

# **Cadastral Innovation Driven by Society: Evolution or Revolution?**

**Kees DE ZEEUW and Martin SALZMANN, the Netherlands**

**Key words:** Innovation, Cadastre, Land registry, Web based, Location based, User demand

## **SUMMARY**

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. Our administrative systems have to be adapted accordingly.

This paper deals with the driving forces in society that cause a changing use and demand for land-administrative and cadastral data. Based on these changing demands, the data, systems, people, legal aspects and communication channels need to be adapted rapidly.

In this paper an overview of the consequences for the Dutch Kadaster is presented, to be translated into appropriate solutions and innovations. 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.

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## **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 aims to analyse the developments in society that influence the functioning of a cadastral organisation and to show how the Dutch Kadaster handles these developments. The driving forces behind development are categorised and the impact on our business processes is explained.

Secondly we like to show how Kadaster reacts on these developments by introducing new solutions and innovations constantly, and by adapting our organisation and company strategy accordingly. Finally, 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. 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 they can cope with two driving forces causing rapid development: technological push, and societal pull.

Technological development that influences our 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.

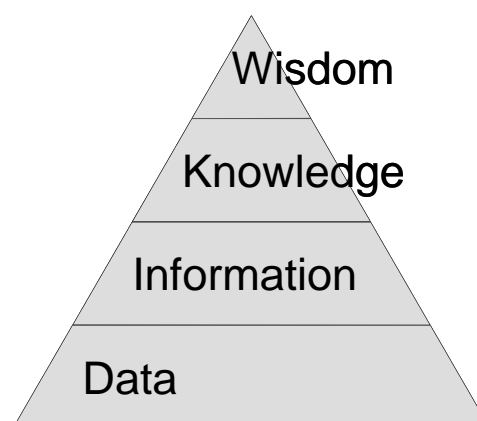
Recently we experienced the impact of economic and political changes world wide on the functioning of cadastre and land registry organisations. The financial crisis (2008) influenced property and credit registration world wide and political changes in Northern Africa (2011) emphasize the importance of 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.

### 3. 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 translated in some clear developments effecting the business processes and position of the Dutch Kadaster directly.

#### 3.1. 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 the purchase classes of the property (see table 1); 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.

**Table 1.** Example of a new information product: Index buyers profile and purchase classes. Based on our data we can categorize buyers on age and height of purchase price of the property. Example for the period September 2008 – September 2009 (index value September 2008 is set to 100), averaged for the Netherlands. The table shows that the financial crisis starting in November 2008 gives a large decrease of purchase prices for people older than 50 years.

Age/Month	Sep-08	Oct-08	Nov-08	Dec-08	Jan-09	Feb-09	Mar-09	Apr-09	May-09	Jun-09	Jul-09	Aug-09	Sep-09
< 25	100	110	86	124	63	70	79	87	88	82	110	76	82
25 – 30	100	109	78	111	55	60	66	69	72	69	95	68	75
30 – 40	100	107	71	104	57	55	58	59	61	60	78	55	61
40 – 50	100	108	72	108	53	56	56	61	60	61	80	59	64
50 – 60	100	108	73	102	54	49	55	56	56	52	70	59	61
> 60	100	101	74	99	56	50	53	52	55	51	67	52	56

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).

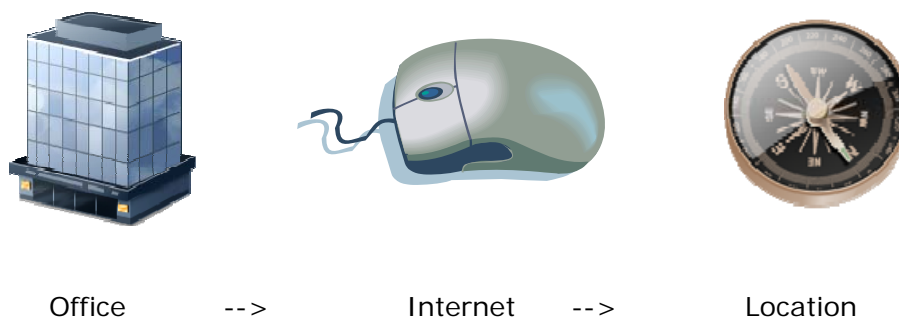
### 3.2. People change

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 a 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.

### 3.3. 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.



**Figure 2.** Development from office, to internet, to location based services using high end technology and improved user interfaces.

### 3.4. 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-Service (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.

### 3.5. Problems / demands become to complex to handle on your own

At 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).

#### 4. 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](http://www.woningwizard.nl), [www.funda.nl](http://www.funda.nl), [www.woningquote.nl](http://www.woningquote.nl)).

The Key Register Cadastre, along with the Municipal Personal Records Database (GBA) is accessible via the [www.MijnOverheid.nl](http://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 it's 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.

## **5. OUR BUSINESS STRATEGY**

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 it's approach and policy on a yearly basis in relation to it's 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 an 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.

## 6. 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 indispensable 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 indispensable link in a chain and an international context. It 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.

## 7. 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 adopt 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 too 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.

## REFERENCES

- Ackoff, R.L. (1989) "From Data to Wisdom", *Journal of Applied Systems Analysis*, Volume 16, 1989 p 3-9.
- 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 case of the Netherlands Kadaster*. FIG international congress, Sydney, Australia.
- Deininger, K., C. Augustinus, S. Enemark and P. Munro-Faure, 2010. *Innovations in land rights recognition, administration, and governance*. The World Bank.
- Molen, P. van der, 2009. *The evolving function of land administration in society*. FIG regional conference, Hanoi, Vietnam.
- 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.

## BIOGRAPHICAL NOTES

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Martin Salzmann is director of strategy and policy with the Cadastre, Land Registry and Mapping Agency (Kadaster) of the Netherlands. He is deeply involved in the development of eGovernment (including Spatial Data Infrastructures) in the Netherlands. In the past Martin has worked extensively in the fields of quality assurance of cadastral surveying and mapping, information strategies and marketing before moving into the realm of strategic planning and eGovernment.

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