

The Cadastre in the Age of Climate Change and Energy Transition: Juridical and Environmental Data as the Foundation in the Land Market

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Key words: cadastre, data, environmental data, land market, ecosystems

SUMMARY

Cadastrals have since long been fundamental in a well-functioning land market, facilitating property transactions, valuation and taxation by providing – in unison with the land registers – legal security in the land market. In the past decades the scope of cadastrals and land registries has widened to registering all (public and private) rights, restrictions and responsibilities. Cadastrals have seen automation of existing working processes. Cadastrals are now entering the age of digitalisation of land administration in a wider sense. We will discuss how putting data centric will affect their role, and how we can and should link up with data from related domains. This are, e.g., the developments in the construction industry (BIM) and environmental issues. Climate change and actions related to carbon reduction will have an impact on the land market.

In this paper we provide an insight how cadastrals evolve in this data-driven world and contribute to sound decision making in the spatial domain and the land market in particular. This requires that the data ecosystem of the cadastrals is linked up with the data of other domains.

The paper discusses the issues, solutions and dilemmas we encounter in bringing our cadastrals and land registries to the next level in a world where data are at the heart of society's needs and our operations.

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1. INTRODUCTION

Cadastrals have since long been fundamental in a well-functioning land market, facilitating property transactions, valuation and taxation by providing – in unison with the land registers – legal security in the land market. In the past decades the scope of the cadastre has been widened to registering all (public and private) rights, restrictions and responsibilities. This has provided parties in the land market with a fuller picture of the issues at hand. Furthermore, cadastral processes have been digitized and cadastrals are now entering the age of digitisation of their workings and organisation. Data are key. This could have happened rather unnoted (in the general evolution to a digital society) were it not that also major issues have arisen that affect the land market. These are climate change, the related issues of energy transition and circularity.

Decisions in the spatial domain and in the land market increasingly rely on physical data on climate related issues and energy conversion. This means not only our (public and private) RRR's matter, but increasingly data from construction and materials (BIM), (sub-)soil, energy generation and distribution and new financial arrangements are needed.

In this paper we provide an insight how cadastrals evolve in this data-driven world and contribute to sound decision making and recording in the spatial domain and the land market in particular. This requires that the data ecosystem of the cadastrals is linked up with the data of other domains. This is not predominantly a technical issue. We have found – based on our experiences as an agency covering cadastre, land registry and mapping – that users in the land market need and want meaningful information and streamlined processes in this ever more complex world.

Cadastrals will be more data-centric and have to link up with other domains if they want to remain a relevant to the users. Therefore not only in providing the foundation for the legal or fiscal aspects in land transactions, but also in providing the basis of sound decision making and planning concerning sustainable land and properties in the coming decades. This presents an opportunity for cadastrals, but also requires that cadastrals are ready for this change.

The central issue we address in this paper how cadastre and land registry agencies can operate and stay relevant in this data-driven world.

2. CHANGING PERSPECTIVES IN A DIGITAL WORLD

In the past years society has undergone a number of major changes. The most prominent one is the digitalization of our world (see e.g. UN-GGIM, (2015)). This has affected many industries. In the land market we have witnessed that all parties in the land market have

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FIG Working Week 2020

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automated their working processes, be it financial institutions, real-estate agents, notaries or legal advisors, cadastres and land registries. Also the users (buyers, sellers, owners, occupants) have become accustomed to doing business digitally. Land markets are on the brink of developing (new) value chains or even becoming embedded network environments. This enables and at the same time requires that the system of checks and balances in the land markets are reconsidered. Simultaneously also neighbouring sectors as the construction industry have embarked on full-scale digitisation. At the same time in developing land markets digital means have made it possible to accelerate the introduction of security of tenure by building fit for purpose land administration systems in which citizens actively participate.

For land administration (and its institutions as cadastres and land registries) already digitisation by itself requires a reassessment of their relevance to society. At a global level the Framework for Effective Land Administration (Expert Group on Land Administration and Management, (2019)) provides both existing and developing land administrations with a methodology for this assessment.

Traditionally land administration systems have been focussed on legal security underpinning a transparent land market, providing security of tenure and facilitating the economy. In many cases properties are considered as an economic asset. Lately this view has been widened by considering the issues related to land from the perspectives of people, profit and planet. Climate change will have (and already has) a large impact on the land market. Effects of carbon emissions (and the measures to reduce these), changing precipitation patterns (downpours, droughts), global warming (sea level rise) also have an impact on the land and housing market. At the same time, we see a continuing trend of urbanization, a need for food security and maintaining biodiversity with still growing populations in many countries. Making sound decisions related to land transactions and planning thus also have to take these environmental aspects into account. Parties in the land market want to and have to make decisions based on all relevant data (legal, economic, environmental and physical).

3. IMPACT OF DIGITISATION ON CADASTRE AND LAND REGISTRY AGENCIES

Limiting ourselves – for the moment – to the effects of digitisation we see this already has a major impact on both the operation and the positioning of the cadastre and land registry organisations. We witness the following developments:

- Increasingly all rights related to land and properties are becoming part of land administration systems. More and more public rights and restrictions are part of the land administration domain and in many cases also use rights are included. All rights, restrictions and responsibilities (RRR's) related to land are embedded in the system.
- Cadastres traditionally have been 2D. We see a transition to 3D both for registration and representation purposes.

- The classical distinction between administrative data and spatial data will disappear over time.
- Land administration becomes part of the larger system of the public information infrastructure. This means that interconnection (explicitly by linking objects or implicitly by matching geography) between various data (personal records databases, business registers, topography, buildings addresses, valuation) becomes the norm.
- All parties in the land market have by now automated their working processes. Buyers and sellers in the land market expect that they are serviced quickly, fully and (where applicable) digitally, be it in a land transaction, application for a mortgage or a building permit.
- The construction industry is in the process of digitizing the building process (using the BIM-methodology). Buildings therefore not only have a physical lifecycle, but also a digital one from cradle to cradle. This results in more comprehensive information on properties and links land administration with asset management (although an average property owner may not yet think in these terms).

Cadastral and land registries have traditionally been based on well-defined working processes with transparent checks and balances resulting in trusted data. We currently see a shift where data and trust in data are at the core and fuel and enable processes in the land market. In an economic sense the data itself become the main asset of our agencies (Salzmann, (2019)).

We can see these developments reflected in the Land Administration Domain Model (LADM), which is currently revised (Lemmen et al (2019)). In this revision also valuation, planning and 3D information are taken into account. Linking up spatial information from different domains is an essential element in the overarching Integrated Geographic Information framework (IGIF) (see UN-GGIM, (2018)).

4. CHANGING PERSPECTIVES IN THE LAND TRANSACTION CHAIN

Within the ‘classical’ land administration domain in the Netherlands we are working to optimize our dealings in the land market to improve the process in land transactions with all the stakeholders involved (see Figure 1). Purpose is to improve the effectiveness of the value chain of land transactions and therewith facilitating ‘carefree dealings in real estate’. Actors in want more information up front in the process: are the parties involved ‘legally fit’ (entitled), ‘financially fit’ and is the property ‘physically fit’. An example is the common case where a sales agreement is concluded under the condition that a mortgage can be provided. If this condition is not met, the agreement has yet to be cancelled. Would a process where a financial institution can judge up-front if providing a mortgage is successful considering the financial fitness of a buyer and the state of the property not be a better alternative?

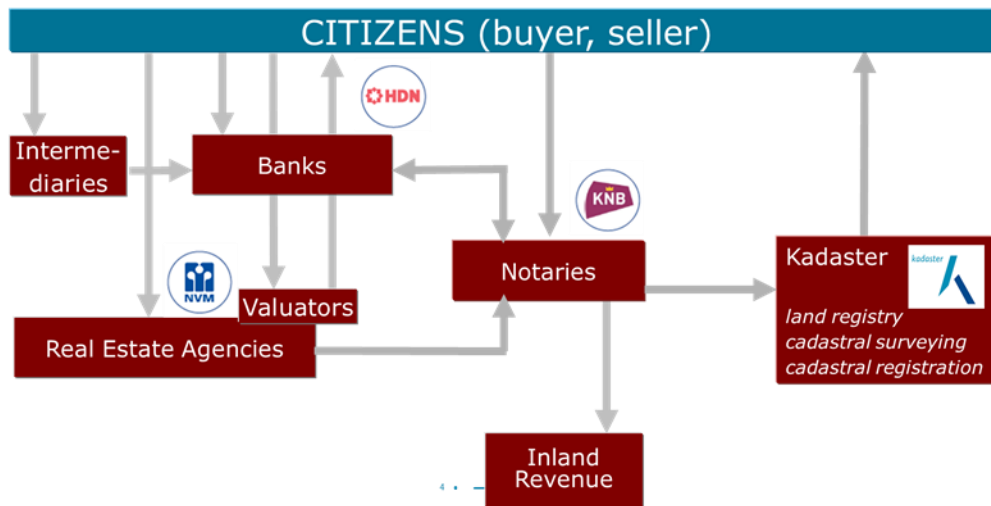


Figure 1: Real estate transaction chain in the Netherlands.

The Kadastre, Land Registry and Mapping Agency cooperates with the financial institutions, the real estate agents and the Royal Dutch Association of Civil-law Notaries in investigating possible improvements.

In the past we would have started this project with optimising our mutual processes in order to achieve better interoperability. Putting data central and focussing on a ‘care-free’ transaction process (providing transparency, efficiency and trust) we have chosen to start with defining a number of joint guiding principles closely related to data:

- *(Legal) security at an earlier stage*: By retrieving validated data directly from the source, we offer (legal) security at an earlier stage.
- *Insight and overview*: Citizens and chain partners have insight into information and process and know what is expected of them.
- *Control of data*: We enable the citizen and chain partners to actively control their data.
- *Interoperability*: The guiding principle is that the system of agreements is open to everyone and relies as much as possible on existing standards.
- *Security*: Information exchange only takes place at a high security level.

This has resulted in the insight that we need a shared information ecosystem (see Figure 2). We are now at the stage where we are considering what are the first steps towards this concept.

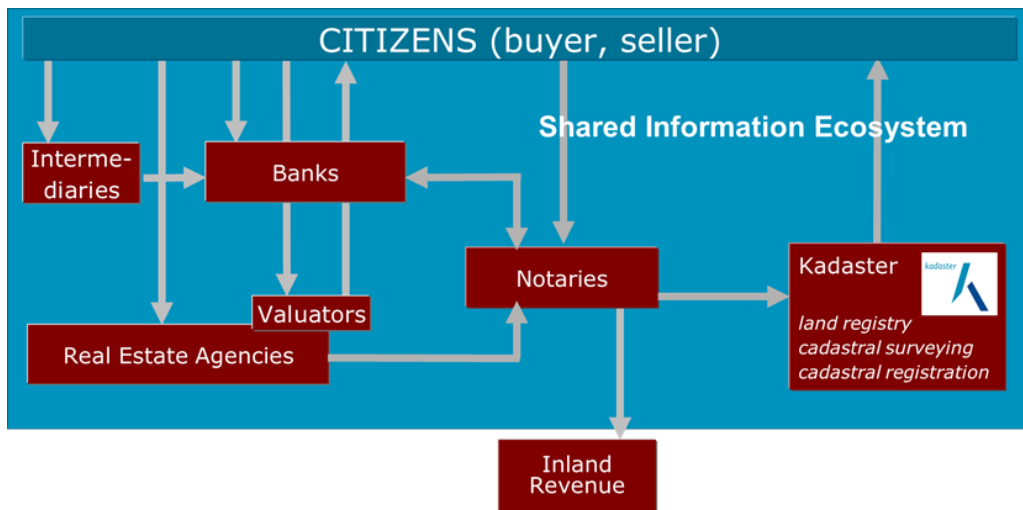


Figure 2: Domain of the shared information ecosystem.

5. RELATING TO OTHER (DIGITAL) ECOSYSTEMS

As indicated earlier also other data ecosystems relate to the domain of land administration. Considering the state of play in the Netherlands we see the following developments related to properties:

- Increasing digitisation in design and construction (BIM) of buildings providing the opportunity to extract legal spaces from BIM-models.
- Transparency in the quality of constructions and reusability of building materials in promoting sustainable building (as part of the circular economy) and structural quality assurance of buildings. (This should ultimately result in a building passport addressing quality and full reuse of building materials.)
- The introduction of a new Environmental Planning Act, which is an act fully based on data and digital working processes for issuing permits and providing planning information. This requires data to be available, readily accessible, usable and data that can be upheld in court.
- Policies in stimulating property owners in energy transition and efficiency (new energy systems, transportation).
- Integrating subsoil information in decision making by making this information available (related to ground water, subsidence, geothermal energy, underground construction).
- Climate change (related to flooding, resilience to downpours, heat stress, vegetation).
- The use of digital twins for planning and decision making in virtual worlds.

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Example: energy transition

The objective to reduce carbon emissions has resulted in a national policy to work towards climate neutral housing without the use of carbon fuels (natural gas). This is achieved by e.g. installing solar panels, and heat pumps in individual properties or linking up to (municipal) heat networks (see Figure 3). These developments also require a major investment in our energy infrastructure and notably our electricity networks.

For individual properties this requires a large investment. A mortgage linked to the property could be a logical way of financing these facilities in a modular way (existing in parallel to an existing mortgage). When the house is sold that has the consequence the mortgage is transferred as part of the property. At the moment we are looking how this modular way of financing can be accommodated in land transactions and thereby in the cadastre and land registry.



Figure 3: Energy transition: heat pump (left) and solar panels (right) might lead to new forms of modular financing.

Example: climate change

In the case of climate change the Netherlands is influenced by sea-level rise. At the same time, we also face soil compaction (felt as subsidence) induced by lower ground water levels, especially in our peat regions in the west of the Netherlands and the areas of natural gas extraction.

Combined with more frequent heavy downpours the drainage of excess water becomes an issue. Part of the solution is to convert paved areas to green areas (see Figure 4). In some municipalities owners of properties are now offered subsidies in executing this conversion. Also in this case proper information is essential regarding which properties are potentially flooded and which paved areas can be converted.

An issue related to lower ground waters is that the rot of piles on which houses are built in the original peat districts are built. This causes structural damage to the buildings.



Figure 4: Visualisation of the density of paved areas (grey) and green areas (green) City of Groningen as basis for policy making on conversion measures (source: Jeroen Drewes; winner of the 2019 GIN-Cartography Contest).

6. LINKING UP CADASTRE AND LAND REGISTRY TO DATA ECOSYSTEMS

The developments listed above provide sufficient reasons to at least reconsider our positioning in the context of the digital (public) society if we want to stay relevant as a cadastre or land registry agency. In society there is a permanent need for transparency and digital trust in the land market and tenure security. This trust is very much vested on the quality and interoperability of data in the land administration system. If cadastres and land registers can provide this, they will stay relevant.

In any case the ongoing digitisation and developments in the land market require that cadastre and land registry agencies continue to keep themselves up to date in the juridical core of land administration. A sensible strategy is to team up with other partners in the land market. Furthermore, it is wise to link up to the digital government in your jurisdiction. Links to natural persons, businesses, buildings, addresses and large-scale topographic mapping are (or will be) taken for granted by the parties in the land market. In many cases this development may already requires a lot of effort, but it will render the cadastre a valuable and sustainable building block in the digital government and the land market.

Following up on these developments cadastres and land registries basically have two options to evolve even further:

1. Pursue a **connection strategy** with other relevant data ecosystems. This means that the parties in the land market can access information of relevance to the issues at hand. This means that sources of relevant data are available, accessible and fit for use. Combining these data and considering which information is needed to provide useful and consistent information is then the task of the cadastre and land register organisation. In this way it will evolve into a full-service provider (for transactions) in the land market.
2. Pursue an **integration strategy** within the world of data ecosystems. In this world the end user is leading. Depending on the issue at hand parts or the whole of the land administration ecosystem will be available and accessed. If the end user is operating in the land market this strategy will to a large extent provide the same result as the connection strategy. Moreover, result of this approach is that land administration data will be used by a much broader community and for purposes that before would never have been considered by cadastres and land registers.

Both the connection and integration strategy require that you have a proper data strategy in place. Sharing data between different ecosystems requires that interoperability not only at the technical level, but also at the semantic and process level (and in some cases also at the organisational and legal level) are taken into consideration.

Our recommendation is first to improve the land administration system in its core (if necessary) and thereafter to link it to the digital government infrastructure. In many cases this might be sufficient at this stage of maturity and meet the current needs in society. If linking up with environmental issues is important then proceeding with one of the strategies (connection or integration) is necessary. Which strategy you choose, depends on your ambitions and more importantly on your jurisdiction's, users' and societal needs.

All these considerations might have an impact in the way you organise the land administration system in general or cadastre and land registry agencies in particular. In this paper we have focussed on the desired functionality in the digital age and data ecosystems. We have not considered the organisational consequences. In organisational change the adage is that structure follows strategy.

7. CONCLUDING REMARKS

Cadastres and land registries will be more data-centric and have to link up with other domains if they want to remain a relevant to the users. Also in the future they will provide the foundation for the legal or fiscal aspects in the land market, but also be at the basis of sound decision making and planning concerning sustainable land and properties in the coming decades. This presents an opportunity for cadastres, but also requires that cadastres are ready for this change and evolve.

In any case we advise to keep the land administration information system user focussed, fit for purpose in the digital age and to link it up with the domain of eGovernment. It is then for each cadastre and land register to consider how to further connect to or integrate with other data-ecosystems that are related to the land market.

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BIOGRAPHICAL NOTES



Martin Salzmann is the strategy lead with the Cadastre, Land Registry and Mapping Agency (Kadaster) of the Netherlands. He holds a Ph.D.-degree in technical sciences (geodetic engineering) from Delft University of Technology. 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. Martin is board member of Eurogeographics and of its coordinating team of the cadastre and land registry knowledge exchange network.

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