

# Spatial Data Infrastructure for knowledge sharing

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**Key words:** SDI, knowledge sharing, people – profit – planet, Kadaster, system of key registers, good governance, e-government, spatially enabled society, GIDEON

## SUMMARY

Today's global challenges have a substantial magnitude: climate, ecosystems, resources, nature, disasters and population. Those issues relate to the development and protection of our economy, our society and our environment, referred to as the principles for sustainable development: people - profit - planet. For the purpose of good governance and corporate social responsibility, governments and companies need to have access to state of the art tools, products and services. In modern systems, geospatial information plays a key role, provided through Spatial Data Infrastructures (SDI).

This paper shows how Dutch Kadaster contributes to the national SDI of the Netherlands, being aware of the fact that our information, products and services contribute to knowledge sharing for sustainable development. Good governance, the development of e-government services and growing towards a spatially enabled society, are basic elements in our national strategy, asking for a good functioning SDI.

Specific initiatives contributing to improvements, are the Dutch national policy called 'GIDEON' and the setting up of a national system of key registers. This system of key registers, concerns a set of interrelated datasets on persons, companies, addresses, parcels, buildings and topography with a legal and institutional fundament. The Dutch SDI has been implemented already for a substantial part but is still under development for some components and can not longer be seen apart from the international context.

It is a challenge to meet up with the fast and continuously changing demands in society. Our services become more and more location based. Also the business processes of Kadaster and its customers are further automated constantly. As a result we have to be flexible in our organisation and we have to adapt our business model accordingly. The strong societal demand for a national 'Open Data Policy' effects the way Kadaster services and products will be developed in the future.

Kadaster is looking for international collaboration and opportunities to share its knowledge and experience world wide.

# **Spatial Data Infrastructure for knowledge sharing**

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## **1. THE FUNCTIONS OF AN SDI (SPATIAL DATA INFRASTRUCTURE)**

### **1.1 SDI and Global challenges**

Our global challenges have a substantial magnitude: climate (sea level rise and draught), ecosystems (biodiversity and deforestation), resources (food, water, energy and minerals), nature (economy, employment and pollution), disaster (erosion, security and protection) and population (urbanisation, prosperity and poverty). Those issues relate to the development and protection of our economy, our society and our environment, referred to as the principles for sustainable development: people - profit - planet.

For the purpose of good governance and corporate social responsibility, governments and companies need to have access to state of the art tools, products and services. In modern systems, geospatial information (describing attribute value, location and temporality) plays a key role, provided through Spatial Data Infrastructures (SDI).

### **1.2 User demand driven SDI framework**

To meet up with these global challenges SDI's have to be - and will become - more and more demand driven. A new group of users starts using and defining the user requirements for SDI's indirectly. In practice these users don't think and speak in terms of SDI's. Coming from the daily issues that are to be solved, these users define the information products and services they require for their purposes. Geospatial information is needed as input for information supply in these services. SDI's provide this information and are therefore not defined by the end users in a direct way. This makes it difficult for SDI developers to take account for user demands in the definition and setting-up of SDI's.

For that reason, four layers of definitions should be brought in relation to each other: issues, products and services, geospatial information and SDI's, see figure 1.

Good examples exist where not only from developers perspective initiatives are taken to match these different levels, but also from the user perspective awareness is growing that solving issues requires the understanding of a 'layered' system. For example, the United Nations Chief Information Technology Officer at the level of Assistant Secretary-General is promoting the model as shown in figure 1 in the UN system. It is the UN's task to solve the daily global challenges the UN is faced with. Without a proper SDI at the basis, it is difficult to realize solving these issues.



Figure 1: Four layers of definitions. (Source: UNSDI website, by J.C. Venema)

To provide a usable framework for SDI system design and maintenance, the user demand can be linked to the development concept of ‘people - profit - planet’. Insight in the issues that users have to solve, can be valuable knowledge in system design. These issues are divers, difficult to predict and do change in time and place. Still, both for commercial and governmental professional users, it can be expected that for example the provision of good land administration data in a (national) SDI, should contribute to corporate social responsibility. Thinking in terms of people - profit – planet, can help in this understanding.

### 1.3 People, profit, planet

The principal of ‘people - profit – planet’ is used in the domain of sustainable development (Elkington, 1994). ‘People - profit – planet’ captures an expanded spectrum of values and criteria for measuring organizational and societal success: economic, ecological and social. With the ratification of the United Nations and ICLEI<sup>1</sup> TBL<sup>2</sup> standard for urban and community accounting in early 2007, this became the dominant approach to public sector full cost accounting (ref., Wikipedia). The principals have become the basis for corporate social responsibility. By translating this so-called triple bottom line to the design of an SDI, it can be of help understanding the future user demand of our land administration systems.

Our information supply should be supportive in the balanced analysis, monitoring and planning of land use and ownership, accounting for all three of these elements. This information modelling approach applies both to developed and developing countries.

In figure 2 it is shown how geospatial information is linked to this concept of development (De Zeeuw, 2012). To clarify better, the information is translated into three different types of information (see figure 2). To support ‘people’ related information demands, so-called ‘*ego-information*’ is required. For example the use of navigation systems (‘where am I?’) is considered to be a form of ego-information. ‘Profit’ related information is referred to as

<sup>1</sup> International Council for Local Environmental Initiatives

<sup>2</sup> Triple Bottom Line - abbreviated as TBL or 3BL, and also known as people, planet, profit or the three pillars

'*econ-information*'. This information is necessary for making economic choices and performing financial analysis. Kadaster's information describing the 'Planet' component is referred to as '*geo-information*' (information describing our world). For example the topographic data datasets play an important role in land use planning in the Netherlands. But also the geodetic reference system Kadaster maintains is of an essential value for linking the national available geo-information to geospatial databases.

Combining these three types of information, the total of information supply could be indicated as '*Egeon-information*'.

In the development of data sets and infrastructures it is important to realise that information is required on these three components.

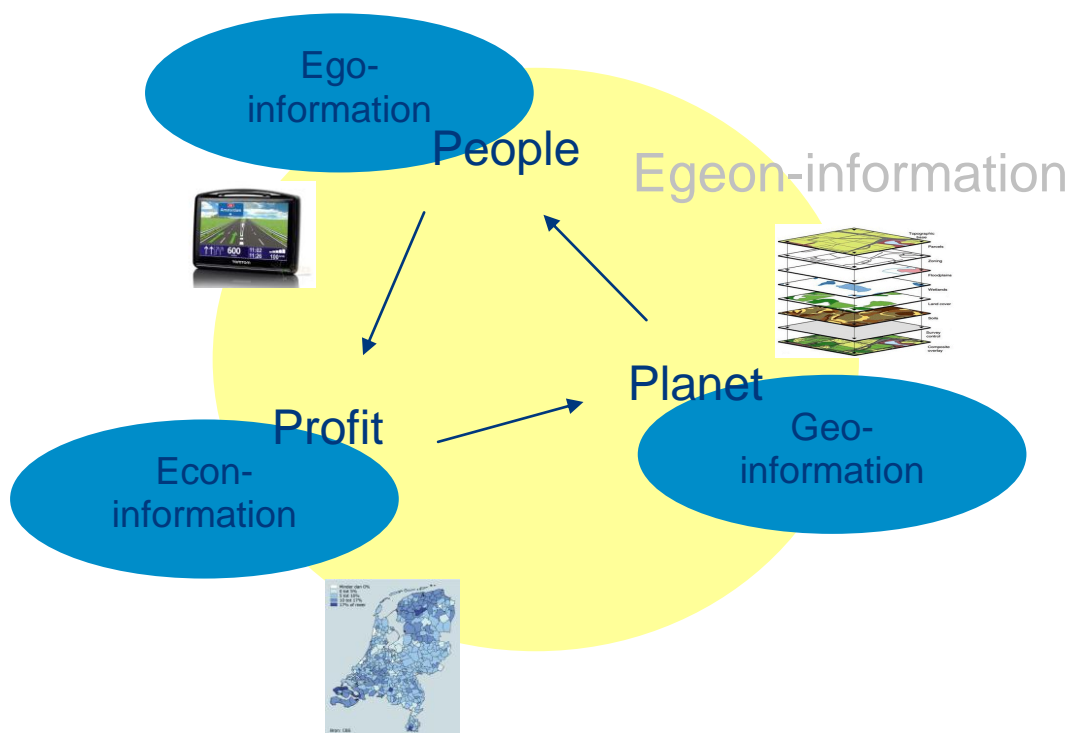


Figure 2. People, profit, planet in relation to information sources in a spatial data infrastructure, together referred to as '*Egeon-information*'.

## 2. THE DUTCH SDI

### 2.1 GIDEON: A national policy

Dutch Kadaster contributes to the National Spatial Data Infrastructure, being aware of the fact that its information, products and services contribute to sustainable development, or better: the sustainability of growth. Good governance, the development of e-government services and

growing towards a spatially enabled society, are key elements in our national strategy, asking for a well functioning SDI with a trustable land administration as a basis.

The SDI in the Netherlands has been implemented already for a substantial part and is still under development for some components. Specific initiatives contributing to improvements, are the national policy called 'GIDEON' and the setting up of a national system of key registers.



Figure 3. GIDEON, the National policy document on key geo-information in The Netherlands (2008 – 2012)

For the implementation of a basic infrastructure of key registers the organisation of access/authentication, data exchange, information nodes and national services is foreseen in this policy.

Various parties are working together on GIDEON. For the realization of the GIDEON policy seven implementation strategies are formulated. Jointly, these strategies will lead to the creation of a key geo-facility for The Netherlands (Grus *et al.*, 2009). The seven strategies aimed at are:

- provide geo-information an appropriately prominent place in the e-service strategy,
- encourage use of key geo-registers,
- implement INSPIRE directive and realize the technical infrastructure,
- optimize standardization in geo-information supply and create joint facilities (national geo-register, services) for access and joint management of the infrastructure,
- stimulate the use of geo-information by chain cooperation in the policy areas of disaster and crisis management; sustainable living environment; mobility; development of urban areas and neighbourhoods; and development of rural areas,
- create value. Create conditions to enable the geo-industry to create as much value as possible, based on public sector geo-information, and:
- encourage collaboration in knowledge sharing, development of innovations and education to continuous develop and enhance the key facility for geo-information.

The objective of this policy is in getting available improved services for citizens and businesses, increased government efficiency and effectiveness and decreased administrative burden and fraud.

At present, the policy for the next up-coming five years, 2013 – 2017, is under discussion within the professional geo sector in The Netherlands.

**2.2 The framework of our SDI**

Dutch Kadaster contributes to the SDI of the Netherlands, being aware of the fact that its information, products and services contribute to knowledge sharing for sustainable development. Good governance, development of e-government services and growing towards a spatially enabled society, are basic elements in the national strategy for a proper functioning SDI.

In figure 4 the Dutch framework is represented. In order to achieve sustainable development it is believed that good governance is a prerequisite. Good governance requires three components: e-government, a spatially enabled society and a well functioning Spatial Data Infrastructure (SDI). Our national SDI is built upon a system of key registers (see chapter 2.3). As an example it is shown how the land administration information that Kadaster is providing, fits – as one of the key registers – within this framework.

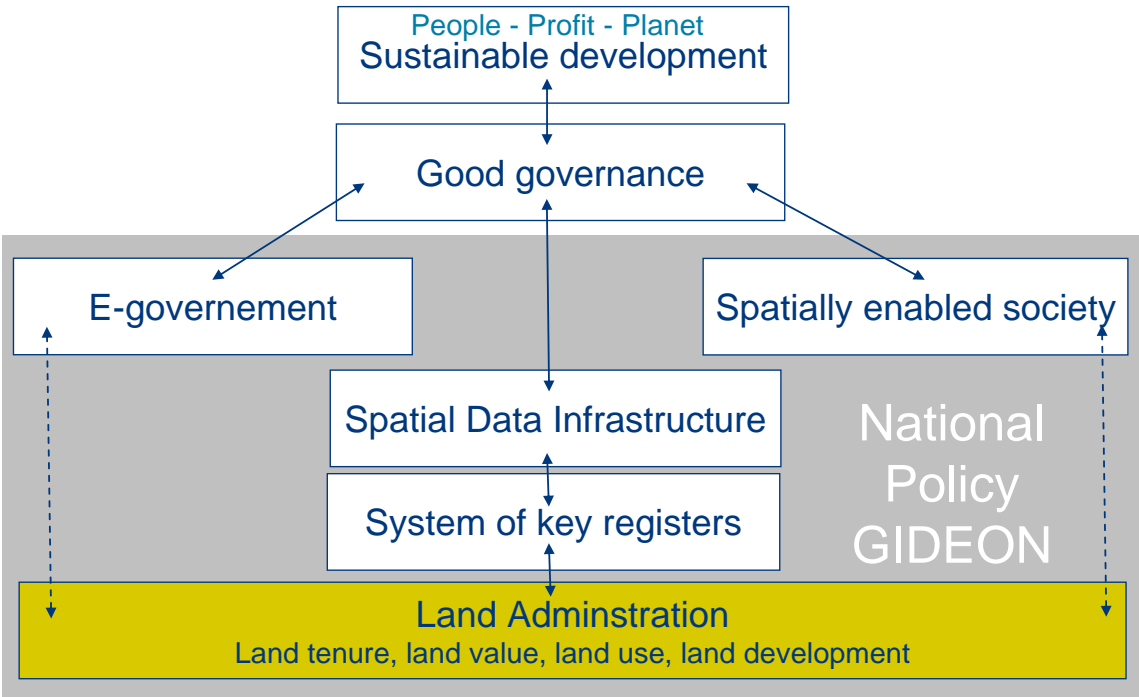


Figure 4. The Dutch spatial data framework; how the components get together.

## 2.3 The system of key registers

To implement our national policy within the mentioned framework of an SDI a so-called 'system of key registers' has been developed in the Netherlands. This system of key registers concerns a set of interrelated datasets on persons, companies, addresses, parcels, buildings and topography with a legal and institutional fundament. Figure 5 gives a simplified representation of the components of the Dutch national system of key registers.

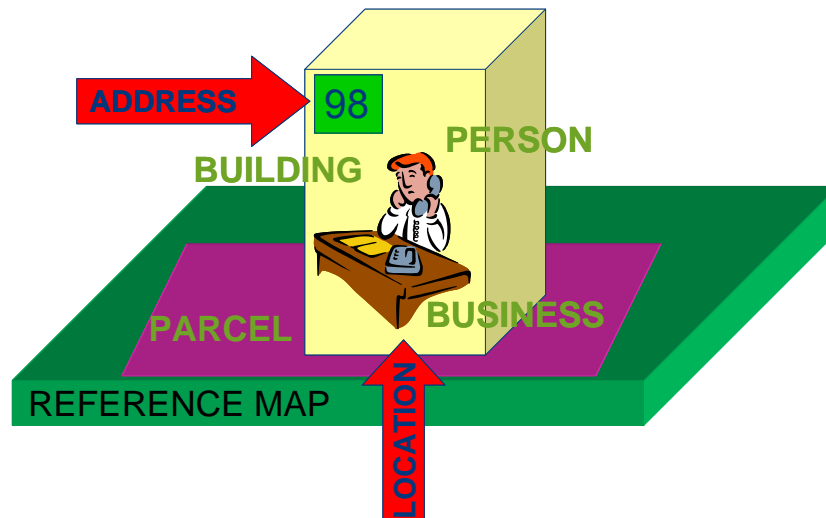


Figure 5. The core system of Key registers in the Netherlands (simplified representation).

## 2.4 International context

The Netherlands SDI is well defined and can not be seen isolated from the international context. Cross border initiatives with Germany and Belgium require agreements on standards and legislation. But mainly, the directive on INSPIRE is influencing all developments on the national SDI in the Netherlands, involving many governmental organisations (both national and regional).

Kadaster is looking for international collaboration and opportunities to share its knowledge and experience on SDI development, world wide. Doing so, good insight in standards and legislation is obtained and the alignment of ideas and interests can take place at an early stage in development.

## 3. KNOWLEDGE SHARING

### 3.1 Changing environment

Two forces influence strongly our daily working environment: The technological 'push' and the societal demand 'pull'.

The technological development is impressive: exponential rather than linear. The possibility

to have access to internet services on small and powerful mobile devices has become commonplace in large parts of the world. It directly influences the expectations of citizens and professionals on the services that are facilitated through a national SDI.

It is a challenge to meet up with these fast and continuously changing demands in society. Our services need to keep its level of reliability and accuracy. At the same time they have to become faster, (close to) real time and location based.

The business processes of Kadaster and its customers are further automated constantly. As a result Kadaster has to be flexible in organisation and has to adapt its business model accordingly. Not data provision and information services, but the sharing of knowledge will become the most important competence of Kadaster's future organisation.

### **3.2 Business strategy of the Netherlands Kadaster**

Cadastre and land registry in the Netherlands are integrated since the establishment of Kadaster. There is a development towards a positive legal status of the registration<sup>3</sup>. This has been extended with the national topographic mapping since the late nineties. Recently also services for addresses, building information and information on the location and ownership of (subsurface) utility networks (cable and pipelines) have been added to our organisation's responsibilities. The national information provision service for taxation on housing and the large scale base map of the Netherlands are under preparation. Kadaster as an organisation is moving towards a national centre for geo-information services, rather than a pure cadastral agency.

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 (Lemmen *et al.*, 2011). The key targets for the policy period 2012 – 2016 are defined as:

- offering services that suit our customers needs,
- collaboration with partners (government, science and industry),
- cost control,
- flexibility, and:
- quality and continuity.

### **3.3 Open data policy**

The strong societal demand for a national 'Open Data Policy' strongly effects the way Kadaster services and products will be developed in the future. Coming from a cost recovery business model on our products and services, the societal demand for open data forces our organisation (and other governmental bodies) to set up a good mixture of cost recovery and budget financed developments. Also it forces our organisation to develop from a data providing organisation, towards a information services providing organisation and to a

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<sup>3</sup> It should be noted that the legal system in the Netherlands is a negative system; there are no real practical implications because of this; the provided information to the land market is very reliable and cost effective.



knowledge centre. The added value Kadaster can deliver to society will be more in the services and knowledge, than in the data and information itself.

### **3.4 Towards new knowledge based services**

It is clear that data, information and knowledge sharing is becoming part of future business strategies. Providing public registers to society, the maintenance and developments of these registers, asks for new approaches and insights. Dutch Kadaster has chosen for a strategic approach containing the following components (De Zeeuw and Salzmann, 2011):

- develop from data provider to information serves centre and (inter)national knowledge organisation,
- maintain the concept of safeguarding the public registers as part of a national system of key registers,
- guarantee the provision of information and services at the lowest cost possible, but guaranteeing high standards of quality and reliability, and:
- focus on continuous (collaborative) product and process innovation.

## **4. EXAMPLES OF NEW SERVICES**

### **4.1 Location based services**

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 a company called Layar). Also developments have started to provide our data to smart phones through modern Apps (like Windows 8, Ios or Android), rather than using texting services as we have used for 'WoningWizard'<sup>4</sup>. All these initiatives have been started in close collaboration with other (commercial) parties.

As a first step in 2010 an I-phone App has been developed to give location based information on property sales prices and ownership (see figure 6). Technically the development of an App is no rocket science. However, exploiting an App in for example the I store environment, means that Kadaster had to rethink the business model of it's services and to match it to national law and standards.

### **4.2 Chain integration**

The use of our cadastral services are very 'life event driven'. Citizens need information on property rights when they are going to buy a new house. To the potential buyer it is more important to have access to Kadaster's information during the process of selection, rather than to have the knowledge that this information is available.

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<sup>4</sup> In a set Sms-messages the following data are provided: the year of construction, the volume, the area, the building type, transactions since 1993 (max 3), the current value (with an indication on reliability based on a widely accepted model), value as basis for taxation, tax, existence of mortgage (y/n).

<http://www.woningwizard.nl/>



Figure 6. Location based services developed for mobile devices, providing cadastral information to citizens and professionals.

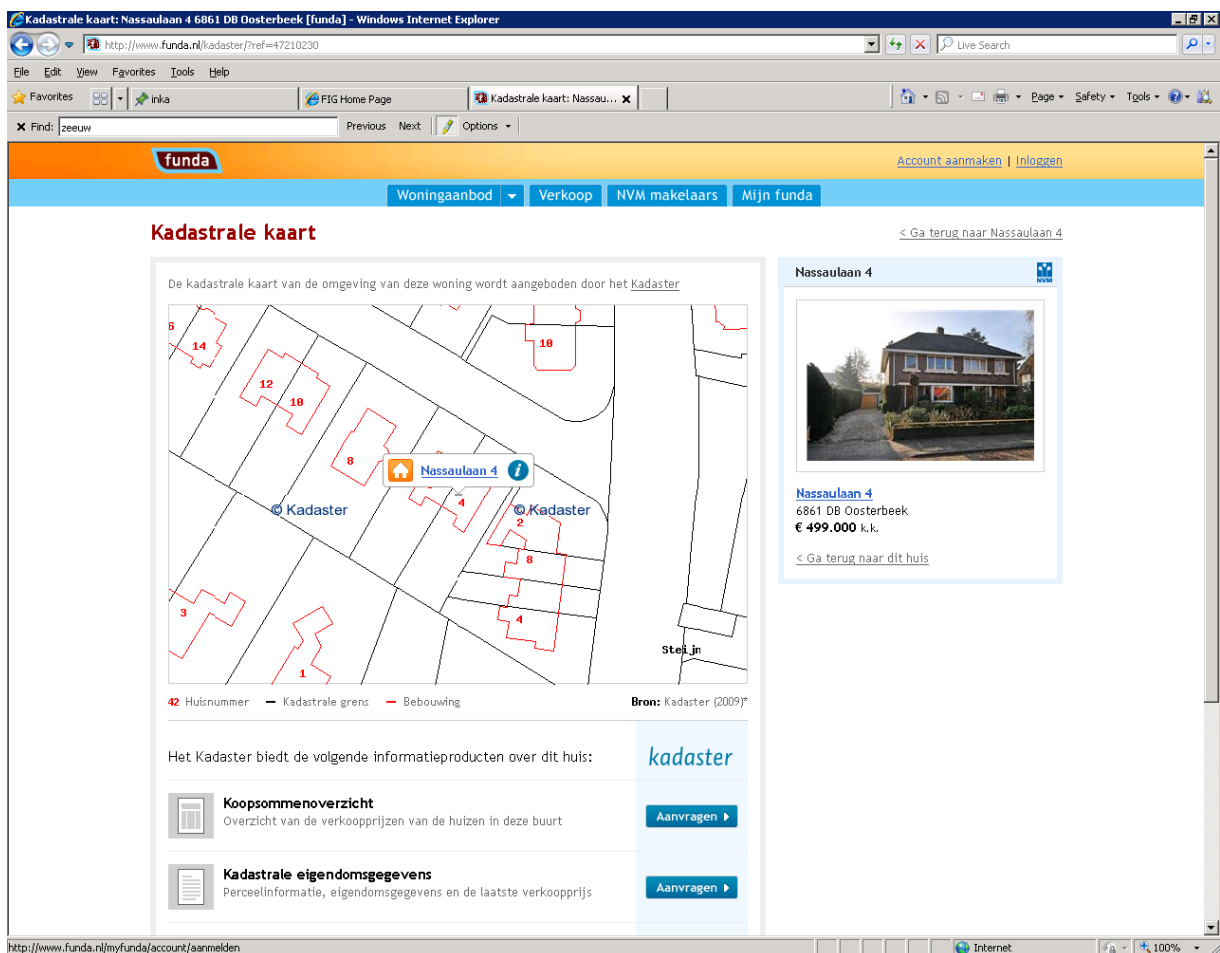


Figure 7. Searching for a house at the commercial FUNDA web site, directly links to the Kadaster web site for cadastral information and additional products (at charge).

For this reason, Kadaster is developing new applications in collaboration with other parties, to be as close as possible to these life events. As an example, the cooperation with Funda, a commercial party in the Netherlands operating as property broker on the internet, allows users to have direct access to the Kadaster information, through the website of Funda. This means, that during the process of searching for the proper house, information on the object, e.g. size, ownership, last transaction value, etc., can be obtained directly. Figure 7 shows how Kadaster information is integrated in the commercial Funda<sup>5</sup> website.

### 4.3 Kadaster Dash board

Since the economic and bank crisis started in 2009, the cadastral database in the Netherlands has gained in importance and use. It's function as the formal registration of property remains important, but nowadays also the analysis of the development in the real estate market and the value of our national mortgages have become important information flows, provided by Kadaster. This information is publically available at a monthly basis through our website<sup>6</sup>, only in Dutch. In figure 8 an example is given of a graph representing the economic data provided on the development of the average house price in the Netherlands in the year 2011.

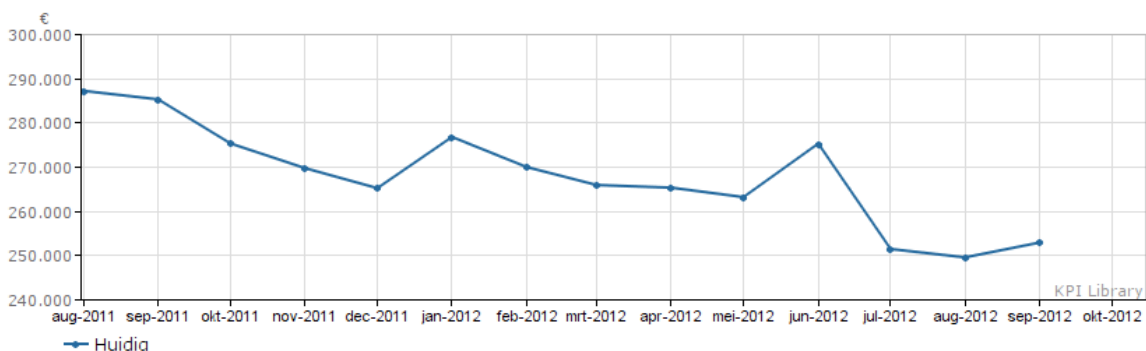


Figure 8. Example of Kadaster dashboard information, provided on a monthly basis. In this graph the development of the average house price is given for August 2011 - September 2012.

## 5. INTERNATIONAL COOPERATION

As a monopolist organisation Kadaster has no competition at the national level. Of course, close co-operation with the private sector, academia, scientific organisations and other governmental bodies is an important issue for a customer oriented organization. Kadaster has the ambition to collaborate internationally and looks for opportunities to share its knowledge and experience world wide. To accommodate this, a separate organisation unit, Kadaster International, has been established almost two decades ago. International advisory services and cooperation projects are the core business, but also the coordination of Kadaster's international activities are the responsibility of this organisational unit.

<sup>5</sup> <http://www.funda.nl/>

<sup>6</sup> [www.kadaster.nl/perskamer/dashboard](http://www.kadaster.nl/perskamer/dashboard)

Sharing of our knowledge consists of three important components: *giving, getting and influencing*. ‘Giving’ refers to our corporate social responsibility. By providing advisory services on a cost recovery basis, not only our services and products find it’s way to society, but also our knowledge and experience. Our contribution to the development of a Land Administration Domain Model (LADM) is a good example of this. Many years of experience, have been synthesised into a model that helps other national cadastral organisations in setting up a good cadastral system for good governance and as a basis for the national SDI.

By working in the international context, Kadaster employees are ‘getting’ also a lot in return. New insights are obtained and employees are inspired to develop new methods and products that would never had been thought of in the home environment. For example, the lessons learned on the decision making process for process and product innovation as applied in projects in Turkey and Korea, influence the approach that is applied within our own organisation nowadays.

Finally, ‘influencing’ is an important international aspect. By operating outside the national borders, influence can be acquired in standardisation and international law development. It also allows for anticipating on developments that are expected to influence our work in the (near) future. For example, timely anticipation to the impact on Kadaster of the upcoming INSPIRE directive in Europe, was possible by international interaction. Similarly, the developments at a global level at UN GGIM<sup>7</sup> are within our scope of daily operation.

## 6. CONCLUSION

A national SDI is essential in the provision of geo-information for products and services that allow for solving regional, national and global issues. The concept of people – profit – planet to achieve sustainable development, could be translated in the approach of the information flows that an SDI should provide: ego-information, econ-information and geo-information. The Dutch SDI plays a crucial role in national ambition that sustainable development is based on good governance as a result of e-government practices and a spatially enabled society.

Not only data provision and information services, but also the sharing of knowledge will become an important competence of Kadaster’s future organisation. This requires an open mind for new business strategies and the handling of an open data policy and the development of new knowledge based services.

International cooperation is considered an important means to share knowledge. Sharing knowledge outside the national borders is part of an organisations corporate social responsibility, enforces the capacity of your own organisation and allows for influencing international standardisation and legacy.

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<sup>7</sup> The UN initiative on Global Geospatial Information Management (GGIM)

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## BIOGRAPHICAL NOTES

**Kees de Zeeuw** is director of Kadaster International at the Cadastre, Land Registry and Mapping Agency (Kadaster), the Netherlands. He has an MSc in environmental and geo-information sciences working from Wageningen University and ResearchCentre. After being responsible at Kadaster for product and process innovation (2007 – 2010), he now is responsible for the coordination of Kadaster's international activities and international cooperation projects. Kadaster International provides world wide advisory services in the domain of land administration, e-governance, geo-information services and SDI.

**Christiaan Lemmen** holds a PhD from Delft University of Technology, The Netherlands. He is international consultant at Kadaster International, with many years of experience in international consultancy on cadastral systems, geodesy and the development of domain models (like LADM). He is assistant professor at the University of Twente, Faculty ITC. He is chair of the Working Group 7.1 'Pro PoorLand Management' of FIG Commission 7. He is contributing editor of GIM International, the Global Magazine for Geomatics. He is director of the FIG International Bureau of Land Records and Cadastre, OICRF.

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