SOCIETY DRIVEN INNOVATIONS IN LAND ADMINISTRATION

[1,3]Christiaan Lemmen, [2]Prof. Dr Peter van Oosterom, [1]Kees de Zeeuw, and [1]Martin Salzmann

[1]Netherlands Cadastre, Land Registry and Mapping Agency,
P.O. Box 9046, 7300 GH Apeldoorn, THE NETHERLANDS

[2] Delft University of Technology, OTB, Section GIS Technology,
P.O. Box 5030, 2600 GA Delft, THE NETHERLANDS.

[3] Faculty of Earth Observation and Geo-Information Science (ITC), University of Twente,
P.O. Box 217, 7500 AE Enschede, THE NETHERLANDS.

e-mails: [1]Chrit.Lemmen@kadaster.nl, [3].Lemmen@itc.nl, [2]P.J.M.vanOosterom@tudelft.nl,
[1]Kees.deZeeuw@kadaster.nl, [1]Martin.Salzmann@kadaster.nl

Abstract

Motto of this paper is: "Spatial enablement of society is only possible with forward planning and a shared vision of what is possible. This vision is at the heart of the next generation of Land Administration systems" (Williamson et al, 2010).

Our society is digitising rapidly. This also affects cadastral and land-administration organisations. Due to fast IT-developments and globalisation, the demand for data and services changes from office-based applications towards web-based and location-based. There is both a growing ability and need to analyse complex issues. Furthermore, decision making is done more and more in virtual (spatial) environments. Hence, the provision of high-quality authentic governmental data and services becomes more important.

With this in mind one may wonder what will be the consequences of this in 15 years time. This paper tries to give a perspective. The influence of ICT-related developments is treated: Mature Information Infrastructure; Dynamic Process Models; 3D (and 4D) Space+Time Administration; Parcel Design Applications; More Than Traditional Rights, Restrictions and Responsibilities; Faster and More Direct Updating by Actors; International Seamless Registration; Semantic Web-Based Content; Mobile Applications and Monitoring Applications. All this in the context of Shared Information Services.

Of course all those developments are recognised and know in the Netherlands Cadastre. An overview of the consequences in terms of solutions, innovations and business strategy for the Dutch Kadaster is presented. Implementation of measures to meet the actual developments requires a matching business strategy and compliance with often legally- constrained business-processes in land administration.

The conclusion of this paper is that innovation is not as much an option but a prerequisite that affects our information strategy, systems, services, organisation and way of working. The increasing pace of innovation demands can no longer be tackled by a single-party strategy. Therefore, the need for collaboration (open innovation) is stressed. If cadastral organisations embrace such an open approach, they will be co-creating the evolution of land administration and spatial data information systems. If not, they risk being a spectator and follower of revolutionary land-registry developments.

Keywords: *Land Adminsitration, Cadastre, Land Registry, Strategy, Innovation, Web based, Lacoation based, User demand, LADM, STDM*

1 INTRODUCTION

We come from a situation where the societal relevance of a cadastre was limited to the core statutory tasks of registration and maintenance of cadastral maps and providing information on land parcels and their ownership and use-rights (van der Molen, 2009). Nowadays, modern land registry organisations do not only face many new challenges, also the pace of demand for new products and services increases every year.

This paper looks from a global perspective at side – with the ambition to identify relevant global trends for cadastre and land registry organisations and activities. Then from a national, Dutch perspective: what are the impacts of developments and trends for the next years?

First an overview of twelve trends for Land Administration Systems towards 2020 is given in paragraph 2. It should be noted here that looking into futures is not so easy, but efforts are made earlier: Kaufmann and Steudler, 1998, van der Molen, 2003, Uitermark et al, 2010, Bennet et al, 2010; and also Lemmens, 2010a and 2010b. Augustinus, 2010; and Zevenbergen and Haile, 2010 look from a perspective of developing countries.

Within this context of those future trends we look to the Netherlands Cadastre, Land Registry and Mapping Agency (Kadaster). The driving forces identified by Kadaster overlap with the identified trends; see paragraph 3.

Then this paper aims to analyse the developments in society that influence the functioning of a cadastral organisation and to show how the Netherland Kadaster handles these developments. The driving forces behind development are categorised and the impact on our business processes is explained in paragraph 4.

In paragraph 5 and 6 it is shown how Kadaster, reacts on these developments by introducing new solutions and innovations constantly, and by adapting our organisation and company strategy accordingly (see also Zeeuw, de, and Salzmann, 2011).

Finally, in paragraph 7, we summarize the consequences of these developments for the Dutch Kadaster and how our experiences can be of value to other registering organisations, questioning ourselves: are we in the middle of evolution or revolution, should we act or should we react?

2 TWELVE TRENDS FOR LA SYSTEMS TOWARDS 2020

It is our vision that, in moving towards the year 2020, many developments will help to strengthen the complex relationship between land registrations and other public basic registrations, in their true 3D complexities (or, even 4D, when the temporal dimension is integrated), helped by ICT-developments. In the next sections our vision is sketched by describing twelve developments, which are expected to be operational by the year 2020 (Uitermark et al, 2010).

2.1 Mature Information Infrastructure

The information society, which is currently in its infancy stage, will be more mature by the year 2020, with as a result several well established domain standards, enabling meaningful information exchange at a global level, but also at a national or sub-national level, between different domains or disciplines. The information infrastructure will provide the environment for integrated and 'seamless' access to all these sources. Furthermore, the information infrastructure will provide the environment in which these sources can be maintained in a consistent manner. Domains will have links with other domains, which require that updates take care of consistency with related registrations. For LA systems, as cornerstone of the information infrastructure, these links with other registrations are numerous, for example, persons, buildings, rights, or topography. Besides 7*24 hours access over the network, this requires certain mechanisms to be in operation, like every registration must maintain history (in order to avoid 'dangling' references from outside, not aware of certain changes), update alert or notification systems must be established (in order to inform related registrations about changes, which may also need an update in the related registrations) and providing adequate solutions for performance and robustness; for example, via replicated, proxy servers. For an organization in order to rely, for its primary task, on a registration of another organization, some kind of 'information assurance' must be established: a legal and financial framework. In case of a failure, which should of course be avoided as much as possible, there will be a compensation, which is proportional to the damage of having no access to required information.

2.2 Dynamic Process Models

After agreeing on the information content in LA, via initiatives such as the INSPIRE Data Specification for Cadastral Parcels (EU, 2007), and the ISO/TC 211 (and CEN/TC 287) Land Administration Domain Model (ISO, 2011), different processes in different countries will become more transparent. It will therefore be easier to compare the different processes and discover 'best practices'. These in turn may be used in the future to harmonize the processes, as in an ever more global economy that will be expected and appreciated by the users of LA systems. In addition, due to the fact that current systems more and more do maintain history, this will enable researchers to develop social and economic dynamic process models (for example, to analyze the effect of certain policies or economic developments on the land market). These dynamic process models will then be supportive in better predicting future developments in the land market and the effect of new policies.

A complete different need for such dynamic processes can be derived from an urgent need for land registration world wide. There is a lack of land information in developing countries, especially in informal settlements and customary area's. Less than 30% of LA coverage is in conformance with the situation on the ground. This means that over 70% of the land is outside LA systems. In many countries informal rights are not recognized as being legal. Customary land tenures are not included in the LA system. This has caused enormous problems, for example in cities, where over one billion people live in slums, without proper water, sanitation, community facilities, security of tenure or quality of life (Enemark et al, 2009).

Where there is little land information, there is little land management. Conventional LA systems are based on the 'parcel-based' approach, applied in the developed world, and implemented in developing countries in colonial times. A more flexible system is needed for

identifying the various kinds of land tenure in informal settlements, or in customary area's. Alternative representations of area's and alternatives for traditional land surveys are needed. Traditional land surveys are costly and time consuming, and proved not to work in many situations in developing countries. Handheld GPS, or the use of satellite imagery, are considered to be inaccurate by the surveyor's community; but this attitude results in a lack of LA coverage. There is a need for complete and up-to-date LA coverage. A more flexible system has to be based on a global standard like LADM, and it has to be manageable by the local community itself. It is here where the Social Tenure Domain Model (STDM) comes in supported by dynamic processes: this kind of standardization allows for the integration of data collected by communities into a formal LA system at a later moment in time.

2.3 3D (and 4D) Space+Time Administration

The increasing complexity and flexibility of modern land use requires that LA systems will need an improved capacity to manage the third dimension. As the world is per definition not static, there will be a need in relation to the representation of the temporal (fourth) dimension, either integrated with the spatial dimensions, or as separate attribute(s). In the long term, an integrated 4D registration of all objects, will be the most effective solution (Van Oosterom et al, 2006; Döner et al, 2010).

The 4D integrated space/time paradigm, as a partition of space and time without gaps and overlaps (in space and time), is a very generic and solid basis. Initially, this approach may seam an overkill, and only to be applied for some more complex objects such as construction works and utility networks. However, by the year 2020, the technological challenges related to 4D registrations will be solved, and this will be the most effective base for registering all objects. 5D (scale) will be solved (Oosterom, van, and Stoter, 2010).

2.4 Parcel Design Applications

Today LA systems are mainly used in 'registration' mode, but with all information available within these systems, and related registrations within the information infrastructure, it may be well situated to be used in 'design' mode. Traditionally, in many countries LA systems have been involved in (rural) re-allotment, land consolidation projects, or in physical planning. In our dynamic environment, both in rural zones, urban zones, and transitional zones, the design capabilities of the LA systems will have to be further developed in order to solve complex situations. As this will also happen more and more often in dense urban areas, it will be required that these designs (similar to the administration) will support 3D (both topographically and legally). In designing new spatial units, the future information infrastructure will be heavily used as the design requirements are related to many other geo-information sources, like soil and land value, or accessibility to roads and water. This will support in decision making for food and energy provision.

2.5 More Than Traditional Rights, Restrictions and Responsibilities

The proven capabilities of LA systems (and trust or confidence of society in its content) to register a range of different rights, restrictions and responsibilities will also be used as starting point for a range of new registrations. A characteristic of all these registrations is that somehow people, spatial objects or spatial phenomena (and the relationships between these) are important. Emerging examples of this are: registration of groundwater quota (note that this has clearly a 3D and temporal character) (Ghawana et al, 2010), carbon credit quota

registration (as a tool to assist in taking measures against global climate change), or rights of all kinds of natural resources (such as mining). But also the physical plans and the associated rights, restrictions and responsibilities they bring along, will belong to this category of 'new' registrations in LA systems. Instead of unrelated registrations, by the year 2020 society will benefit from a harmonized system of registrations of all these spatial and temporal objects and the involved rights, restrictions and responsibilities.

2.6 Faster and More Direct Updating by Actors

The currently established update procedures will be simplified by the year 2020. For example, to split and sell a part of a parcel, require nowadays professionals, such as notaries, surveyors, and registrars, each performing certain sub-tasks. An early example of this was the developed prototype to add a boundary sketch by the notary as part of the transaction (Brentjes et al., 2004). Based on authenticated identification of persons (e.g. in The Netherlands the well accepted 'Digid' system; Digid, 2010) and trusted reference material (e.g. high resolution and up-to-date geo-referenced imagery), seller and buyer will together, via web-services, draw the new boundaries of the split part of the parcel and complete the transaction, including payment via a web-service of the bank (e.g. in The Netherlands the 'iDeal' system for digital payment is in use; iDeal, 2010). The required web-services and protocols are currently being developed and implemented; e.g. WFS-T (Web Feature Service with Transaction capabilities; OGC, 2010). The accuracy of digital reference material becomes so high that there is no need to go outside for a survey. The reference material can also include the 3D aspect; e.g. in The Netherlands by 2012 the completed AHN2 elevation data set is available and has an accuracy of 2-3 cm, about 10 points per m^2, with a nation-wide-coverage (AHN, 2010). Also integration of outdoor geo-information (GIS) with indoor spatial-information (CAD/BIM) will be completed by the year 2020 and can be used. The role of the LA authorities will be to provide the required infrastructure, at least the LA part and the links to other parts of the geo-information infrastructure (GII), and perform quality control and validate transactions: "are all steps performed correctly?".

2.7 International Seamless Registration

Today LA is a national or sub-national matter (province or state). The effect is that on the boundaries the parcels do not always fit, but also that many systems may need to be visited to find all rights (properties) of a single person. Due to international standardization (INSPIRE and ISO), the content of these national registrations can be better exchanged and combined. Furthermore, the international GII will also stimulate the development and maintenance of an international coverage that 'fits' by the year 2020: seamless data across country or territory borders (with no international overlap or gaps), and all data accessible in the same client environment without bothering the end-users; even if sources or servers are different.

2.8 Semantic Web-Based Content

The differences in (legal) concepts, terminology and languages which are used in the different LA systems is today still limiting the access and understanding of LA data in an international context (compare EULIS project; see Tiainen, 2004). However, legal concepts of the different countries will be formalized using semantic web technology, similar to all other kinds of knowledge. These formalized semantics are used in the mapping between the concepts and terminology from different countries, allowing the users to have access to all information in an unambiguous and understandable manner. So by the year 2020, via these semantic

translators, foreigners can as well understand and trust the content of an LA system as natives do: so, the meaning is crystal clear to outsiders such as foreigners, but also to machines.

2.9 Mobile Applications

Augmented reality applications, precise positioning and orientation (for example, the Dutch company Layar with applications for smart phones, such as the iPhone): data accessible everywhere, all using authentic sources, but also for updating these sources by the community outside. Furthermore, mobile applications can read the successors of bar codes of id-cards to identify people, and digital fingerprints, or iris scans will be available in the field.

2.10 Monitoring Applications

Satellites can monitor changes in areas, which have been identified as world heritage sites: forest and nature, lakes, coast lines, glaciers, and polar zones. But also agriculture land, inundations, and draughts. This information can be linked to 'RRR' polygons and other GII layers for decision making in water and food provision, with attention to flora and fauna.

2.11 Community Driven Cadastral Mapping

There are many examples where citizens have to compensate for transaction costs in a way leading to corruption. This makes LA not a popular activity in many countries. People should have the confidence that LA is in support of their own development. Traditional land surveys are costly and time consuming. For this reason alternatives are needed, e.g. boundary surveys based on handheld GPS observations, or by drawing boundaries on satellite images (as available on GoogleMaps). Another community driven mapping approach is OpenStreet maps and other alternatives (OpenStreetMap (2010), Norwegian Council for Africa, 2010).

As in OpenStreet map, cadastral data can be collected by local communities in a participatory way. And then data may be accessible on the web, e.g. in GoogleMaps or OpenStreet map. This may also support the complete coverage of all land in a LA, which is only possible with an extendable and flexible model, that enables inclusion of all land, all people and all 'people – land relationships'. The Social Tenure Domain Model is built for this purpose. An open approach will close partly the technical gap in developing countries in terms of making LA covering the total territory. Of course an infrastructure is needed: web-based with options for authorisation on who will access data for viewing and editing.

Just a press release: more than 60 members of the Southern Sudanese diaspora came together to help locate schools, hospitals, and other social infrastructure at a "Mapathon" on South Sudan today. Held at the World Bank's headquarters in Washington, D.C., the day-long event was jointly organized by Google and the World Bank. South Sudan is expected to become the world's newest country come July this year. The event began with remarks from World Bank Vice President for the Africa Region Obiageli Ezekwesili, who talked about how today's technology can empower civil society, including the diaspora, to collaborate and support the development process. This is especially in places which face daunting development challenges, such as South Sudan. "*This is about shifting the center of gravity from organizations to people, and empowering them to solve their own problems and develop their own solutions using maps*," said Ezekwesili. Worldbank, 2011.

2.12 OpenCadastreMap

The developments as pointed out before may look as enlarging the digital gap between the so called developed world and developing world. However, it is expected that ICT provides opportunities to avoid undesired developments (e.g. land grabbing, distribution of titles over land used by local communities to mining companies, agricultural industries and other ways of large scale land use and investments), where the local communities, who are often overruled by this, even in areas where those developments have been taking place for long time. Recognition of customary rights and of occupancy rights are relevant in formalization, apart from adjudication (which is time consuming and expensive). OpenCadastreMap is exploring the possibilities and dilemma's of participatory cadastral mapping by asking for instance the following questions: what will happen if people start uploading their land claims to the internet if the formal statutory systems lag behind? What are the social, legal and technical dilemmas? What are the economic implications? OpenCadastreMap is also investigating the problem solving power of social media. The issues mentioned above are of a multi-dimensional nature. OpenCadastreMap aims at bringing the knowledge of related LinkedIn Groups and other social media together.

In a setting like STDM data that comes in via OpenCadstreMap can be included. Of course different layers are needed with collected and authorised data. Approaches are de-central and participatory. Quality labels for accuracy are needed (Lemmen, 2010).

It should be noted that many organizations have attention to the registration of land rights, and there are networks, like the Indigenous Mapping Network, established by anthropologists. The mission of the Indigenous Mapping Network is to connect native communities with the tools needed to protect, preserve, and enhance their way of life within the aboriginal territories. This endeavour often requires an amalgamation of traditional “mapping” practices and modern mapping technologies. Another network is the aboriginal network. According to Chapin et al (2005), the mapping of indigenous lands to secure tenure, to manage natural resources, and to strengthen cultures, is a recent phenomenon, that begun in Canada and Alaska in the 1960s, and in other regions during the last decade and a half. They recognize that indigenous mapping has shown itself to be a powerful tool and it has spread rapidly throughout the world. Their review covers the genesis and evolution of indigenous mapping, the different methodologies and their objectives, the development of indigenous atlases and guidebooks for mapping indigenous lands, and the often uneasy mix of participatory community approaches with technology. A recent workshop in Québec, Canada, on the Land Administration Domain Model, pointed out that this issue is still most relevant in Canada (Egesborg, 2009).

3 DRIVING FORCES FOR DEVELOPMENTS

Cadastre and land registry organisations are an essential part of modern societies. Modern societies are partly defined by the fact that the can cope with two driving forces causing rapid development. Technological development that influences cadastral working processes are:

- Improved hardware (especially the hand held devices like PDA’s and smart phones);
- The high availability of base maps and aerial photographs at various scales, both commercial as governmental;
- The widely availability of GPS signal for commercial and governmental applications;
- New techniques like Lidar and the collection of 360 degrees ground imagery;

- The possibility to globalize business process services (making use of fast internet connections). The hosting of a server park, the set up of a Helpdesk or the digitizing of data can be easily done elsewhere in the world at a more convenient price, quality or time scale.

Societal developments that influence our cadastral working processes are:

- The growing ability and need to analyze complex issues; on the fly decision making is expected and asked for;
- Political changes within the country and further globalisation of national policy issues;
- Virtualization of space, ownership and decision making processes (for example an increased liability demand in the virtual world);
- More critical and ICT-literate (end-)users;
- The continuous need for cost reduction and the expectation that data and information are for free.

Recently we experienced the impact of economic and political changes world wide on the functioning of cadastre and land registry organisations. The financial crisis (2008) influenced property and credit registration world wide and political changes in Northern Africa (2011) emphasize the importance of reliable land registration in the political redevelopment of a country or state. But also demographic, environmental and maybe even ideological changes influence the primary business processes of cadastres and land registries, as these meta-changes have a direct influence on the role and services society demands from our organisation.

4 DEVELOPMENTS EFFECTING DUTCH KADASTER

As a consequence of the rapidly evolving technological push and societal pull, the processes of collecting, managing and distributing data and information on land properties need continuous adaption to actual demands and insights. Without the intention to be exhaustive, this can be translates in some clear developments effecting the business processes and position of the Dutch Kadaster directly.

4.1 Developing demand: From data to information to knowledge

In our primary business processes we experience an increasing demand for more knowledge intensive services. According to Ackoff (1989, see figure 1) we shift from data deliverance centre, towards information provision and knowledge centre. This means that advisory services on our information products (based on our data collection activities) become more and more important.

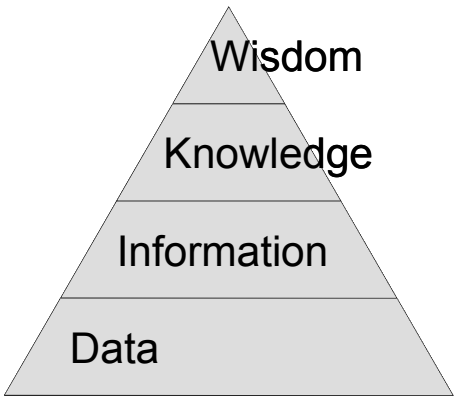

Figure 1. The knowledge pyramid.

In the last decade much effort was put in keeping up with the demand for many new information products. Kadaster organisations transformed themselves from 'data factories' into 'information service organisations'. For example, since 2008 the Dutch Kadaster provides to its customers an index matching buyers profile in relation with he purchase classes of the property; an information product that ten years ago would have been impossible to produce. This index is now a standard automated product of Kadaster and refreshed every month.

Many other information products could be thought of. However, much time for development is not given as new and different user demands arise swiftly (often based on a strong technology push).

4.2 People change

Our society changes into an information based society where citizens, professionals and officials become more and more informed and connected. As a consequence the status of an organisation like Kadaster changes as well; Kadaster moves, unsolicited, from an single issue authority towards a widely available service provider.
Also, worldwide, the next generation is better educated in the use of high tech interfaces and the interpretation of huge amounts of information. Social media and virtual environments become part of the real live environment of individuals and organisations.

4.3 Offices become web services and location based services

Our society gets more digitalized every day and improved communication technology opens up new applications and possibilities for both citizens as professionals. The demand from office based to internet based to location based information services is a development affecting our business processes severely. Hence, spatial and administrative registrations of governments need to adapt.

4.4 Environmental management becomes more and more a 'virtual world activity'

In the demand for a more efficient and reliable government, essential information (which we define as 'key registries' in the Netherlands) is being stored digitally and connected systematically. As the concept of 'data at the source' is assumed to avoid duplication and to improve the efficiency and data quality, data management becomes a joint responsibility of different governmental organisations using all kind of commercial facilities like services, application platforms and infrastructures. The actual terminology used for this is Software-as-a-Services (SaaS), Platform-as-a-service (PaaS) and Infrastructure-as-a-Service (IaaS). Good further reading on this subject is for example given by Baranski *et al.* (2009).

The management of our national spatial data infrastructure (SDI) becomes more and more a virtual world Activity. Hence, decision making and environmental monitoring become more dependent on the virtual environments that governmental organisations maintain. Our cadastral and land registry information sources play a crucial role in these processes, as it

influences personal (People), economic (Profit) and environmental (Planet) issues in society. Worldwide, this also becomes obvious in all kind of post-disaster and post-conflict situations.

4.5 Problems / demands become to complex to handle on your own

A the Dutch Kadaster we experience that the demand for plain raw data decreases while the demand for solving complex issues increases. These issues are very often not solvable with a single issue data analysis. The integration with information from other organisations or sources is unavoidable in that process. The other way around, our data becomes more and more part of analysis done by other organisations or individuals. For that reason we have to make our data and information available in such a way that our partners and others can solve their problems by integrating our data and information into their systems. This has to be done taking account for all different aspect of the national spatial data infrastructure: data, standards, technique, policy and organisations (after Rajabifard *et al.*, 2003).

5 SOLUTIONS AND INNOVATIONS

Barnasconi and van der Molen (2010) and van der Molen (2009) categorize cadastral innovations into four major areas of development, giving many examples of innovations:

- The land and real estate market
- Governance
- e-Government services
- Economic activities in general

Innovation of our products and business processes should contribute to improvements in these areas of development. Without repeating the innovations mentioned in previous papers, only the most recent developments are mentioned in this paper. At present about 12 % of our annual turnover is spent in projects focussed on the development of new products and business processes. A substantial part of that budget is spent on new and other registrations ('non-cadastral') and the renewal of existing (database) systems which is necessary as a basis for further innovation and the introduction of new services and products. Looking at the land registry and cadastral mapping part of our organisation, in which roughly 30% of our innovation budget is spent, some notable development projects are mentioned.

For more efficient data collection in the field, tablet computers have been introduced for our land surveyors. These mobile devices have been equipped with a set of software tools for error reduction, optimum route planning and on the spot access to digital information. A gradual introduction of these new techniques for more than 300 land surveyors started in 2010. In connection to this introduction 'solo surveying' is introduced (one person surveying units) and experiments are being done with GPS based tracking and tracing of our vehicles, allowing for better personnel security and planning of activities and routes.

Apart from many new information products (index buyers profiles, Kadaster 'House reports", suitable land plot acquisition for farmers, etc.), Kadaster recently introduced a dashboard on its website (http://www.kadaster.nl/perskamer/vastgoedcijfers.html) providing a monthly actual insight on a variety of Kadaster data. This information is also provided as a web service to selected partners, to be incorporated into other information services outside Kadaster.

Our web services to our professional customers are evolving rapidly. A chain integration project for property registration (so called 'KIK' project) has resulted in the possibility for the

automated acceptance and mutation of mortgage deeds and deeds of transfers, both improving our services to notaries and banks. But not only the demands of commercial banks are met much better, also collaboration with national and on-line property brokers is initialised. The integration of our information services improve their commercial web based applications (e.g. www.woningwizard.nl, www.funda.nl, www.woningquote.nl).

The Key Register Cadastre, along with the Municipal Personal Records Database (GBA) is accessible via the www.MijnOverheid.nl website. After identifying themselves using their electronic ID, private individuals can consult the rights that have been registered for them in the Key Register Cadastre. This consultation is free of charge. In the event people believe they are registered incorrectly, they can report these errors via the Kadaster website, again using their electronic ID for identification purposes.

Location based services and augmented reality (AR) applications become part of societal demand. Therefore Kadaster has invested in the facilities to present its data using augmented reality (using 3D glasses or AR technology as developed by Layar). Also developments have started to provide our data to smart phones through modern apps (like I phone or Android Apps), rather than using texting services as we have used for 'WoningWizard'. All these initiatives have been started in close collaboration with other (commercial) parties.

In 2010 Kadaster has started a project called 'Provisional cadastral boundaries'. As the time between deed registration and parcel creation after field survey is long (from 6 to 12 months), the registration and map seems temporarily inconsistent, causing a complex database system. Hence, a solution in the cadastral update process is being developed. In the future mutation process, parcel creation will be done before deed registration with provisional boundaries and parcel area. A simple verification of geometry of the new boundaries will be done in the terrain later on. To facilitate this process a web application (called 'Splits!') is being developed. This application allows the owner or notary to prepare a request for parcel division with provisional geometrical data of the new future cadastral boundaries, using a web based geographic information system.

6 BUSINESS STRATEGY OF THE NETHERLANDS KADASTER

Looking back at the last decade, we can conclude that our systems and products have changed a lot. Not only many new services have been developed based on the same set of basic data, but also many new registrations have become part of an integrated geo-information organisation, as Kadaster is today. The traditional integrated approach of cadastre and land registry in the Netherlands (and the movement towards more positive legal status of the registration) has been extended with the national topographic mapping since the late nineties. Recently also services for addresses, buildings, cables and pipes have been added to our organisation's responsibilities. Kadaster as an organisation is moving towards a national centre for geo-information services, rather than a pure cadastral agency as the name implies.

To comply with our rapid changing environment Kadaster is evaluating its approach and policy on a yearly basis in relation to its long term policy which has a five years cycle. The key targets for the policy period 2011 – 2015 are defined as:

- Offering services that suit our customers needs
- Collaboration
- Cost control

- Flexibility
- Quality and continuity

The key actions for 2011 are summarized in a working plan 2011 called "Working according to your demands". In this working plan our actions are defined according to our key targets as mentioned. Being of value to our customers is done by offering high quality products at stable and affordable prices. This means that we will be looking more at how we perform our statutory tasks through the eyes of our customers; offering services that suit our customers needs. To do so, we direct our organisation more in a customer relevant manner than in a production process relevant manner. Therefore we make a clear distinction in three different main tasks: i) Data acquisition and registration, ii) provision of information and iii) customised work and advice. To improve our data acquisition and registration we envisage further automation to achieve more efficiency, providing optimum quality at the lowest possible cost. The provision of information will evolve to more and more online services for faster and easier access to our information products. It will be made easier to establish links between data obtained online and to import data into our customers' automation systems. Our customised work and advice is offered for more complex customer questions when our basic product range is not sufficient. This activity includes our advice on setting up cadastral and key registry systems in countries where land and property registers are less well developed or our knowledge is relevant for further development.

We recognise that our activities in the property and geographic sector form a kind of supply chain with activities performed by other parties. Therefore we move towards more collaboration with private, public and scientific partners, to meet society's expectations. Most appealing effort we make in 2011 is the collaboration with five public partners to furnish a joint web service for an integrated information infrastructure serving public information demands (called "PDOK – Publieke Dienstverlening Op de Kaart", meaning "Public Services Mapped"). But also the development of an I phone app in collaboration with a small private enterprise could be mentioned. Doing so, Kadaster plays a key role in optimizing the national spatial data infrastructure.

The recent financial crisis (starting 2008) affected strongly the real estate and credit market in the Netherlands. This resulted in the need for a new financial policy and strategy of the Dutch Kadaster. To be able to work at the lowest possible prices of our products, we strengthened our focus on cost control. Doing so, a fragile balance is strived for, between cost control, a minimum level of structural reserves and investment in innovative services to keep track with our fast changing environment.

The fluctuations in the property market ask for flexibility in our organisation. The deployment of people and resources should be made available according to the workload. This is managed by moving towards a human resource management aiming at a dynamic workforce, examination of changes in our terms and conditions of employment and a critical evaluation which tasks can be performed by others, either in house or outside of Kadaster.

Finally, we have eye for quality and continuity of our products, business processes and the knowledge of our employees. The continuous upgrading of our IT systems for (future) automated services is an essential part of this.

Looking at this business strategy it is clear that many preconditions have to be maintained or developed. Our contribution to a new set of national and international standards is a clear

example of that. Though it is important to cherish the values of good land administration and the existing spatial data infrastructures, it is equally important not to re-invent the past.

7 CONSEQUENCES FOR KADASTER

To fulfil the demands of our customers and society, Kadaster has a strong focus on the innovation of products (the 'what?' question) and processes (the 'how?' question).

A firm investment in information technology and infrastructure is indispensible to meet up to these requirements. Nevertheless, it is clear that the solution will not be in making things bigger and bigger. There is a limit to possibilities of up-scaling. Keywords these days are 'open source, the crowd and the cloud'.

As community driven software development reaches a quality level comparable to commercial software packages, the use of open source software becomes within reach of governmental organisations. Especially as the technical support of open source software is taken up, as a new service, by private companies. Kadaster has a cautious policy in the use of open source software, but is open for development. The use of open versus closed source software is highly related to the security level and life cycle of applications. For database management systems our closed source systems are still in place. In the field of analysis and operational tools a mixture of closed source and open source arises, while at the front end (portals, web interfaces, etc.) a majority of open source applications develops.

With respect to 'crowd sourcing' (or voluntary geo-information provision), Kadaster is a partner in several pilot projects, involving the general public in data provision for our key registries. This paper will not go into detail on possibilities and limitations. But an important restriction one should realise is that in our case crowd sourcing for cadastral purposes is not a community based initiative, but an effort to support a professional organisation in cost efficient data gathering. This requires a different attitude from both the Kadaster as from the volunteers providing this data.

In the IT world 'cloud computing' is strongly believed to be the only way to keep up track with user demands for data retrieval, management and analysis. Commercial parties start offering software, platforms, infrastructures and services (as mentioned in 3.4.) in a cloud environment. Kadaster is in a phase of reconnaissance of our possibilities. It is realised that it is unavoidable and offering a lot of potential, but also that many quality and security issues are still to be solved or to be clarified , before certainly right data can be brought into 'the cloud'.

Apart from the financial investment that is required, effort is being put into capacity building of our own personnel and the clever building up of networks and alliances. Our organisation transforms from a production type organisation into a knowledge driven shared service centre, with a national and international importance. This asks for continuous adjustments to our position, personnel and functions. Coming from a national monopolist situation, we become more and more an indispensible link in a chain and an international context. Its becomes our task to co-create the evolution of land administration and spatial data information systems. We have to match users' expectations and technical possibilities with existing (and often sound) legal and business rules and processes.

8 CONCLUSIONS

Based on the environment and developments as delineated in this paper, it is concluded that innovation is not an option but a prerequisite. Society goes on, whether we like it or not. This innovation concerns our information strategy, systems, services, organisation, way of working and business models. The pace of innovation is becoming so fast that solving user demands alone with existing systems is not possible any longer. We have to adapt to the concept of 'open innovation' and be open to new technological developments. The increasing pace of innovation demands can no longer be tackled by a single-party strategy.

By participating in the process of innovation and development the changes can be managed as an evolution and business processes and organisational aspects can be adapted accordingly.

If not participated in this process, the pace of development will be to fast and a cadastral organisation will experience developments as a true revolution.

If cadastral organisations embrace such an open approach, they will be co-creating the evolution of land administration and spatial data information systems. If not, they risk being a spectator and follower of revolutionary land-registry developments.

So: an evolution is for cadastral organisations in the developed world may be a revolution for the developing world? Or is it so that the organisations in the developing world have a good starting position where they can use directly the latest innovations (see Worldbank 2011). Let's be optimistic!

References

AHN (2010). http://www.ahn.nl/

Ackoff, R.L. 1989 *From Data to Wisdom*, Journal of Applied Systems Analysis, Volume 16,1989

Augustinus, C. 2010. *Social tenure domain model: what it can mean for the land industry and for the poor.* XXIV FIG International Congress 2010. Sydney, Australia.

Baranski, B., Schäffer, B. and Redweik, R. 2009. *Geoprocessing in the Clouds*. Presented at Free and Open Source Software for Geospatial Conference. Sydney, Australia.

Barnasconi, G.J.M. and van der Molen P., 2010. *Cadastral innovations and financial crisis. The cas of the Netherlands Kadaster.* FIG international congress, Sydney, Australia.

Bennett, R., Rajabifard, A., Kalantari, M., Wallace, J., and Williamson, I. 2010 *Cadastral Futures: Building a New Vision for the Nature and Role of Cadastres.* FIG Congress 2010, Facing the Challenges – Building the Capacity, Sydney, Australia, 11-16 April 2010. http://www.fig.net/pub/fig2010/papers/ts08k/ts08k_bennett_rajabifard_et_al_4096.pdf

Chapin, Mac, Zachary Lamband and Bill Threlkeld 2005 *Mapping indigenous lands.* Annual Review of Anthropology, 34 : pp. 619-639.

Digid 2010. http://www.digid.nl/english/

Döner, F., Thompson, R., Stoter, J., Lemmen, Ch., Ploeger, H., van Oosterom, P., and Zlatanova, S. 2010. *4D cadastres: First analysis of Legal, organizational, and technical impact - With a case study on utility networks.* In: Land Use Policy, Volume 27, pp. 1068-1081.

Egesborg, P. 2009 *Land Administration Domain Model. Canada Lands Survey System / Indian Land Registry Reconciliation Project.* LADM Workshop. Québec City, Canada.

Enemark, S., R. McLaren and P. Van der Molen 2009 *Land governance in support of the millennium development goals. A new agenda for land professionals*. FIG / World Bank Conference, Washington D.C., USA. FIG publication No. 45.

EU 2007 *.Directive 2007/2/EC of the European Parliament and of the Council of 14 March 2007 establishing an Infrastructure for Spatial Information in the European Community (INSPIRE).* Available at <http://inspire.jrc.ec.europa.eu/>

Ghawana, T., Hespanha, J.P., Zevenbergen, J, Oosterom, P. van, 2010 *Groundwater Management in Land Administration: A Spatio-temporal Perspective,* XXIV FIG International Congress 2010. Sydney, Australia, pp. 1-21.

iDeal (2010). http://www.ideal.nl/?lang=eng-GB

ISO 2010) ISO 19152. Draft International Standard (DIS), Geographic information - Land administration domain model (LADM). Lysaker, Norway, ISO: 120pp.
Available at <http://www.gdmc.nl/oosterom/ISO19152LADM_DIS.pdf>

Kaufmann, J. and D. Steudler 1998 *Cadastre 2014 - A vision for a future cadastral system.* FIG XXI International Congress. Brighton, U.K.

Lemmen, C.H.J. 2010 *The social tenure domain model. A pro-poor land tool.* Copenhagen, Denmark, International Federation of Surveyors (FIG): 21pp. Publication No. 52. http://www.fig.net/pub/figpub/pub52/figpub52.htm

Lemmen, C. H. J., P. J. M. van Oosterom and I. Greenway (2011). The road to a standard for a Land Administration Domain Model, and beyond…. FIG Working Week. Marrakech, Morocco.

Lemmens, M., editor 2010a Towards Cadastres 2034: Part I – International experts speak out. GIM International (invited reply), 24(9): 41-49. http://www.gim-international.com/issues/articles/id1587-Towards_Cadastre.html

Lemmens, M., editor 2010b Towards Cadastres 2034: Part II – International experts speak out. GIM International (invited reply), 24(10): 37-45. http://www.gim-international.com/issues/articles/id1604-Towards_Cadastre__Part_II.html

Molen, P. van der, 2009 The evolving function of land administration in society. FIG regional conference, Hanoi,Vietnam.

Norwegian Council for Africa 2010 http://www.afrika.no/Detailed/19176.html

OGC 2010 http://www.opengeospatial.org/standards/wfs

OpenStreetMap 2010 http://www.openstreetmap.org/

RIVM 2010 http://www.rivm.nl/en/

Rajabifard, A., Feeney, M. E. and I. Williamson 2003 *Spatial Data Infrastructures: Concept, Nature and SDI Hierarchy,* in Williamson, I., Rajabifard, A. and M. E. Feeney (Eds.). Developing Spatial Data Infrastructures: From Concept to Reality, London, UK: Taylor & Francis, pp. 17–40.

Tiainen, E. 2004 *Aspects of EULIS glossary approach, semantics and information services.* Workshop Standardization in the Cadastral Domain. Bamberg, Germany, FIG: pp.117-138.

Uitermark, H., van Oosterom, P., Zevenbergen, J., and Lemmen, C. 2010 *From LADM/STDM to a Spatially Enabled Society: a Vision for 2025.* In: Proceedings of the Annual Bank Conference on Land Policy and Administration, April 2010, Washington D.C., pp. 1-13.

UN-HABITAT 2008 *Secure land rights for all.* Nairobi, Kenya, United Nations Human Settlements Programme: 40pp.

Van der Molen, P. 2003 *The future cadastres : cadastres after 2014.* In: FIG working week and 125th anniversary : Still on the frontline, Paris 13-17 April 2003.

Van Oosterom, P., Ploeger, H., Stoter, J., Thompson R., and Lemmen, Ch. 2006 *Aspects of a 4D Cadastre: A First Exploration.* In proceedings: XXIII International FIG congress, Munich, October 2006, 23 p. http://www.fig.net/pub/fig2006/papers/ts12/ts12_02_lemmen_vanoosterom_0605.pdf

Van Oosterom, P.J.M. and Stoter, J.E. 2010 *5D Data Modelling: Full Integration of 2D/3D Space, Time and Scale Dimensions.* In proceedings: GIScience, Zurich, September 2010. Springer Verlag.

Williamson, I.P., S. Enemark, J. Wallace and A. Rajabifard 2010 Land administration for sustainable development. Redlands, California, U.S.A., ESRI Press.

Worldbank, 2011 Press Release No:2011/461/AFR, *World Bank and Google Support Development in South Sudan with Diaspora-driven "Mapathon"* http://web.worldbank.org/WBSITE/EXTERNAL/COUNTRIES/AFRICAEXT/0,,contentMDK:22902389~menuPK:258657~pagePK:2865106~piPK:2865128~theSitePK:258644,00.html

Zeeuw, de, K. and Salzmann, M 2011 *Cadastral innovation driven by society: evolution or revolution?* In: Proceedings of the FIG Working Week 2011, Bridging the Gap between Cultures, Marrakech, Morocco, May 2011

Zevenbergen, J.A. and S. Haile 2010 *Institutional aspects of implementing inclusive land information systems like STDM.* XXIV FIG International Congress 2010. Sydney, Australia. http://www.fig.net/pub/fig2010/papers/ts04k/ts04k_zevenbergen_haile_4254.pdf