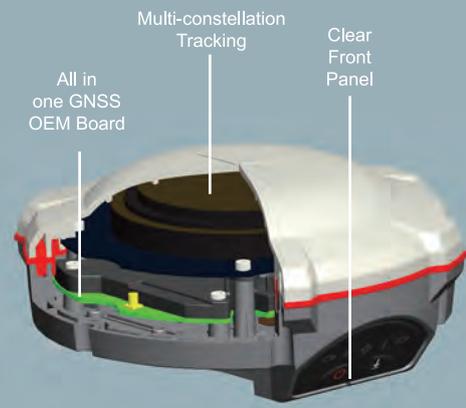
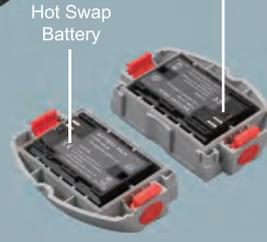
Building information modelling is an 'intelligent' approach in design workflow. Thanks to the additional information stored in the shared BIM database platform, it differs from common 3D modelling by facilitating multidimensional control. Today, the prefix 'multi-' means seven dimensions: 3D + time + cost + sustainability + facility management. Historical building information modelling can be defined as a semantic-aware database regarding historical buildings, in which the geometric model is connected to descriptive multi-source information.

The workflow for HBIM projects starts with data acquisition from various different sensors according to the context requirements and the expected outputs. Then, the surveyed point clouds have to be pre-processed and reduced with various systems and dedicated software, and perhaps adapted for segmentation using automatic or semi-automatic object recognition into a BIM platform. Furthermore, elements will be modelled and converted into an approximation of reality according to parametric rules, so it is possible to adapt each instance of the model. Finally, the shapes and the identities of objects must be linked by accurate and solid relationships according to the semantic definition of entities. From that moment, the model is ready to be explored with other information for analysis and monitoring over time. Nevertheless, the manual generation of 3D models connected to as-built BIM is complex and time-consuming. Since the costs and skills for processing the data mean that this approach is not sustainable, more automatic or semi-automatic tools for parameterisation of metric and non-metric information are needed.

BIM platforms offer dedicated embedded tools or plug-ins: 3D modellers, viewers, analysers. They assist in point cloud optimisation and processing in order to produce geometric modelling, feature extraction and parameterisation in heritage buildings. Some commercial ones include ArchiCad BIMx by Graphisoft, Scan-to-BIM by IMAGINiT, Revit by Autodesk, BIM360 by Autodesk, Recap by Autodesk, PonitSense by FARO, Leica CloudWorx, Green Spider, Bentley MicroStation V8i and Tekla Structures. Some open-source alternatives are Edificius, Tekla BIMsight and Autodesk Navisworks Freedom by IMAGINiT.



GNSS RECEIVER T300

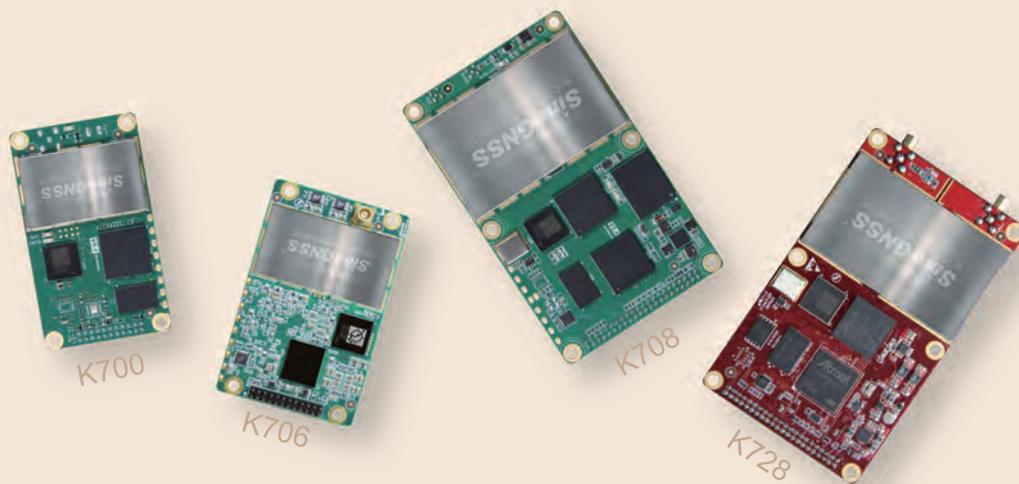


THE NEXT LEVEL RTK

GNSS RECEIVER M300 Pro

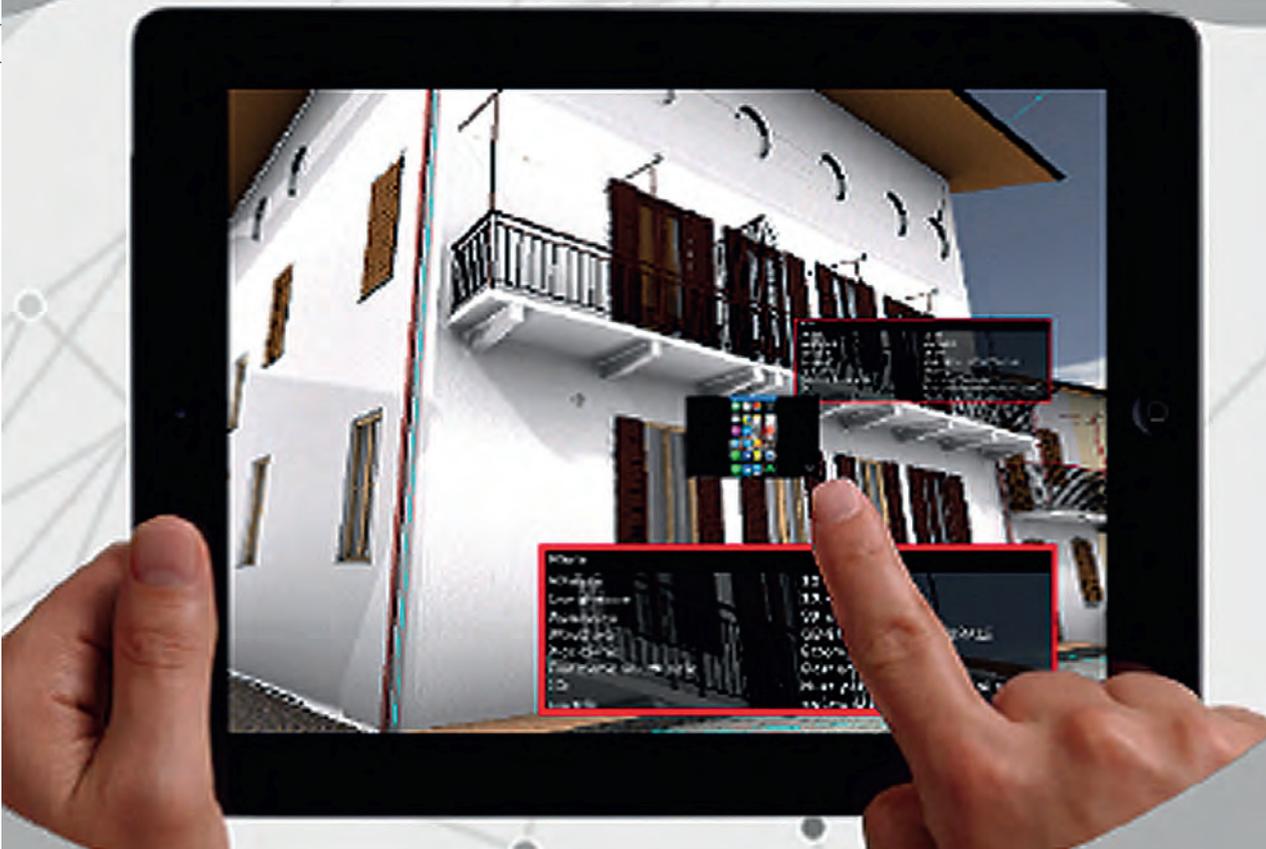


THE NEXT GENERATION CORS RECEIVER



THE NEW GENERATION K FAMILY GNSS BOARDS





▲ Figure 2, A portable and navigable HBIM of the town of Pollenzo.

domain. A user-oriented model can be useful to analyse the building with the information ex-post (highly detailed model). It can also be utilised to create and adjust the building information model directly on site in real time during the conservation and restoration phase. That entails a less specific and more convenient model since a lower level of detail (LoD) is required. To optimise and pre-process for the desired LoD, it is necessary to differentiate and pre-determinate models from 3D surveys – for both the structure and the embedded

information. Figure 2 shows a portable and navigable HBIM model of the town of Pollenzo (the ancient Roman city of Pollentia in northern Italy). After the 3D metric documentation by integrated terrestrial and aerial sensors, the model is navigable and queryable on a tablet, for instance.

The advantages of portability and the ease of information sharing encourage the use of HBIM models in a wider community. It is possible to generate models for specific applications including: museum installations

and popularisation projects; for specialists in architecture, restoration and structural engineering; for 3D (city) GIS; and also for immersive virtual reality (VR) / augmented reality (AR) experiences. ◀

FURTHER READING

Murphy, M., McGovern, E., Pavia, S. (2013) Historic Building Information Modelling – Adding intelligence to laser and image-based surveys of European classical architecture, *ISPRS Journal of Photogrammetry and Remote Sensing*, Volume 76, February 2013, pages 89-102, ISSN 0924-2716, <http://dx.doi.org/10.1016/j.isprsjrs.2012.11.006>.

Volk, R., Stengel, J., Schultmann, F. (2014) Building Information Models (BIM) for Existing Buildings – Literature review and future needs. *Automation in Construction* 38, pages 109-127, DOI: 10.1016/j.autcon.2013.10.023.

Del Giudice, M. and Osello, A., 2013. BIM for Cultural Heritage, CIPA Strasbourg: BIM for Cultural Heritage, *The International Archives of the Photogrammetry, Remote Sensing and Spatial Information Sciences*, XL-5/W2, pages 225-229.

Tang, P., Huber, D., Akinci, B., Lipman, R., & Lytle, A. (2010) Automatic reconstruction of as-built building information models from laser-scanned point clouds: A review of related techniques. *Automation in Construction*, 19(7), pages 829-843. DOI: 10.1016/j.autcon.2010.06.007

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All three authors are members of the Laboratory of Geomatics for Cultural Heritage and of the DIRECT Team for emergency surveying in heritage contexts. For this article they acknowledge the MSc theses of D. Leoni (2016, LiDAR and HBIM technologies: a proposed approach applied to the Valentino Castle) and of M. Somano (2015, From point cloud to BIM. Testing on the Roman amphitheatre in Pollenzo).

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INSTITUTION OF SURVEYORS OF KENYA DEMONSTRATES ALTERNATIVE APPROACHES

Handheld Land Administration Mapping Methods

Fit-for-purpose methods of land administration have been tested in Kenya, with a focus on the provision of land titles with inclusiveness for all in an approach that is affordable, fast and 'good enough'. Earlier this year a group of Kenyan surveyors performed a field test in Makueni County, collecting land data using handheld devices. This first test was a learning experience; a more comprehensive test must be conducted to prove the scalability of the approach.

The fit-for-purpose approach recommends the use of 'visual boundaries' to identify the delineation of land rights. There are many naturally visible boundaries in rural areas in Kenya, and the local people have made some other boundaries visible using sisal plants. During the field test performed by a group of Kenyan surveyors to trial a fit-for-purpose approach, all boundaries were easy to identify in the field and on satellite imagery. After being identified in the field, the visual boundaries were then drawn in an analogue manner using a pen or 'digitally drawn' using handheld GPS devices on top of imagery.

ALL LAND RIGHTS

Making an overview of all existing people-land relationships includes formal ownership and informal land use, as well as possession and occupancy of lands. The overview of the existing situation should also reflect overlapping claims, disputes and conflicts, since it is crucial for the authorities to get an overview of spatial units or boundaries under dispute. This 'dispute map' is the starting point in supporting the dispute resolution procedures. Dispute mapping is already done in other countries, just as imagery is used for cadastral mapping. The test in Kenya was an initiative by the surveying community to find out how to organise support and nationwide introduction of a fit-for-purpose approach.

PARTICIPATION

Community involvement is the basis for success. Cadastral survey requires the participation of neighbours, family members, etc. Therefore, the village elders and other villagers are informed in advance to ensure awareness and involvement of all parties (see Figure 1). Everyone can monitor the on-site process in the field. During the field test, the collected data was transmitted from the mobile device directly to a cloud-based GIS environment, enabling everyone to follow the process remotely and creating 'remote participation'.

HOW DOES IT WORK?

Fieldwork is about creating an overview of all existing people-land relationships, including formal ownership and informal land use and also overlapping claims. Villagers and farmers are invited to walk the perimeters of their land parcels and point to the vertex points of the boundaries themselves using a GPS antenna. An experienced surveyor or grass-roots surveyor records the observations with the Collector app from Esri. Satellite imagery of the area is displayed on the screen of the mobile device (see Figure 2). Data collection is done in an integrated way: the perimeter



▲ Figure 1, Community members and village elders are informed.



▲ Figure 2, Cadastral boundaries are digitally drawn by the people themselves, using handheld GPS devices.

is stored as a closed polygon together with the claimed type of right combined with a photo of the owner or claimant and a photo of the owner's or claimant's ID (Figure 3). A preliminary identifier is used as linking key. Accuracy is not so much about the geometry, but is rather focused on linking spatial and administrative data or, in other words, linking people to polygons. Since citizens

are required to provide proof of their identity, the government has to be represented in the field. This is of general importance for the success of this methodology.

DISPUTES

It is crucial to get an overview of parcels or boundaries under dispute and at the same time an overview of all the areas which are

not under dispute. 'Dispute holders' need to 'agree' on the area and location of the dispute. During the adjudication process in the field, disputes may lead to the creation of overlaps between polygons. In that case, those overlaps are mapped and the corresponding authorities know the exact location of which type of land-related conflict.

DATA HANDLING

After field data collection, the data must be checked for completeness and prepared for public inspection. Some editing was needed in order to present the spatial data – this concerned mainly the calculation of average locations of boundaries based on the input from the neighbour on each side of the boundary.

PUBLIC INSPECTION

Usual procedures, such as public inspections, are conducted at village meetings – often in the local town hall – accompanied by trusted third parties. At a village meeting (which in the field test was held in the local church), community members gather to view all the collected data on a map and discuss and reconcile the results. In the field test, the presented data was loudly confirmed by the community.

CONFIGURATION

The design environment in this case is based on Esri's Collector app, which enables very efficient data collection. The app is used in combination with a GPS device for sub-metre accuracy, via a Bluetooth connection. Devices from Trimble and other suppliers can be used. Lightweight devices in the field are very efficient to use in mountainous Kenya, and the tools and technologies to develop the application are available. The GPS device requires a correction signal for correction of atmospheric distortions of the GPS signals. Sub-metre accuracy is sufficient. High accuracy is not needed – no beacons need to be placed. It is important to gain an overview of the plots with a highly reliable link to the type of right and the owner. If necessary, placing beacons and highly accurate surveys can be done later during the maintenance phase. This can also be done by the people themselves.

FIELD TEST

The field test conducted in Makueni County in 2017 demonstrated that the field data collection and data handling can be carried out quickly, affordably and reliably. This test was carried



▲ Figure 3, Taking a photo of a land right holder's ID.

out by the Institution of Surveyors of Kenya, the National Ministry of Lands, Housing and Urban Development and the Ministry of Lands, Mining and Physical Planning in Makueni County, in close collaboration with software and hardware providers.

INSTITUTIONAL COMMITMENT

There is attention to this approach at the highest level. Prof Jacob Kaimenyi, the Minister of Lands, Housing and Urban Development of the Republic of Kenya, welcomed a delegation from the Institution of Surveyors of Kenya (ISK) and Kadaster International to his office at Ardhi House in Nairobi. The delegation informed the minister about the goals and potential impact of the test and introduced the fit-for-purpose approach to land administration. The chair of ISK explained the benefits of the approach, and this topic now has the minister's attention.

Prof Kivutha Kibwana, a representative of the Governor of Makueni County, and the Minister of Lands, Mining and Physical Planning of Makueni County welcomed the delegation to the Governorate of the County. The test was done in this county and had permanent attention of the minister herself. The word of welcome was followed by intensive discussions on the approach: on participation, on quality and costs, on time effectiveness, on the need for monumentation, on accuracy versus coverage, etc. The minister underlined the importance of alternative approaches. However, this innovative approach may have some impact on existing regulations, and there is also the issue of how to store and manage the integrated data. Should the data be divided into a cadastral subset and a registry subset, with different object IDs?

These are important issues to discuss as the basis for future development. A further issue is whether the data can be kept fully digitally after the fieldwork, or whether paper-based storage is needed. Or perhaps a paper copy of the satellite image should be left to the local community as the 'people's data'. Notably, in Kenya it is already commonplace for the boundaries to be drawn by hand on top of imagery, including in the test area (see Figure 4).

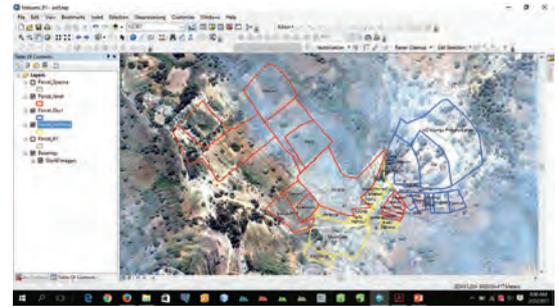
CONCLUDING REMARKS

The field test conducted in Makueni County in 2017 demonstrated that the field data collection and data handling can be carried out in an integrated, participative, fast, affordable and reliable manner. Figure 5 shows the results. Two surveyors collected data about 40 parcels in the space of six hours in a mountainous environment and the results were well received. However, the legal and institutional set-up requires attention in order to be able to implement the approach, and most of the participants agreed that the approach needs further attention in order to bring land titles for all.

It is estimated that, at this point in time, approximately 20% of the land parcels in Kenya have been surveyed (in one way or another) and are registered. The current cost to adjudicate, demarcate, survey, map and register a two-hectare parcel in Kenya is at least a few hundred dollars per parcel. In terms of the total cost, there are an estimated 15 million of parcels still to be included in the registry. It is clear that this amount of money is simply not available.

Alternatives are needed – or should at least be a topic of debate amongst professionals.

An alternative methodology is presented here to ignite this debate. It is proposed to organise this debate now, with an open mind and a focus on the future. A more comprehensive test will lend support into this debate, and ISK is optimistic about the potential. ◀



▲ Figure 5, Results: there is still a gap between GPS coordinates and imagery.

FURTHER READING

Enemark, S., McLaren, R., Lemmen, C., 2015. *Fit-For-Purpose Land Administration – Guiding Principles*. UN-HABITAT / GLTN, Nairobi, Kenya. Available at: FIG and World Bank, 2014. *Fit-For-Purpose Land Administration*. FIG Publications No 60, FIG Office, Copenhagen.

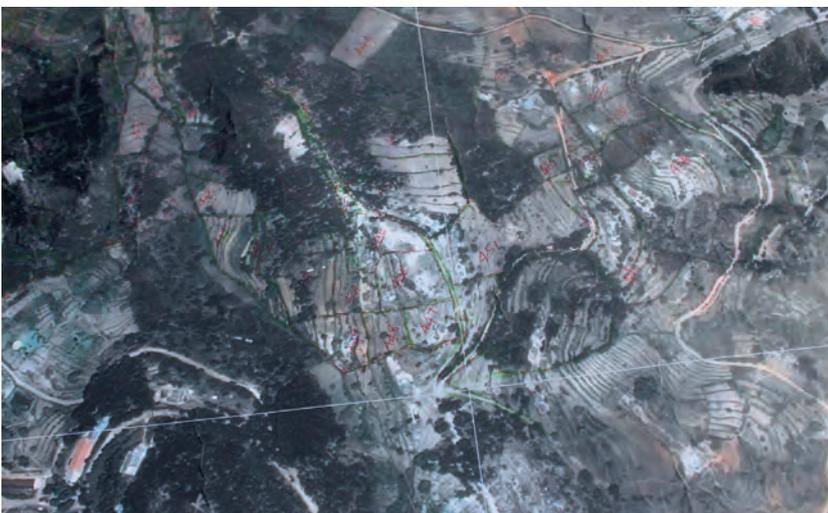
Molendijk, M., Morales, J.M. and Lemmen, C.H.J. (2015) Light mobile collection tools for land administration : proof of concept from Colombia. In: *GIM International*, Volume 29, November 2015.

ABOUT THE AUTHORS

Stephen Ambani, chair of the Institution of Surveyors of Kenya, is a licensed land surveyor with 21 years' experience. He is very passionate about resolving challenges that hinder citizens in acquiring land ownership documents.

Judith Kalinga is the Minister for Lands, Mining and Physical Planning of Makueni County in Kenya. A qualified lawyer, she seeks to use the law to solve land problems rather than compound them. Judith sees a fit-for-purpose approach as a structured way of achieving this objective.

Christiaan Lemmen is geodetic advisor at Kadaster International. He is visiting researcher at the Faculty of ITC, University of Twente, The Netherlands and chair of the Fit-For-Purpose Land Administration Working Group of FIG Commission 7 on Cadastre and Land Management.



▲ Figure 4, Cadastral boundaries are drawn in an analogue manner.

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TAPPING INTO THE VALUE OF THE REAL ESTATE MARKET

Improving Local Government Services in Jamaica

In developing countries worldwide, governments and citizens hold massive amounts of real property and unmovable assets that are hidden or underutilised. Citizens, and in particular the poor, are unable to maximise economic output from real property. The situation in Jamaica was no exception to this problem in 2015. Against this background, the challenge was to design and implement a self-sustaining property information and valuation system which could generate both information and greater tax returns for the government land office. This was an interesting and challenging experience. Not only did it lead to the discovery of a demand across all sectors of society for freely accessible information regarding land and property data, but it also provided an alternative for the private sector to create a transparent, user-friendly, mobile-accessible website that displays all of this data for free. This can be accomplished by using the advertising potential that lies within the value of real estate for sale and rent. This article provides a personal narrative of an incremental research and development experience.

As often occurs, research and development questions emerge while conducting on-site investigations. It was identified from previous work in March 2015 that Jamaica’s National Land Agency (NLA) was still relying on old-fashioned computing technology that was in dire need of an overhaul to improve employee efficiency and productivity.

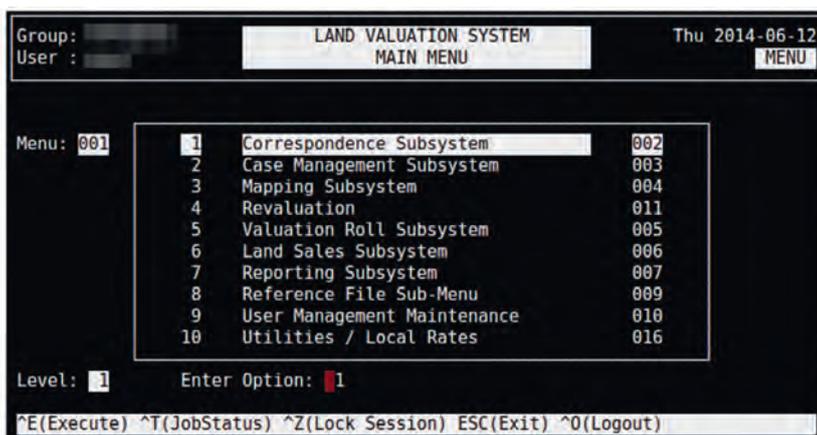
The first issue is immediately clear; the back-end database for the valuation division is woefully out of date. Figure 1 shows a screenshot of the system, called LVS. Designed in the 1980s, it still resembles a DOS interface with DOS-like usability, lacking a spatial component or mouse functions. This is the interface that the Agency uses to maintain the Valuation Roll for all of Jamaica. It is not

only outdated and inconsistent, but also not freely available for public use and scrutiny.

The second major issue is the NLA website, called iMap, that is used to display land information (Figure 2). Some major deficiencies include:

- Poor user interface from an outdated Esri template
- Not enough bandwidth, making it slow or completely inaccessible and forcing NLA employees to use other services that do not offer the same depth of information
- No data integration with other eGovernment services
- Not designed for public consumption and inaccessible from mobile devices
- Outdated imagery – in many parts, coverage is from 2001.

In order to redesign the system, the focus was initially on testing a prototype in a single district and assessing its property data with alternative technologies. Disparate datasets



▲ Figure 1, A screenshot of NLA’s land valuation system.

owns the adjacent lot to the east, the tiny parcel whose number ends -044, which featured a completed 32-unit condo. The market value of the condo is around JMD1.5 billion, yet the parcel is valued by NLA at just JMD1.5 million. The improvement is more valuable by a factor of 1,000 times the land and results in a property tax payment of JMD22,000 instead of JMD8 million. Needless to say, it is difficult to have well-functioning government services when the property tax rate is 0.006%. But the owner of the land is not doing anything illegal. He is utilising a loophole created by the failure of the government to adopt current market valuations for land and tax them appropriately.

The Government of Jamaica struggles to collect property tax on par with OECD countries due to three main reasons. First, compliance rates in Jamaica average only around 50%. Second, only the land is taxed, rather than improvements. Third, the valuation is not pegged to the current market value, but relies instead on values from 2002.

The chart in Figure 5 compares property tax collection of the sample area under Jamaican standards and US standards. On average, Jamaica collects about 9% of what the US would collect in the same area.

CREATING A NEW ENTITY: ITABO

With open government data in mind, the idea arose to create a company called Itabo. Its goal is to dissolve the information silos and create a transparent real estate market built on a comprehensive database.

Leveraging the US Open Data Initiative and a location-based, targeted advertising revenue model, Zillow (the leader in this field) has maintained free access for all users. While ample opportunities for similarly targeted advertising exist in Jamaica, US companies are not interested in taking on the challenge of moving abroad. But where they see obstacles, there is an opportunity, a step toward achieving transparency in property transactions worldwide. As such, Itabo’s focus is on the development of a mobile-responsive platform. Pending traction in Jamaica, the plan is to expand into greater Latin America.

CONCLUSION

As stated earlier, whilst the focus was not only on analysing the problems of land data in Jamaica, the work also served to identify – or in this case, create – potential solutions. There are myriad Jamaican websites that display properties for sale. Anyone can create a classified advertisement with a sale price and photos. However, to make an informed decision about selling or purchasing property, considerably more data is needed. In Jamaica, this information-intensive process poses an immense challenge. Once you find a property for sale on one of the aforementioned websites, you need to visit another website to find its parcel boundary. You then make your way to a third website for land value, a fourth for sales data, and a fifth for property tax records. Each of these websites presents its own obstacles for the user, be it a high subscription fee, lack of mobile accessibility or a complex interface

Property Tax Comparison to US

Country	Jamaica	US
Market value/parcel	\$1mil JMD	\$4.6mil JMD
Improvements taxable?	No	Yes
Tax base	\$377mil JMD	\$3.5bil JMD
Tax rate	1.5%	1%
Compliance	50%	95%
Property tax collected in Springfield	\$2.8mil JMD	\$33mil JMD

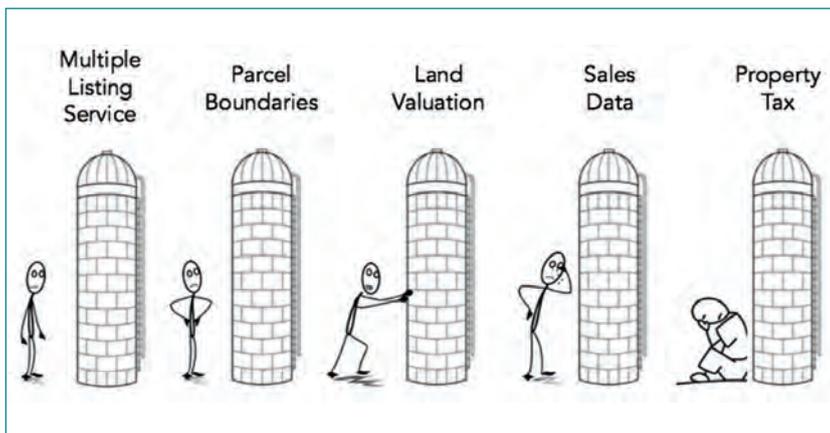
▲ Figure 5, A comparison of property tax collection in the sample area under Jamaican standards and US standards.

that requires prior knowledge of GIS. Hence, important land information is locked into separate silos (see Figure 6). Processes that should be simple are inefficient, affecting both citizens and the government while deterring foreign investment.

Land and property information is dominated by government agencies. Governments are meant to be the authoritative source for information, not data merchants. Property data in Jamaica is privileged information. However, there is an opportunity to start using open government data. This is a movement that has struggled to gain traction in the developing world, but could greatly assist in balancing information asymmetry.

ACKNOWLEDGEMENTS

A special thanks to the members of NLA for allowing the research to be conducted and for being so forward-thinking in adopting solutions. ◀



▲ Figure 6, Land and property information silos affect both citizens and the government while deterring foreign investment.

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Optimism about Land Rights for All

The way in which land rights are registered in The Netherlands is internationally renowned. The relevant national agency, Kadaster, has extensive knowledge and skills regarding land registration, land consolidation and geographic information. Kadaster believes it has a social responsibility to apply its knowledge and skills in any country where they are needed. Registered rights give owners legal security, so sound land registration is an instrument for economic development and better living conditions. In this interview, *GIM International* talks to Kees de Zeeuw, the enthusiastic manager of Kadaster International which handles the organisation's international consultancy activities.

Kees, could you introduce Kadaster International to our readers?

Kadaster International is a part of the Cadastre, Land Registry and National Mapping Agency of the Netherlands, which is called Kadaster for short in Dutch. Our international team is focused on international advisory services, but we also contribute to international forums, conferences and partnerships in order to develop and share knowledge, expertise, networks and innovative ideas.

Do you operate worldwide?

Yes. Our policy is that we work in countries where our input contributes to the improvement of land rights for all. This means we can work almost anywhere, from developed to developing countries. Of course we are sometimes limited by safety issues, available funding or a mismatch with our organisation's values. In general national governments are our logical partners, but in most cases we also cooperate with the private sector, non-governmental organisations and academia. In practice our main focus is on countries in Africa, Latin America, Asia and Europe. Typically, we work in about 20 different countries every year.

Do you work on a cost recovery basis or as a profit organisation?

We provide our services on a cost recovery basis. This means we charge consultancy

fees for our work that match the level of expertise we provide, but we have no profit-related or minimum turnover targets. Our internal accountability is focused on impact, effectiveness and cost recovery. Because we always work for external customers and financing bodies, however, we also have to account for adhering to our terms of reference and budget constraints.

Do you work in cooperation with the Dutch Ministry of Foreign Affairs?

At this moment we do. Not only the ministry, but also the Dutch embassies worldwide are

cooperation, but over the last decade this has decreased quite steeply. However, looking at the governmental situation over the last four years, there has been a clear rise in interest in the topic of land tenure and land governance. This means that we have seen significant growth in development partnerships in our sector. However, it is uncertain whether this will continue in the years ahead. We had a general election in March of this year and four political parties are currently trying to form a new coalition government. What this will mean for development partnerships and the focus on

THERE HAS BEEN A CLEAR RISE IN INTEREST IN THE TOPIC OF LAND TENURE AND LAND GOVERNANCE

an important partner in our work. Especially the diplomatic expertise and support of our embassies has proven to be of great help in achieving our project goals in various countries.

Today, development partnerships are under pressure in many countries – is this also the case in your country?

I'm afraid that overall I have to answer this question with a 'yes'. The Netherlands had a good history of allocating 0.7 percent of its gross domestic product to international

land all depends on the new government to be formed.

Why has specific attention been paid to tenure security over the last few years?

I think there are various reasons, ranging from the personal political interest of our minister of foreign affairs to renewed insights into how to achieve good results in development partnerships. But I'm convinced that the Sustainable Development Goals (SDGs) as defined by the UN have played a very important role in creating

awareness of the importance of land governance and land tenure for sustainable development. In many descriptions of the targets and indicators as used in the SDGs, land is mentioned as a key success factor. I see both developing and developed countries taking this up in their policies and activities.

The Sustainable Development Goals are ambitious in striving for security of tenure for all. Can this be achieved?

I think the most challenging part of the SDGs is the time frame. Although 2030 still sounds a long way off, we actually only have 13 years to go which is a short space of time in which to achieve land rights for all. After all, there are billions of parcels still to be mapped. But it can be done! Now, you might be wondering why I'm so optimistic about this. First of all, because I feel a sense of urgency wherever I go – from the peace negotiations in Colombia to the World Bank's Land and Poverty Conference, and from the FIG Working Week in Helsinki to the national and local projects in Mozambique. Everywhere, the need for fit-for-purpose land administration is on the agenda and attempts are being made to achieve country-level implementations. Secondly, technology is on our side. Satellites, electronic devices, connectivity and mobility are helping us find new ways to do things. Not only are the possibilities increasing, but the cost of technology is also decreasing. Sure, we still need tomorrow's innovations to further speed up the processes. But the pace of advancement increases exponentially and we have some very clever people in our field of work who will be able to translate the developments into a boost in registrations. And thirdly, because of the money aspect. Registering billions of parcels costs many billions of dollars, or euros, or whatever currency. But on a global scale, this isn't much money at all. The money is there. As long as we are able to reduce the cost per parcel, it is achievable.

Don't you see any restrictions?

The restrictions stem from the people, not the conditions. Corruption, inequity and disputes complicate the matter. The people must be willing to create an inclusive society and a shared sustainable development. The sustainability of the land tenure systems should also be anticipated. And let's not forget the capacity and expertise necessary to make it all happen.



How do you support knowledge development?

The days when cadastral organisations were just data factories and information providers to society are almost behind us. Knowledge has become a cornerstone of our work. This

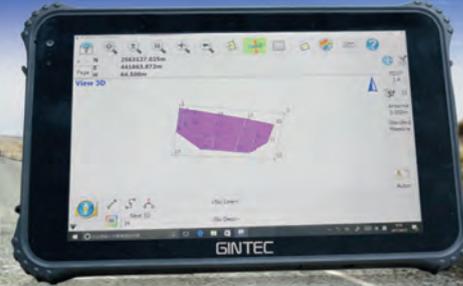
fit-for-purpose approach which includes all three aspects: the geospatial framework, the legal framework and the institutional framework. Capacity building is an essential part of this mix. Knowledge development can

THE PEOPLE MUST BE WILLING TO CREATE AN INCLUSIVE SOCIETY AND A SHARED SUSTAINABLE DEVELOPMENT

means that we should invest not only in standards and systems, but also very much in people. Competences, shared values and expertise need attention – at all levels and in large numbers. In the projects we run around the world, we therefore embrace the

be done in many ways, and training and higher education programmes are part of that. Our long-standing cooperation with ITC Enschede's Land Administration faculty, part of the Technical University of Twente, is therefore important to us.

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In terms of meeting your goals, what is the biggest single challenge for Kadaster International in the next 5 years?

The question is whether we can ignite initiatives that result in inclusive and sustainable land administration systems all over the world. We can't do the hands-on work needed to map billions of parcels, set up thousands of sustainable IT systems and to

WE CAN NOW DO WHAT THE WORLD HAS BEEN ASKING OF US FOR MANY DECADES

reform governments into efficient citizen-oriented organisations based on good governance. But, hopefully, we can inspire others to rise to the challenge and to take things to the next level. Part of that challenge is to be prepared to make mistakes and to admit our failures and defeats. Most innovations and true changes are not achieved through a series of successes only.

Does the Kadaster organisation also learn from other countries and, if so, can you give us some examples?

Very much so! It is a specific objective of our international work to also learn from it ourselves. We must! We are a monopolistic organisation in our own country, so our inspiration should be found abroad. Developments around blockchain and bitcoins are a great example of that. Seeing other countries experimenting with these new possibilities inspired us at Kadaster to set up a working group to investigate the impact, opportunities and threats of blockchain technology for our own organisation.

What can other developed countries learn from your approach?

I think that having an international department within a cadastral organisation is a form of maturity. The exchange of ideas and knowledge is essential for organisations to contribute to the Sustainable Development Goals at the global level and to provide the best possible services to the citizens in your own country.

Do you have a message for our readers?

Be optimistic! There are several good reasons for optimism. The future for the profession is bright and promising. We can now do what the world has been asking of us

for many decades, and it's possible to share and use the data for many purposes. The more data that is produced, the more data that has to be maintained – either by professionals or by means of crowdsourcing.

But the quality of crowdsourced data must be checked, so there's work to be done! I firmly believe it is possible to achieve the ambitions of the Sustainable Development Goals. ◀



ABOUT KEES DE ZEEUW



Kees de Zeeuw is director of Kadaster International at The Netherlands' Cadastre, Land Registry and Mapping Agency (Kadaster) and is chair of the United Nations Group of Experts on Land Administration and Management (UN-GE-LAM). He holds an MSc degree in land and water management from Wageningen University. Following long-term contracts in Rwanda and Bolivia, he spent more than 10 years working in environmental and geoinformation sciences at Wageningen University and Research Centre. At Kadaster, he was initially responsible for product and process innovation (2007-2010) and he is now responsible for coordinating Kadaster's international activities and cooperation projects. Kadaster International provides worldwide advisory services in the domain of land administration, e-governance, geoinformation services and spatial data infrastructures.

RICS Michael Barrett Award Lecture

In December 2016, Prof Stig Enemark received the Michael Barrett award for his contribution to land administration. There were few free seats for the lecture he gave when accepting the award at the RICS in London, UK.

The Michael Barrett award is made by the RICS Geomatics Professional Group and the Boundaries & Party Walls Practice Panel. It is open to fellow and professional members of the RICS (and non-member overseas surveyors) and to barristers and solicitors at law practising in the field of land law. The recipient is a person who, in the opinion of the panel/professional group, has contributed most to the understanding of the subjects of land transfer, registration and administration, encroachments, cadastre and boundary issues, or to an improvement in the

administration of the laws regarding them, within the UK and overseas.

FORGING INTERNATIONAL PARTNERSHIPS

This year's recipient was Prof Stig Enemark, a well-known figure in the world of land administration. He was presented with his award by Robin McLaren who gave a brief overview of Enemark's achievements. In McLaren's view, the highlight of his career was Enemark's presidency of the International Federation of Surveyors (FIG) from 2007 to 2010, during which time he

forged international partnerships with other members of the UN family and raised the profile and influence of the profession.

With the award comes a lecture, and Enemark used this as an opportunity to give an overview of land governance and particularly its importance in the fight

'DO AS LITTLE AS POSSIBLE AND AS MUCH AS NECESSARY'



▲ The Sustainable Development Goals.

against poverty. Like much of surveying, land administration is an enabling discipline that is needed to achieve the various global development aspirations stated in the Millennium Development Goals and the subsequent Sustainable Development Goals. The latter call specifically for year-by-year measurement of progress. Enemark argues that efficient land administration is an essential part of this process.

POVERTY REDUCED IN CHINA

Everyone likes a success story and the first Millennium Development Goal was to reduce poverty by 50% by 2015. This was achieved but, said Enemark, digging down into the data reveals a massive regional variation clouding the real picture. Reduction of poverty in China overwhelmed a situation in Africa where nothing had changed. But the good news is that the reduction in poverty in China could be attributed partly to the introduction of a land administration system.

Enemark stressed that efficient and effective land administration is central to achieving the Sustainable Development Goals by 2030. To enable this to happen, he has been a proponent of the concept of fit-for-purpose land administration. The fact that only 40 countries have functioning systems is, he suggested, proof that traditional land administration systems are not fit for purpose in developing countries. Enemark set a challenge: to increase the proportion of the world with secure tenure from the current 30% to 80% by 2030.

FIT FOR PURPOSE

The fit-for-purpose (FFP) concept is disarmingly simple and can be summed up in the phrase ‘Do as little as possible and as much as necessary’. Different fit-for-purpose solutions are appropriate for different cultures. There has to be a focus on purpose and it has to provide secure tenure for all. It also has to be flexible and incrementally upgradeable. The concept has been put into practice already with some impressive case studies. Rwanda, for example, registered 11 million parcels in five years at a cost of USD5 per parcel.

Fit-For-Purpose Land Administration		
KEY PRINCIPLES		
Spatial Framework	Legal Framework	Institutional Framework
<ul style="list-style-type: none"> Visible (physical) boundaries rather than fixed boundaries. Aerial / satellite imagery rather than field surveys Accuracy relative to the purpose rather than technical standards Demands for updating and opportunities for upgrading and ongoing improvement 	<ul style="list-style-type: none"> A flexible framework designed along administrative rather than judicial lines. A continuum of tenure rather than just individual ownership Flexible recordation rather than only one register Ensuring gender equality for land and property rights 	<ul style="list-style-type: none"> Good land governance rather than bureaucratic barriers Holistic institutional framework rather than sectoral silos Flexible IT approach rather than high-end technology solutions Transparent land information with easy and affordable access for all

In fact it is not possible to make meaningful progress without FFP, Enemark suggested. How, for example, could you implement a traditional land administration system in Indonesia – a country with a population of hundreds of millions but with only a hundred surveyors?

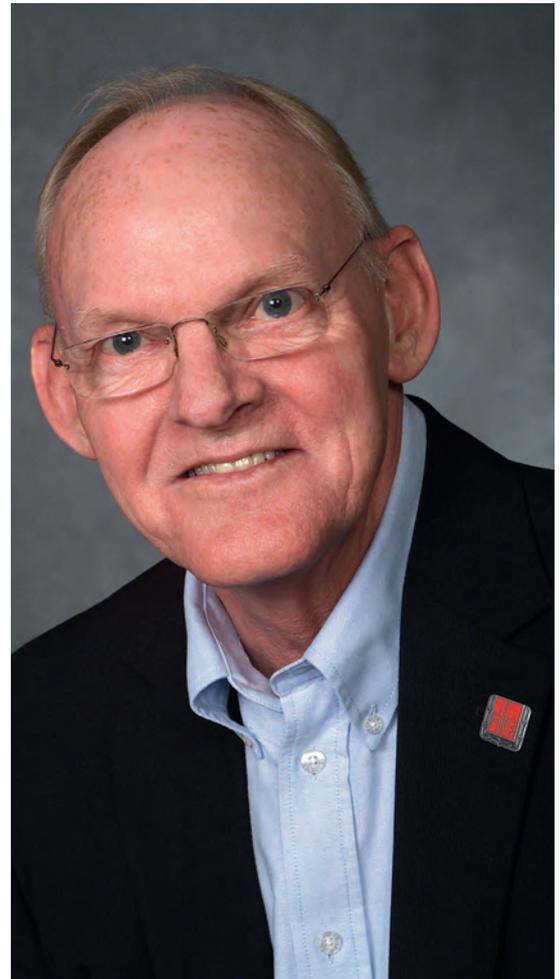
Questions at the end of the lecture raised some interesting points. What role does the surveyor play in the process? The answer is that he manages the system and trains those who will maintain it in the long term, rather than doing the fieldwork.

AVOIDING THE BLOCKERS

In terms of convincing the politicians, the question was who had to be convinced? The answer was someone at minister level as this is above the level at which blocking can confound a project. And those blockages largely come from the legal profession. This was a situation where, Enemark said, the professions can be an obstruction. If you can convince the leaders, the professions have to fall in line. In general, Enemark’s advice was to get as close as possible to the relationship between people and land. Furthermore, planning of a land administration system should encompass maintenance and operation of the system as well as the process of getting titles registered.

VISUAL BOUNDARIES

There was inevitably a question on general boundaries. In answer to this, Enemark stressed that fit-for-purpose boundaries are visual, not general, because general boundaries might not follow the boundary



▲ Prof Stig Enemark.

feature visible on the ground. Interestingly, he did not see visual boundaries as a drawback because changes in visual boundaries can be detected easily from satellite or aerial imagery. ◀

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FIG STDM Publication Now Available in 4 Languages



The Social Tenure Domain Model – A Pro-poor Land Tool is a FIG publication written by Christiaan Lemmen. The publication dates from 2010 and is a co-production between FIG, UN-Habitat and the Global Land Tool Network (GLTN).

Low cadastral coverage in many developing countries causes enormous problems – especially in the world's cities, for example, where over one billion people live in slums without proper water, sanitation, community facilities, security of tenure or quality of life.

This has also caused problems for countries with regard to food security and rural land management issues.

The Social Tenure Domain Model (STDM) is a pro-poor land information management system that can be used to support the land administration of the poor in urban and rural areas. The security of tenure of people in these areas relies on forms of tenure different from individual freehold. Most off-register rights and claims are based on social tenures. GLTN partners support a continuum of land rights,

including rights that are documented as well as undocumented, of individuals and groups, of pastoralists and in slums – whether legal or illegal and informal.

Over recent years GLTN and FIG, primarily FIG Young Surveyors, have held STDM workshops around the world to encourage and instruct (young) surveyors in the use of the STDM model. Another STDM workshop will be held during the FIG Working Week in Helsinki, Finland, on 29 May 2017.

The Social Tenure Domain Model – A Pro-poor Land Tool has now been translated into Arabic, French and Japanese. The Arabic version was translated by GLTN and reviewed by Ms Kholoud Saad, Egypt. The French version was also translated by GLTN and reviewed by Ms Claire Galpin, France. The Japanese version was translated by Mr Kazuaki Fujii, Japan, and confirmed with the Japan Federation of Surveyors.

Louise Friis-Hansen, FIG director

More information
www.fig.net

Member in the Spotlight: GeoCat Strives to Make Geospatial Data Sharing Easier



GeoCat, a valued GSDI Association member, helps governments to create and maintain a spatial data infrastructure (SDI). GeoCat was established in The Netherlands in 2007 by GeoNetwork founder Jeroen Ticheler. Since then, the company has thrived on offering software and services which make geospatial data sharing easier and more efficient than ever. Its solutions are based on international standards and proven open source software.

The adoption of free and open source software (FOSS) has led to the creation of

sustainable applications, while the focus on open standards has enabled the easy combination of applications with proprietary GIS software, supporting the development of hybrid infrastructures. Following this approach, GeoCat has provided successful consulting services and products to the development of organisational, national and international SDIs for The Netherlands, Switzerland, Sweden, Finland, Canada, Germany, Scotland, Belgium, Turkey, EEA, EuroSTAT, JRC, ESA and many others around the world. More specifically, it has supported

organisations in publishing data to a FOSS server platform, in accordance with ISO/OGC/INSPIRE regulations, and other relevant country regulations.

Apart from consulting services around GeoNetwork Opensource, GeoCat also invests its time and experience in developing products which focus on simplifying the implementation of SDIs. GeoCat Bridge is an extension for Esri ArcGIS Desktop, designed to make the process of publishing geospatial data on the internet as easy as hitting the

'Publish' button. From a project in ArcGIS Desktop, it is possible to use Bridge to publish data, metadata and symbology on a FOSS server platform, with literally one click. These platforms include globally adopted, mature software projects based on OGC

standards, such as GeoNetwork, Geoserver and Mapserver.

GeoCat Live is a subscription-based solution which provides ready-to-use, managed servers and software to support the development of an SDI in the cloud. It is built upon the latest virtualisation techniques, FOSS and open standards. The solution is complemented with back-ups and monitoring for complete peace of mind. Bridge and Live can and should be combined, to provide a complete pipeline for storing, describing, discovering and publishing data in the cloud, from a desktop GIS.

Early this year, GeoCat joined OGC – another valued GSDI Association member. Following this step, GeoCat is looking forward to joining

in discussions and becoming more formally involved in the standards it has been implementing for so many years.



More information
www.gsdiassociation.org
www.geocat.net

The International Service for the Geoid (ISG)

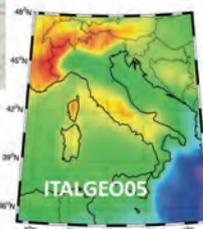


The International Service for the Geoid (ISG), hosted by Politecnico di Milano in Italy, was founded in 1992 and is an official service of the IAG. Its activities are related to those of Commission 2 on Gravity Field. ISG's principal activities are the collection and distribution of local, regional and global geoid models (currently exceeding 150) and geoid computation software, and the organisation of technical schools on geoid determination techniques.

ISG also participates in international projects and working groups with the aim of improving methodologies for the determination of the geoid. These include the European Gravity Geoid Project, the ESA Gradiometric Mission GOCE, the Global Geodetic Observing System project, the International Height Reference System project, and the computation of improved geoids for Italy and the Mediterranean area for the GEOMED-2 project (2015-2017).

The First International School for the Determination and Use of the Geoid was organised in Milan in 1994, and since then other schools have been held, in many countries, with the support of local organising committees. The general purpose of such intensive, full-week Geoid Schools is to educate graduate students, young scientists, employees of national agencies and industry staff in the techniques of geoid computation as well as the use of gravimetric geoids for scientific and engineering applications, including transforming ellipsoidal (GNSS) heights into orthometric height values. The schools provide opportunities for participants to familiarise themselves with the latest developments in geoid determination and to develop international contacts and partnerships with scientists interested in gravity field modelling.

The ISG staff consists of four senior scientists (including president Mirko Reguzzoni and director Giovanna Sona), four other geodesy experts and one secretary.



More information
www.isgeoid.polimi.it



Making the World a Better Place with Maps

The ICA column in the January 2016 edition of this magazine highlighted how our announcement of International Map Year 2015/16 and the promotion of the new 17 United Nations Sustainable Development Goals (SDGs) aligned to activate a further ICA-wide initiative in preparing a portfolio of posters for the UN. The SDGs and their targets have been mapped based on the specific indicators identified as relevant and important (over 300 indicators in the 17 themes). Each ICA Commission was asked to prepare a map-based representation of one of the SDGs from their particular perspective. The resulting poster collection gives an overview of the strength of cartography, telling a story of cartographic diversity, of mapping options and of multiple map perspectives in meeting the challenge of mapping diverse and important environmental and social phenomena. These impressive displays were exhibited at the UN headquarters in New York in August 2016. The exhibition prompted many comments, and further review of the posters by Commission

chairs and the ICA Executive Committee members, resulting in a long list of potential improvements related to language, the base map (boundaries), content, cartographic representations and graphic quality. As one can imagine, the boundary problem was most sensitive at the UN; although cartographers are used to dealing with incomplete and irreconcilable data sources, it proved difficult to follow UN guidelines, and therefore a disclaimer has been included on all posters. The revised A0-sized posters can be found at <http://icaci.org/maps-and-sustainable-development-goals> from where each can be downloaded. They have also been compiled into a newly designed catalogue for the exhibition, also available there. Through this exhibition, ICA shows how cartographers are relevant to society and can assist in helping to reach global goals. Well-crafted maps can effectively visualise currently known facts, and online mapping technology can disseminate these facts globally to increase awareness of the current

state of affairs. Interactive map dashboards, connected to geographic databases at multiple scales and equipped with space-time analytical functions, will allow decision-makers on various decision levels to monitor and compare indicators for policy development and action at various geographical scales.



The ICA posters as presented in the conference area at the United Nations headquarters in New York, USA.

More information

www.icaci.org

The Asian Conference on Remote Sensing 2017



The Asian Conference on Remote Sensing (ACRS) is an annual event spearheaded by the Asian Association of Remote Sensing (AARS) – Asia's largest society of remote sensing scientists and professionals. The objective of AARS is to promote remote sensing through exchange of information, mutual cooperation and international understanding and goodwill amongst the member countries in the Asia-Pacific region. Held yearly, one of the major activities of ACRS is to promote remote sensing for the collection and updating of spatial information around the world. ACRS-2017 will be held from 23-27 October 2017 at The Ashok Hotel in New Delhi, India. The main theme of the conference is 'Space Applications: Touching Human Lives'. Around a thousand delegates are expected from India and abroad. Although the majority of delegates will be from Asian countries, delegates are also expected from other parts of the globe. This conference will bring together students, researchers, scientists, engineers, policymakers, professionals and

practitioners from developed and developing countries, both in and around Asia and worldwide. They will share insights into the challenges and opportunities of remote sensing and related geospatial technologies in building resiliency and encouraging inclusive economic growth in one, dynamic Asia. The conference also aims to be a platform for international engagement to ensure that knowledge is generated in partnership with society. The major sub-themes of ACRS 2017 are:

1. Advanced Polarimetric Methods & Applications
2. Geological RS and Mineral Exploration
3. GEOGLAM: Asian Experience
4. Citizen Science: Methods and Applications
5. Water Resources Management
6. Disasters: (Hydrological, Natural and Environmental)
7. Forest and Environmental Change
8. Urban/Rural Planning and Infrastructure
9. High-resolution Sensors (Optical, Microwave, Lidar, UAV)

10. Marine Geology and Coastal Studies
11. Ocean and Atmospheric Studies
12. Advance Image Processing and Data Analytic Modelling
13. Calibration/Validation of EO Sensors
14. Asian Space Agencies Report Session
15. Web-based Education and International Efforts in Capacity Building
16. NISAR Session
17. Big Data Analytics
18. Health GIS
19. VIIRS Night-time Light Imaging
20. Climate Change Studies
21. ISPRS Sessions

Dr A. Senthil Kumar, chair, LOC, ACRS 2017
senthil@iirs.gov.in

More information

www.isprs.org
www.acrs2017.org

▶ 2017

▶ JUNE

HEXAGON LIVE

Las Vegas, USA
from 13-16 June
For more information:
hxgnlive.com/2017

COMMERCIAL UAV EXPO EUROPE

Brussels, Belgium
from 20-22 June
For more information:
www.expouav.com/europe

▶ JULY

INTERNATIONAL CARTOGRAPHIC CONFERENCE

Washington, USA
from 2-7 July
For more information:
icc2017.org

ESRI USER CONFERENCE

San Diego, USA
from 10-14 July
For more information:
www.esri.com/events/user-conference

CLOSE RANGE SENSING TECHNIQUES IN ALPINE TERRAIN

Innsbruck, Austria
from 16-22 July
For more information:
www.uibk.ac.at/geographie/summerschool

FOSS4G-EUROPE

Marne la Vallée, France
from 17-22 July
For more information:
europe.foss4g.org

▶ SEPTEMBER

UAV-G 2017

Bonn, Germany
from 4-7 September
For more information:
uavg17.ipb.uni-bonn.de

ISPRS GEOSPATIAL WEEK

Wuhan, China
from 18-22 September
For more information:
zhuanti.3snews.net/2016/ISPRS

INTERGEO

Berlin, Germany
from 26-28 September
for more information:
www.intergeo.de

▶ OCTOBER

ESRI EASTERN AFRICA USER CONFERENCE

Dar es Salaam, Tanzania
from 4-6 October
For more information:
www.esriea.co.ke/user-conference-2017

RACURS CONFERENCE - FROM IMAGERY TO DIGITAL REALITY

Hadera, Israel
from 16-19 October
For more information:
conf.racurs.ru/conf2017/eng

COMMERCIAL UAV EXPO AMERICAS

Las Vegas, USA
from 24-26 October
For more information:
www.expouav.com

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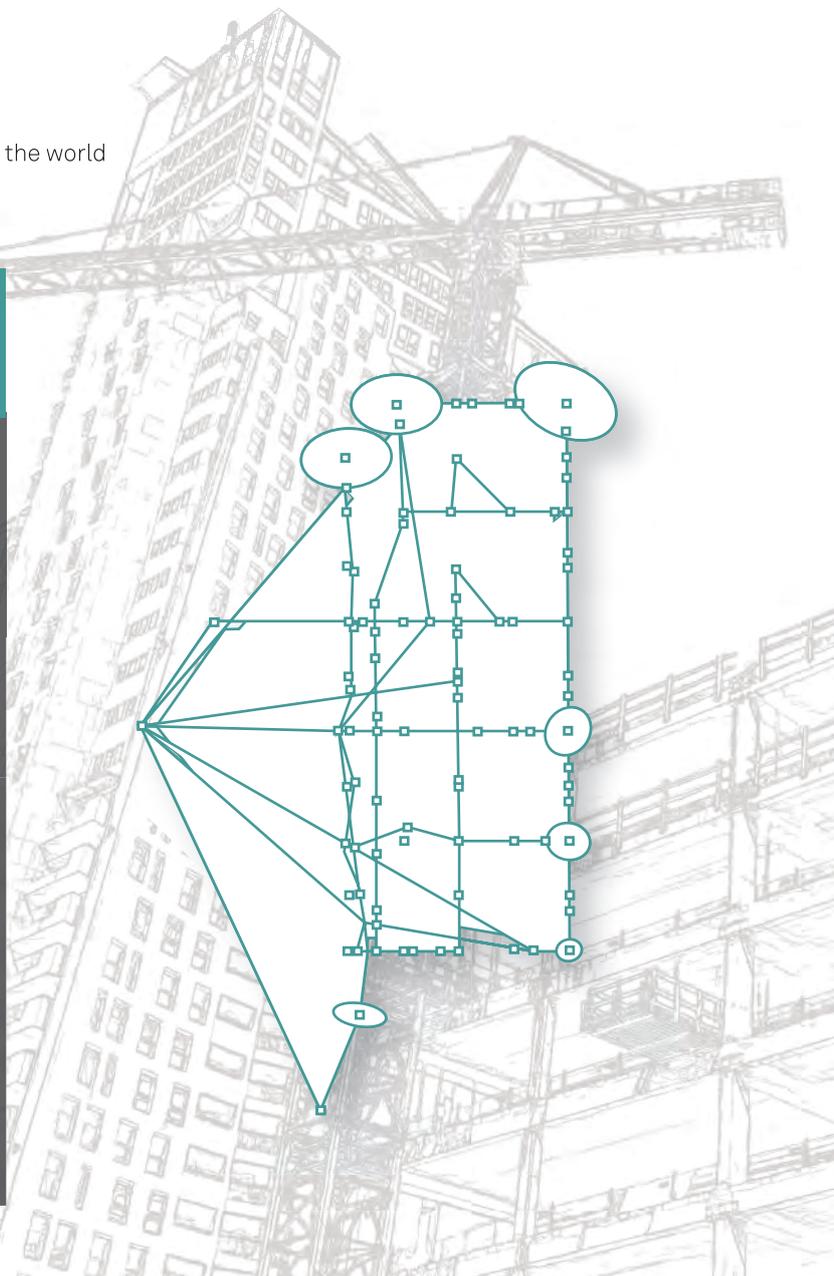
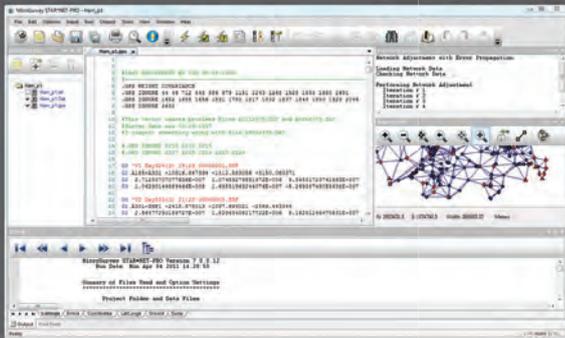
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