Land Rights - Will Technology Ever Replace the Human Touch? From the Perspective of Millennials

The Relationship between Technology and People in Land Tenure

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SUMMARY

It is the year 2017, and an artificially intelligent 'woman' is saying she wants to have a child on her own accord in Saudi Arabia. In the same year, two smart machines from Microsoft start to communicate in their own language which their creators do not understand. In Germany a driverless bus has taken its first passengers to the train station (Hitti, 2017). Meanwhile, residents of slums in Harare, Zimbabwe are still struggling to build houses and safe, sanitary infrastructure.

The world is full of innovation, rapid technological change, and economic disruption. But it is also a world of great disparity. In asking the question, will technology ever replace the human touch?, we refer to the people side of land administration. It is a question which has been asked for many generations. The way people engage with technology is constantly changing. One example is the Luddites, who feared that knitting machines would replace their jobs in the textile industry. However, the textile industry still exists today and people work with these machines to create masterpieces. So, too, will the geospatial industry continue to exist alongside Artificial Intelligence (AI).

AI and automation are proof that technological advancement is not slowing down. However, neither is poverty. This disparity and the digital divide is concerning. Geospatial professionals have a global responsibility to use their skills and help narrow the divide. However, as professionals we must tread with care and wisdom so as not to exacerbate the very same thing we are trying to combat. After all, technology only enables us to use our skills.

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1. INTRODUCTION

Land Administration is an evolving discipline. It generates discussion, debate, and different perspectives on how things should be done. Combine this with emerging technologies and varying cultures, and land administration systems (LAS) can get very complicated.

First off, we dive into a discussion on how technology may go wrong if it is implemented incorrectly. Being millenials, we write this in plain English so our message is not lost in unnecessary words. We encourage you, the reader, to think about the impact that changes in technology could have on people and their security of tenure.

In the second half, we summarise the following with reference to our research:

- Fundamental technologies for human survival;
- Current land administration trends; and
- Emerging technologies which will influence the Geospatial profession.

2. SETTING THE SCENE

What exactly is a millennial, and how are our perspectives different? The term millennial refers to the generation of people born between the early 1980s and early 2000s. We are also commonly known as Generation Y (Main, 2017). Millennials like us have grown up during a time of rapid technological change, globalisation, and economic disruption. This has resulted in a different set of behaviours and experiences in comparison to other generations within the Geospatial Industry (Goldman Sachs, 2018). Our view is socio-technical. We respect social structures, roles, and rights. But we also recognise that technology has its place in a spatially enabled society.

Technology is a common word used throughout this paper. It is a broad term and we cannot use it without defining the type of technology we refer to. As Srinivasan puts it in his book, *Whose Global Village?: Rethinking how Technology Shapes Our World*, "communities across the world, past and present, have always developed and crafted innovative tools, systems, and networks that shape social and cultural life" (Srinivasan, 2017). Throughout this paper, we have used the word technology when referring to these innovations: from basic tools for human survival through to the most advanced 'blue sky' technologies which have come about rapidly in our lifetimes.

3. DISCUSSION

LASs vary in each country. Whether a country is economically successful or not, the improvement of existing systems is essential to ensure that they can adapt to change and meet global challenges.

Though the technical method of data capture may evolve from measuring angles and distances to high accuracy, GNSS Software attached to a smartphone, the human involvement remains the same. We are "working with community members to identify boundaries, settle disputes, and register the rights of all land holders—women and men" (USAID Publications, 2016). In this section of the paper we encourage you to think about the impact that these changes will have on our society and how to prepare for future challenges.

3.1 The Digital Divide

The digital divide is present in both developed and emerging nations. Not only does this divide exist due to economic reasons but it is also due to computer literacy and empowerment. The digital divide will continue to widen as the use of technology becomes common place in basic services.

3.1.1 Mobile Phones

One of the most significant technological advancements for land administration has been the use of mobile technology.

Globally, approximately five billion people have mobile phones (Srinivasan, 2017:25). Smartphone subscribers are anticipated to total 3.5 billion by 2019 (World Economic Forum, 2017). Of a global population of 7.6 billion, these numbers are impressive. But it must be remembered that those mobile phones and smartphones are of differing types. The majority of Emerging Nation's citizens who do own a mobile phone have one that lacks access to the Internet and multimedia. In fact, many mobile devices and applications are not even used for the intended purpose (a common theme also found in land administration trends). For example, a mobile phone is used for spotting crocodiles while hunting in New Guinea more than it is used to speak to another person (Srinivasan, 2017:66).

Once a person has a mobile phone, they must pay to use it. For example, we might read about a fisherman in India who can access real-time price information through his mobile phone. As a result, finding a way around corruption. The same article may not point out that same fisherman's village struggle to make it out of relative economic poverty. The mobile banking services they use "are administered by wealthy corporations who charge high interest rates" which means the rich/poor gap remains (Srinivasan, 2017:24).

There is a bit of a chicken and egg situation with basic needs infrastructure. In 2013, more people on earth had access to cell phones than toilets (Wang, 2013). This is shocking. The residents of slums near Harare may not have running water, sewage reticulation, or electricity, but they do have the opportunity to access mobile phones. In Harare South and Magada in Epworth, there are three mobile phone service providers that are accessible to residents (Chirisa, 2016:4:42).

Can this be flipped around to be a positive thing? In embracing the mobile technologies, those residents of Magada could bring themselves into a position where they can afford to buy basic needs materials. If they are able to accept that a right to their stand in a slum can be registered using a mobile LAS, they may see the benefit of investing and improving these basic needs infrastructures.

3.1.2 Internet

The Internet is also commonly known as the World Wide Web. Is access to the "Web" actually worldwide? It is estimated that only three to four billion people have access to internet (Srinivasan, 2017:25). Other sources suggest 3.58 billion (Statista, 2018b) and 4.05 billion (Internet World Stats, 2017). When looking at all these numbers "...it is far too easy to assume that we live in the democratic "global village"" (Srinivasan, 2017:25).

To the majority of people in developed countries, the word Internet portrays an open source of knowledge, communication, and entertainment. To many other people within both developed and emerging nations, the Internet has a different meaning depending on their type of access. Warschauer (2004) writes, "what is most important is not so much the physical availability of computers and the Internet but rather people's ability to make use of those technologies to engage in meaningful social practices". As such, we have separated access to the Internet into two components, physical and public, below.

Physical access to the Internet is the ability to access it through appropriate infrastructure and through a device. Just because a community has the fibre optic cable infrastructure, it does not mean every person within that community has direct access to the Internet. They may not be able to afford a device to use the Internet.

Public access is relating to the constraints put on Internet either through a government policy, through the person's IT literacy, a lack of economic resources, or through a filtered down version of Internet supplied by certain companies.

The point here is that access alone to the Internet and mobile phones cannot help people in need of assistance. This is why philanthropic initiatives like Facebook and Internet.org's, One Laptop per Child, and Hole in the Wall are met with doubt. The blind assumption that an emerging nation cannot wait to receive the blessings of Western technology is, in itself, ridiculous.

What does this mean for us as Geospatial professionals? It means we must recognise the digital divide and exercise digital responsibility when implementing a LAS. Developers must understand users and their relationship with land. We must all recognise that systems are used by a diverse audience with differing levels of empowerment and varying levels of access to information (Williamson et al., 2009).

3.2 Grass-roots Design

"Land tenure is directly embedded in social identities and relations" (Cousins, 2017).

In our opinion, LASs which benefit people of emerging nations will only be sustainable when implemented by people who are members of the community. Otherwise, 'outsiders' who can remove themselves from their own unconscious bias. Tuhiwai-Smith, a Māori education scholar says that "researchers must let go of their attachments and embrace beliefs, values, and practices that differ from their own" (cited by Srinivasan, 2017:12). Although relating to ethnographic research, this is applicable to all those in the land administration sector who collaborate with communities outside of their own.

This is where Free Prior and Informed Consent (FPIC) comes in. Before implementing a fit-for-purpose LAS, the community should be given as much information as possible. It should be presented in their own language and their own customs without time constraints. Consent is not always given during the FPIC process, nor is it a one-off thing. It is an agreement between the agency and the community on how the project will be implemented. The agreement requires continuous participatory monitoring and evaluation (UN FAO, 2016). We elaborate our discussion on evaluations further below.

During the FPIC process, the technology which is 'fit-for-purpose' should become clear. When taking a bottom up approach, the focus is on the challenges trying to be solved and the information required. Only when these factors are identified, is it decided which technology to use (if any) (Gumb, 1994).

Often systems are pushed upon nations by outsiders as they are seen to be the best solution. However, history suggests otherwise. Look at New Zealand, Aotearoa, for example. British Settlers came in during a time when informal settling was happening by the French. In order to prevent the French taking advantage of the Māori, the British initiated a western tenure system as is the case with other British Colonies. They thought they were doing Māori a favour in blessing them with this rigid system of recognising individual land rights. Now, it is clear that Aotearoa would not be what it is today without colonisation. But Aotearoa would be a different place altogether if the New Zealand Company had been open to a concept like FPIC. As land rights professionals, we must be careful not to rush in and recreate the same issues for communities we work in today. Otherwise we risk inflicting long-term conflict and cultural dilution on future generations.

Fit-for-purpose technology combined with FPIC methodologies will allow for transparency in land administration. Through making the community an active user and creator rather than a passive user of the systems, there is more chance of a sustainable solution.

3.3 Education - Socialising our Surveyors

“If you think education is expensive, try ignorance” - Derek Bok, 1975.

We recognise the importance of education and socialising. But do others in our profession? Having the right connections can help professionals improve individual job performance but also improve the solutions which we provide for customers. We should network and advocate among all other professions, government agencies, and communities. This will result in better collaboration with key stakeholders on land, spatial, and governance issues.

Humans are creatures of habit. Once we learn how to do something, we are likely to keep doing it the same way. If we do not take the opportunity to collaborate and learn from each other, we will continue to to make the same mistakes and provide solutions that waste important resources.

We need to educate our profession and we need to educate the public. The surveying profession in New Zealand struggles to attract diversity. This could be due to the perceived persona of a surveyor: someone who is good at maths and likes the outdoors. But what about the person who had English as their strength at school? Could they not provide an element of diversity to the profession through being a good communicator? The programmes we are aware of do not offer enough opportunity to socialise our young professionals into communities. Earlier this year, two engineering students approached Claire during her lunch break to ask if they could survey her about sea-level rise. Those students were required to do this questionnaire in order to learn how to communicate with the general public. The benefits are twofold with a programme like this: 1. The students gain social skills which are vital in the ‘real world,’ and 2. The public learn more about the profession through exposure to the students.

3.4 Evaluation of effects (whose success criteria?)

Most communities have developed land tenure systems to suit their own specific needs and circumstances. The tenure systems differ within, and between, countries. They vary in terms of complexity which makes evaluating the effects of a LAS difficult.

“One third of the people on the planet...have no documented rights to the land they rely on” (Cadasta, 2017b). There is a clear trend in land administration towards modern, socio-technical LASs that support spatially enabled societies and sustainable development. So, how does one measure the success of a modern LAS? Well, it depends on who is measuring it. This introduces the concept of unconscious bias. Your personal experiences and cultural background can have an impact on your decisions and actions without you realising it (Gumbs, 1994).

It takes years to see changes in a society. This may be why we could not find a large amount of evidence of evaluations. Sure, there have been many assessments of the technical applications themselves, but what of its effect on the community.

After the first pilot of a Mobile Application to Secure Tenure (MAST) in Tanzania, USAID developed a "rigorous impact evaluation...to evaluate the impact of MAST"..."on food security/livelihoods and perceptions of tenure security" (Bouvier, 2018). That is in a baseline phase and it is to evaluate their own product. Another USAID impact evaluation with a different focus will be completed after a pilot in Zambia. Baseline data was collected at the beginning of the intervention in 2014. In mid-2017, endline data was collected. In April this year, analysis and publication of the results are expected (USAID, 2018).

Tony Burns of Land Equity International was engaged to evaluate a LAS pilot. It was an independent evaluation of Solutions for Open Land Administration (SOLA) after it was piloted between 2010 and 2013 in Ghana, Nepal, and Samoa. The review was to focus "on the SOLA pilots from a user perspective rather than a technology perspective" (Land Equity, 2013). This is positive to read that the user was put first when evaluating these pilots.

A FPIC Manual recommends a repeating continuous participatory monitoring and evaluation of the agreement during implementation (FAO, 2016). Note the use of the word participatory. Both examples of evaluation above are not participatory: Land Equity's is independent and USAID's is rigorous, but neither are participatory. An even better approach to evaluation may be to employ a member of the community who was involved in the implementation of a LAS in their community and stay in contact with them. Then, get them to evaluate the effects themselves with their own social tests or success criteria to compare against every year. This can link into the agreement reached through FPIC.

4. FUNDAMENTAL TECHNOLOGIES

Not everything has to be brand spanking new, high spec, and hi-tech when discussing technology. We have written this section in an attempt to make you think about what technology means to the people you work with.

4.1 Essential Technologies

Chirisa (2016:37), looks into the vital role appropriate technology can play in the transformation of peri-urban residential spaces near Harare, Zimbabwe. To Harare slum residents, new technology is building tools like farm-bricks and ash-toilets. Technology like this allows the communities to avoid typhoid due to well locations being poorly located next to blair toilets which are shallow holes in the ground (Chirisa, 2016:43).

There are always social pressures which add complexity to adoption of new technologies. Some houses are shunning the new technologies of farm-bricks and ash-toilets in the Nehanda Housing Cooperative in Dzivaresekwa. This is due to the derogatory names given to them by neighbours (Chirisa, 2016:49). If this is the result when essential technologies are introduced, it doesn't look good for a LAS which can be accessed by a mobile-phone. Unless, as we suggested above, the community embrace the mobile technology.

Becedas, a small peasant village in Spain, is thriving despite technological stagnation. This stagnation is due to the village topography. The technology referred to here is farm machinery. Similar villages have dissolved under the same pressures because they have lost too many residents to emigration. Therefore, they have lost the cultural and social ties which made them a community. Becedas is an exceptional circumstance because they were able to merge old customs with new (Brandes, 2013).

Our point being, whether it is pipes in the ground or a tractor, without low-cost technology, most communities simply struggle to survive. The adoption of new technologies is tied up with social and cultural pressures.

4.2 Earth Observations

It is widely acknowledged that use of large-scale aerial imagery and remote sensing makes increased tenure security more achievable (Lemmen & Zevenbergen, 2010 and Chirisa & Munyaradzi, 2016). Although accessibility is still an issue in Harare, satellite imagery quality is improving. Chirisa and Munyaradzi recognise the solution to building sustainably is combining earth observations with GIS: the cost of this method far outweighing the cost of conventional ground methods (Chirisa & Munyaradzi, 2016:29). Good governance and planning are required to implement, and fully benefit from, aerial imagery and remote sensing products.

Benefits of using aerial imagery, both from photogrammetry or satellites, and either on a device or in paper form, include:

- Real-time capture during adjudication (Kurwakumire 2014);
- Faster processing times (Chirisa & Munyaradzi, 2016:34) and;
- The ability to communicate in a common language with a common, unbiased base map.

The result is less room for conflict and higher chance of increasing tenure security. These benefits are recognised by most technology-based LAS. Most use aerial photography heavily, for example Cadasta, Open Tenure, and the Social Tenure Domain Model (STDM).

Whatever the boundary type, whatever the land right being captured, and whatever the community wants, aerial photography in all forms provides a foundation for flexible land administration.

5. LAND ADMINISTRATION TRENDS

We have come across several names and acronyms when reading about current land administration. To make sense of these we have broken them down below. This is not a critical comparison. Nor is it an exhaustive list: it is merely here to provide context to you, the reader. If you want further information, this topic is widely covered by other authors (Biscaye et al., 2017., Global Donor Platform for Rural Development, 2015., Tutu et al., 2016).

5.1 Land Administration Domain Model (LADM)

LADM is an international standard (ISO 19152:2012) that provides a platform for the development of LASs. The standard recognises that one size does not fit all. It was developed to solve communication issues resulting from different approaches of LASs. Open Tenure, MAST, and STDM are based on LADM. The standard refers to traditional LASs as well as unconventional approaches such as crowdsourcing. The platform components are flexible which means, as new technologies emerge, it will evolve to allow many approaches under the same standardised umbrella.

5.2 Cadasta

Cadasta Foundation focuses on developing digital tools for land and resource rights: they see "technology as the great equalizer" (Omidyar Network, 2016). The Foundation was launched in 2015 with support from UK Aid and the Omidyar Network. Cadasta have used a suite of digital technologies in Bangladesh, Lagos, and Indonesia (FHI360 and The Rockefeller Foundation, 2017). Their software utilises GPS on mobile devices. The online web-based demo is relatively easy to use.

Cadasta include three customisable questionnaires on their web-based demo. These are Urban Informal, Customary Rights, and Sustainable Sourcing. The forms are in French and English but the language can be customised for the community with whom data collection will be done. A rectangular parcel is not the only option for capturing spatial rights: a single coordinate can be used instead. There are also options to include other media: video testimonies, photos of right holders, and voice recordings for example.

Cadasta have trialled a range of external GPS antenna to enhance the accuracy of mobile devices. They field tested Trimble's Catalyst in combination with the data collection application, OpenDataKit (ODK) in East Africa. Cadasta were very positive about the potential of these antenna to provide a cost-effective approach to high accuracy data collection. The biggest barrier remains providing access to those that need it. Cadasta note that getting hold of the Trimble Catalyst technology was difficult and it is not readily usable outside of Europe and North America (Cadasta Foundation, 2017). We elaborate on Trimble Catalyst in the E-Commerce Subscription section, below.

5.3 Kadaster

Kadaster, as opposed to Cadasta, is the name of the Dutch government agency responsible for the cadastre, land registry, and national mapping. Over recent years, Kadaster is changing from providing data to more of an information service organisation (De Zeeuw & Alzmann, 2011). They are involved in aid work overseas, applying their knowledge to advise on land registration for countries who need it (Kadaster, 2016). Most recently, Kadaster was in Brazil advising on fit-for-purpose methods to speed up the land titling process (Kadaster, 2017).

5.4 Global Land Tool Network (GLTN)

GLTN is a network of experts, researchers, and organisations. It is facilitated by UN-Habitat and supported by the UN Food and Agricultural Organisation (FAO) among many others. Kadaster and FIG are part of the GLTN. The Network's goal is to alleviate poverty through access to land and tenure security (GLTN, 2014a). There are 18 GLTN tools in development: one of which is STDM.

5.5 Social Tenure Domain Model (STDM)

STDM is technically a specialisation of the LADM ISO Standard. It is often referenced as being the base of other tools. For example, Cadasta took its inspiration from STDM and Talking Titler can be combined with it. STDM was developed in parallel with LADM in the year 2000. It stemmed from the GLTN emphasising that there was a technical gap. They say "conventional land administration approach cannot support the continuum of land rights approach and will not deliver security of tenure at scale" (UN Habitat, 2017). STDM is designed to plug that technical gap.

The partners who developed STDM are GLTN, UN-Habitat, and the University of Twente (as it is now known). The STDM concept is to represent people-land relationships regardless of formality, legality, and technical accuracy. It is meant to accommodate communally held land. The STDM was field tested in some parts of the Caribbean in 2013. The software was at version 0.9.5 and was generally well received technically. Middle and lower incomes were resistant to the concept of recognising informality because they perceived "difficulties in differentiating between legitimate land tenure rights and illegal occupation and use" (Griffith et al., 2015).

The STDM software is now at version 1.7 and includes mobile data collection capability and has added language translations. Due to the nature of this tool, there are different spatial types and ownership types. There is also an option to link a fingerprint to a coordinated point within a tenancy (UN Habitat, 2009). Kadaster, FIG, GLTN, and UN-Habitat combined forces in late 2017 to pilot a volunteering initiative for young surveyors in Nepal. The outcomes are yet to be published.

5.6 UN-Habitat and Food and Agricultural Organisation (FAO)

UN-Habitat and FAO are both part of United Nations. UN-Habitat is the programme working towards a better urban future. FAO have a series of land tenure manuals for guidance. One is the Voluntary Guidelines on the Responsible Governance of Tenure (VGGT). Another useful one, which was released in 2017, is Community Recording of Tenure Relationships using Open Tenure.

5.7 Solutions for Open Land Administration (SOLA) and Open Tenure

SOLA and Open Tenure are offered by the same group: FAO. SOLA is an open source suite of softwares. It is designed for regional/national land rights administration and uses multi-tier web services to support larger user numbers (McDowell, 2017). Open Tenure was released in 2014 and fills a similar space to that of STDM. Both Open Tenure and STDM are trying to support for social/community tenure.

SOLA has been piloted in three countries: Ghana, Nepal, and Samoa. The pilots had mixed success. Samoa adopted the system and rolled it out to all other ministries concerned but Nepal and Ghana had the common issue of weak governance (Pullar, 2018). The lessons learnt from the pilots have been applied to further implementations of SOLA since. There are now seven working implementations of SOLA around the world in varying extensions and language translations (Land Portal, 2018).

Open Tenure uses mobile devices for field data capture. It has been field tested in Cambodia and Myanmar In combination with the net-based SOLA Community Server software. In Cambodia it has appeared to dwindle due to the internal governance issues within the Monk community implementing it. More recently, Myanmar has had a much more positive experience. It involved positive collaboration between the NGO Partners Asia, an Open Tenure representative, a group of dedicated non-government people, and some local villagers from across Myanmar. These dedicated people are reportedly still using Open Tenure and are trying different sources of satellite imagery and attempting to capture their own imagery using drones (Pullar, 2018).

5.8 United States Agency for International Development (USAID)

USAID is among many similar government agencies in different countries. They have smartphone (MAST) and cloud-based (LandPKS) technologies to apply to land-based projects. They are designed to help improve tenure security for minorities and provide a knowledge source for sustainable farming practices.

5.9 Mobile Application to Secure Tenure (MAST)

MAST is a package which uses a mobile application and web-based data management for capturing rights and preparing land certificates in order to secure tenure. Data capture is completed through filling in standardised entry forms on Android smart devices. The app is not an off-the-shelf application, it requires customisation (Bouvier, 2018) . When a connection to wifi or a mobile network is available, data is sent to the web-based data management platform. There, it is processed for preparation of land certificates (Simons, 2018).

MAST is most appropriate for use by local organisations that deal with land management information like local government and non-government organisations. It is currently being testing for its potential use by community-based organisations. At present, the MAST suite is being used in rural parts or Tanzania, Zambia, and Burkina Faso to help smallholder farmers increase their land tenure security (Simons, 2018).

5.10 Talking Titler

Talking Titler is a land tenure information freeware system being continually developed by the University of Calgary. The lead lecturer there is Dr Michael Barry. The freeware "can be used to manage a range of land information applications which do not handle vast numbers of records." It supports the use of a mix of paper-based and digital documents. "The database design allows for bottom up, top down and open-ended evolutionary system design." Among other intended purposes, this tool can be used as a laptop-based software for field capture and it can augment with initiatives like the STDM (Barry, 2018).

A primary design feature of Talking Titler is the flexibility of recording people-people relationships and people-land relationships (Barry et al, 2011). This is thereby recognising the fundamental concept of intertwining relationships between the two strands in communal tenure: people-people and people-land (Goodwin, 2011).

The tool has been designed to allow for flexible inputs. Video and audio recordings enable a record to be made in the local language thereby surpassing any literacy constraints in a community. This record is linked to a GPS point in a GIS. This method was piloted in 2000 in the village of Algeria, in South Africa and more recently in Nigeria. The benefits of this method have been discussed with First Nations communities in Canada (Barry, 2018).

6. FUTURE TECHNOLOGIES

As a profession, we do not need to sit in fear of a technology take over. Instead, we need to utilise our global community, embrace changes in technology, and solve challenges. Technology is an enabler. It helps us to be better informed and focus on our skill sets. In this section of our paper we identify emerging technologies that will influence our industry and land administration solutions.

6.1 Spatial Data Infrastructure (SDI)

An SDI is a platform that links people to information. Another name for SDI is a multi-purpose cadastre. At its core is the cadastre and accurate geospatial information. It supports the integration and sharing of spatial data from the natural and built environment. It is intended for use by multiple stakeholders for decision making and resource management (Deininger, 2016). An SDI provides important information about the places that people create and use, and is the foundation for supporting a spatially enabled society.

6.2 Electronic Commerce (E-Commerce)

E-Commerce refers to the sale of goods and/or services via the Internet (Rivera, 2017). Think: Amazon, EBay and ASOS, where one click purchasing exists alongside overnight delivery. The evolution of e-commerce shows that consumer expectation drives innovation and change. Is this what users of geospatial data will expect? There are already geospatial data providers utilising e-commerce solutions. One example is Dotka Data, a Netherlands Based data services company that creates imagery based solutions (Hexagon Intergraph, 2018). Dotka Data have developed an e-commerce system where users pay to access original photos and geographic data.

6.3 E-Commerce Subscription/The Subscription Economy

An e-commerce subscription model is used by businesses that charge for services rather than physical products. Netflix is a perfect example, where you pay per month to watch television series and movies, and you as the consumer can unsubscribe at any point. Selling products is quickly becoming a thing of the past, as consumers increasingly opt for subscription services (Corcoran, 2015).

One recent example in the geospatial industry is Trimble Catalyst. This solution incorporates Trimble's core GNSS technology into a subscription based software service for your mobile device, where you select the accuracy you wish to obtain and pay per month. This reduces the overall upfront cost allowing more users to access the technology and the information it can provide.

6.4 Blockchain

A blockchain is a digital ledger or a record of transactions (Kleinman, 2018). Think of it as DNA, where genetics and mutations have been recorded since the beginning of time providing information about the origins of life. Blockchain does the same. Blockchain technology also facilitates secure online transactions. A network of computers must approve a transaction before it can be verified and recorded. Basically, it is harder to hack, because there is more to hack (Iansit & Lakhani, 2017).

Bitcoin is a well known use of blockchain technology, but it is not the only one. Blockchain has the potential to create new opportunities for modern LASs. Where every agreement, process, task, and payment would have a digital record and signature. It could then be identified, validated, stored, and shared (Iansit & Lakhani, 2017). This information would also be protected from deletion and tampering by others.

6.5 Artificial Intelligence

Artificial Intelligence (AI) is the ability of a computer program or machine to think and learn (Williamson et al., 2009). We are already seeing this today, through insights and recommendations on websites and social media such as Google, Amazon, and Facebook (Shani, 2017).

Many people are concerned that AI will replace humans in the workforce. The PWC Global Economic Outlook Report for 2017 summarised that "by the year 2030 it is expected that AI will replace 40% of jobs" with the most vulnerable being "retail, manufacturing and administration." AI will replace simple jobs and processes, for other more complex processes, AI will collaborate with and learn from humans (Shani, 2017).

Geospatial technology providers are already incorporating AI into solutions. Trimble Ecognition is one example, where AI is used for object based image analysis. In Ecognition a rule engine is developed, with the initial assistance of professionals or experts in the field, to create maps from aerial imagery and old cadastral survey plans.

6.6 Cloud Computing

Cloud computing, often referred to as "the cloud," means storing and accessing data and programs over the Internet instead of your computer's hard drive (Griffith, 2016). What this means is that local computers no longer have to do all of the heavy lifting when it comes to running applications as the network of engines in the cloud handles them instead.

In cloud computing, Application Program Interfaces (APIs) are used to tie together different types of technology in an ecosystem that is fast and flexible (Williamson et al., 2009). This means that technology from multiple sources can be combined into an integrated system, alongside file management, version management, and visualisation tools.

Cloud computing is already being used for land management and decision making through established complex rule engines which support data and formats of varying sources. Autodesk's "photo-to-3D" service, is one example, which combines aerial images and point clouds captured by UAVs to produce meaningful 2D orthographic views and 3D data (AutoDesk, 2016).

6.7 Integrated Technologies

6.7.1 Mobile

As we have already discussed, mobile technology such as smartphones are placing geospatial technology in the hands of many. Today there are thousands of smartphone applications that use location data supplied by the device's built in GPS receiver (Stenmark, 2017). Examples include Google Maps, Uber and Pokemon Go. The rise in the use of smartphones has seen an increased demand for accurate geospatial data. This is not only for mobile application developers, but also for users who seek to obtain reliability and accuracy from their location based services.

In 2016, Trimble introduced a software-defined GNSS receiver, Trimble Catalyst, that works with selected Android smartphones and tablets. The software-defined GNSS solution includes software running on a handheld, a small digital antenna, and a subscription to the Catalyst service. With Catalyst, users can obtain positions in real time with accuracy ranging from meters down to centimeters (Trimble, 2017).

Catalyst represents a convergence and evolution of multiple technologies. This includes processing power on small devices, computing algorithms, and cloud based correction services (Stenmark, 2017). Catalyst also allows for mobile application developers to link precise positions to any application running on the smartphone or tablet.

6.7.2 Crowdsourcing

Consumer technology is moving faster than the establishment of government policies, frameworks, and standards. In the geospatial industry, consumers are creating their own databases through the use of crowdsourcing. One notable example is OpenStreetMap (OSM). It was created from frustrations due to restrictions on use and availability of geospatial information across most of the world (Anderson, 2006).

Crowdsourcing involves the participation of end users in an open process with few constraints (Rice et al, 2012). The users while lacking formal training, structure and authority, are locals. Therefore they are more familiar with local geographic conditions and characteristics, making data collection faster and more current.

The use of crowdsourced information for Land Administration is considered an "unconventional method" of data collection because it is difficult to provide quality assurance from an authoritative source. OSM have a set of error detection tools to identify potential data errors, inaccuracy, or sparsely mapped places. Users also contribute to quality assurance by making corrections and accepting suggestions (Anderson, 2006).

Researchers at Carnegie Mellon University and the Hebrew University of Jerusalem developed a way for computers to find analogies. That is, for AI to make comparisons between different methods, identify problems, and highlight similarities. We see this as a huge development for the Geospatial profession. Mobile and crowdsourcing tools, when combined with AI and cloud computing, could change the way geospatial data is collected and verified. It is possible that with technology such as Trimble Catalyst, crowdsourcing will become accepted as a conventional method of geospatial data collection.

7. NEXT STEPS

A common theme throughout our paper is understanding and collaborating with the users of the technology to understand the challenges that they are trying to solve. We think that there is room for additional research. We suggest outlining the various types of technology available in a matrix. Then comparing them to a set of social tests or success criteria. The goal would be to determine if the technology is truly benefiting the communities and the people within them.

8. CONCLUSION

The human touch will never be replaced in the people side of land administration. But it may replace humans when it comes to capturing data. As a profession, we need not sit in fear of a technology take over. Instead, we need to utilise our global community, embrace change, and use technology wisely.

Technology is an enabler and we cannot disregard the opportunities it may provide geospatial professionals in the future. Whatever the technological innovation, humans will always need to exercise their emotional intelligence in land administration and ensure that decisions are being made based on spatial data, collaboration, and empathy. Get to know the people and their customs before choosing the right technology. Then you will create a sustainable solution which secures land tenure for all.

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BIOGRAPHICAL NOTES

The authors, Claire and Melissa, are Bachelor of Surveying graduates from the University of Otago, New Zealand. Both have received the Bogle Young Surveyor of the Year Award, joining a group of dedicated New Zealand surveyors who volunteer hours of their own time to advocating and supporting the industry.

Melissa is the Vice-Chair of the FIG Young Surveyors Network and respected Member of the NZIS. After a few years of 'stagnation' in the NZIS Young Professional's Group, Melissa got involved and kick-started the network again. Nowadays, the Group is arguably the most proactive in the NZIS. Melissa became a voting Member of the NZIS in November 2015 and gained her License to Conduct Cadastral Surveys soon after.

Having gained her first 4 years' post-graduate experience at a private consultancy, Eliot Sinclair in Christchurch, Melissa decided it was time to try something new. In more than six years of post-graduate surveying, Melissa has excelled not only professionally but technically as well. So, with that technical spirit in mind, she joined Trimble Inc. in 2016 as part of the Rotational Development Programme. Her role there has seen Melissa involved in a number of exciting projects and now has her working at Trimble SketchUp in Boulder, Colorado. In her 'spare time,' between exploring the great outdoors of Colorado, Melissa has been overseeing the organising committee for the 4th Young Surveyor's Conference in Turkey this year.

Claire is an active participant of the Young Surveyors Network and the Education Representative for the NZIS Young Professionals. After passing her professional entrance exams in November 2016, Claire became a voting Member of the NZIS and then a Licensed Cadastral Surveyor in February 2017. A consulting surveyor, Claire spent the first four years of her career working at Beca in Christchurch and in Wellington. For a change of scenery Claire now works at Calibre in Wellington, New Zealand.

Having realised her passion was lying in the challenges of land rights at the FIG Working Week 2016, Claire returned to the School of Surveying. She spent the last semester of 2017 studying a part-time paper in Advanced Land Tenure which opened her eyes to what value surveyors can offer. Add to that the advice that Melissa gave Claire when she was deciding whether to do further study. Technology is rapidly taking over Western societies but land tenure issues will never be completely solved without land professionals. Thus, the idea for this paper was sparked.

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