

# The Danish Cadastre of Tomorrow

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**Key words:** Cadastre, Cadastral Systems, Digital Cadastre, Land-use, Land-administration, Spatial Planning, Geo-information, E-governance, Service Oriented Architecture.

## SUMMARY

The digitalization of the Danish cadastral system has in recent years expanded the usability of the system. The cadastral system has evolved from being a somewhat “closed” register containing information about ownership and restrictions on property to being an “open” platform for multiple purposes, for instance reference for visualization in Geographic Information Systems. This multifunctional use of the cadastral system urges the need of rethinking the role of the cadastral system.

Furthermore there are some obvious problems within the Danish cadastral system that needs to be addressed: Some objects are not conclusive (leasehold property) and some objects cannot be identified in the cadastre (flats, houseboats). Perhaps a 3D-cadastre is called upon to solve these problems. Another problem is that the cadastral map is a juridical map, where the absolute accuracy has not been an issue of importance. The fact that the map is now widely used as a reference for data-presentation makes the relative accuracy a problem. The cadastral map also has some imperfections in regard of lacking objects.

The main questions are: Which role is the cadastral system going to play in the future? How is the interaction with other registers going to be? Which information is stored where and how (object-types and relations)?

Die Digitalisierung des dänischen Katasterwesens hat in den vergangenen Jahren zu einer Erweiterung dessen geführt. Das Katasterwesen hat sich von einem eher „geschlossenen“ System mit Informationen über Besitztum und Einschränkungen von Eigentum zu einem „offenen“ System mit multifunktionalen Anwendungen, z.B. als Referenz für Visualisierungen beim Geographischen Informationssystem, entwickelt. Diese multifunktionale Anwendung des Katasterwesens erfordert eine neue Beurteilung der Rolle des Katasterwesens. Dazu kommt, dass es im dänischen Katasterwesen deutliche Probleme gibt, die es zu untersuchen gilt. Einige Objekte sind nicht eindeutig (Genossenschaftswohnungen) und andere können im Kataster nicht identifiziert werden (Wohnungen und Hausboote). Vielleicht könnte ein 3D-Kataster zu einer Lösung beitragen. Ein weiteres Problem ist, dass die Katasterkarte eine juristische Karte ist, wo die absolute Genauigkeit keine entscheidende Rolle spielt. Die Tatsache, dass die Karte heute in hohem Maße als Referenzgrundlage für die Präsentation von Daten benutzt wird, bedeutet, dass die relative Genauigkeit problematisch wird. Auch hat die Katasterkarte einige Mängel in Form von nicht ausreichenden Objekttypen. Die wichtigsten Fragen sind: Welche Rolle soll das Katasterwesen zukünftig spielen? Wie soll die Interaktion mit anderen Registern verlaufen? Welche Informationen sollen wo und wie gelagert werden (Objekttypen und Relationen)?

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## 1. Introduction

The Danish cadastre is in a sense caught up by the future. The digitalization and hence the ability to use the cadastre for multiple purposes results in new demands for the cadastre and the cadastral system.

Before starting the discussion on the future role and structure of the cadastre, this introduction will focus on the evolution of the cadastre and the cadastral system in Denmark up until today.

### 1.1 The present cadastral system

The Danish Cadastral system is a three-string system consisting of the cadastre, the cadastral map and the land book, cf. figure 1.

In theory the system could be organized in many other ways. The most obvious possibility is an integration of the cadastre and the land book.

The Danish way of organizing the cadastral system is due to the historical evolution of the system, sketched out in figure 2. From the very beginning the cadastre consisted of two parts: the cadastral register and the cadastral map. The aim of the cadastre was being able to identify each land-parcel. The information was used for fiscal purposes, to derive a land tax for the property based on the yielding capacity of the soil.

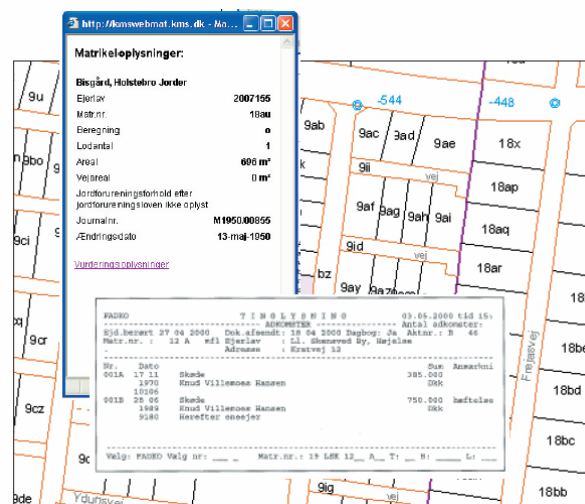
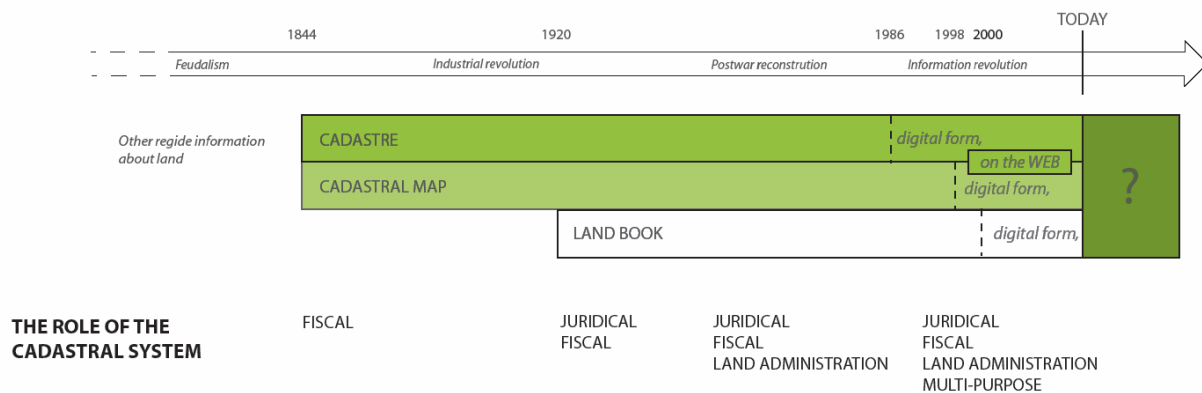


Fig. 1 The components of the Danish cadastral system.

The ability to secure the access to the property was introduced with the establishment of the land book in 1920. The land book is a separate register, which has a close interaction with the cadastre. This structure with three separate registers has been maintained up until today. The National Survey and Cadastre (NCS) is responsible for maintaining the information in the cadastre and the cadastral map. The courts are responsible for the information in the land book.



*Fig. 2 The evolution of the cadastral system.*

## 1.2 The function of the cadastral system.

Over time the function and hence the information in the cadastre has changed. The main function of the cadastre is to identify land, but this identification can be used for many purposes.

In the years after Second World War the increasing population and the demand of better living standards put a pressure on land as a resource. The Planning Act (law) was passed in 1938, dividing the country into rural zones and urbane zones, securing that the cities did not grow uncontrolled at the expense of the rural areas. The control on land-use was implemented in the cadastral process.

Environmental concerns appeared in the late 1970's and developed into major issues in the recent years. Today, comprehensive planning and environmental protection are seen as main tools to secure sustainable development. An example is the Danish coast, which is protected by a 300-meter zone, where the general rule is that urban development is prohibited. This zone is entered in the cadastre as a restriction on the properties afflicted. Likewise goes for forests appointed as "fredskov" (protected forest).

## 1.3 The challenge for the cadastral system

The digitalization of the cadastral system has expanded the use of the system. The cadastral system has evolved from being a somewhat "closed" register containing information about ownership and restrictions on property to being an "open" platform for multiple purposes:

- Reference for visualization in Geographic Information Systems.
- Cross-reference with other digital registers

- Administration-purpose in the digital public service.

The evolution of the cadastre has caused that some information is placed in the cadastre and some information is placed in other registers on basis of the cadastre, for instance local urban plans, which is placed in the land book as restrictions on the properties concerned, and is available as information in a plan-information system on the web.

Furthermore there are some obvious problems within the Danish cadastral system that needs to be analyzed. Some objects are not conclusive (leasehold property) and some objects cannot be identified in the cadastre (flats, houseboats). Perhaps a 3D-cadastre is called upon to solve these problems.

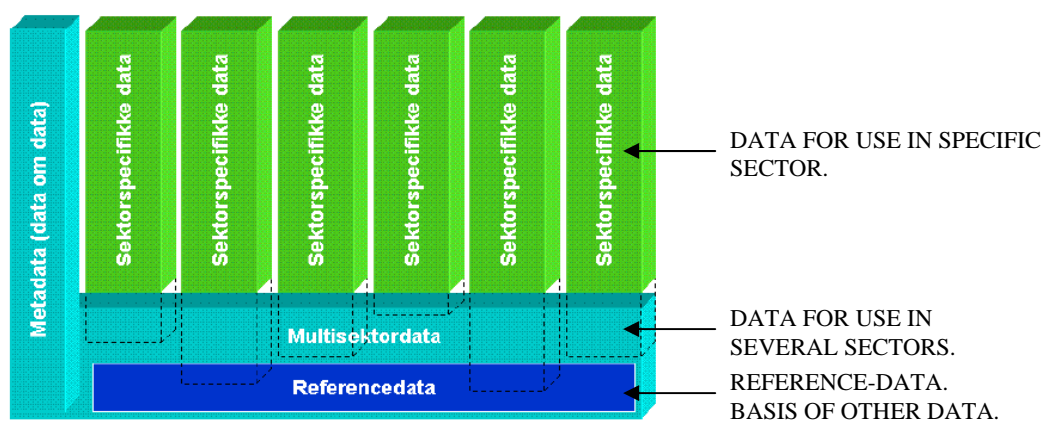
Another problem is that the cadastral map is a juridical map, where the absolute accuracy has not been an issue of importance. The fact that the map is now widely used as a reference for data-presentation makes the relative accuracy a problem. The cadastral map also has some imperfections in regard of lacking objects. For instance, local urbane plans are registered in the land book as restriction on the property (the entire property), but the plan could concern just a part of the property. The ability to localize restrictions and rights is an important issue.

The main questions are:

- 1) Which role is the cadastral system going to play in the future?
- 2) How is the interaction with other registers going to be? What information is stored where and how (object-types and relations)?

## 2. The future role of the cadastre

There is an overall consensus, at least in Denmark, that data needs to be standardized and modelled according to the idea of Service Oriented Architecture, *SOA* (Components and connections are based on interoperations between heterogenic IT-environments and on an independence of placement).



**Fig. 3.** The basic concept of the implementation of SOA in public data, NCS (2005) .

The Internet has evolved from being a place for *communication* (E-mails and information-retrieval) to a place for *interaction*, Jensen (2004).

The users, both professionals and amateurs, demand more and more information and in an easy accessible way.

It is more and more common to use the internet for daily chores, for instance net-banking, buying tickets for cinema or travelling.

When selling, or especially buying, real estate the internet is also a place for finding information.

With the even faster connections to the internet, data only needs to be stored in one place and can be reached through the internet. For administration-purposes the internet offers the possibility of working with updated data at all times.

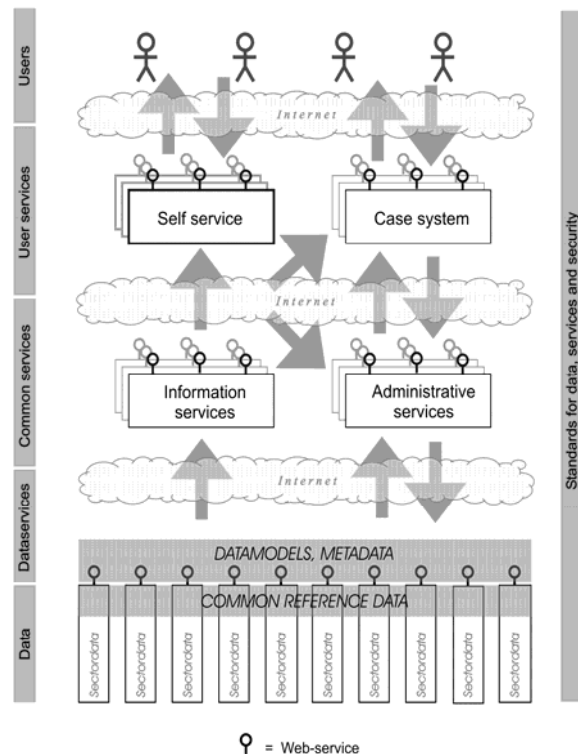


Fig. 4 Data-structure according to SOA, NCS (2005).

For facilitating the analysis of the needs for improvement and changes in the cadastral system the relevant parameters are operationalized according to figure 5.

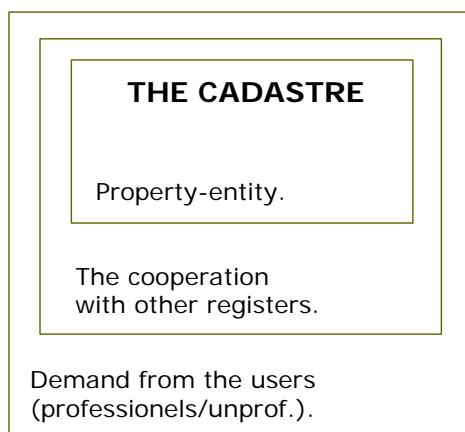


Fig. 5 Relevant parameters in the analysis of the cadastral system

The first step is a discussion of the term “property”. As a reference for other information the definition is of vital importance.

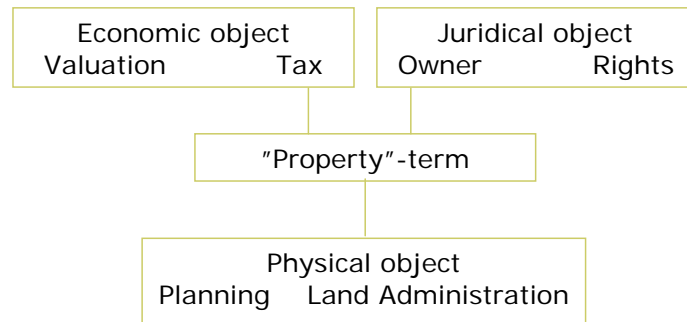
Secondly the discussion focuses on the interaction with other registers, and on the placement of the information.

Finally there is the user-interface, which is of great importance. It is essential that the information is available and understandable for the users.

## 2.1 What is the definition of Property?

In Denmark there exist several types of “property” due to the sketch out historical evolution, cf. figure 2.

According to the Act of Subdivision there is a property-term, in relation to the registrations in the cadastre (cf. *the juridical object* in figure 6). For taxation a property is valued due to the registration in the cadastre and taxed due to the registrations of the owner. Finally in regard of planning and land administration, the mentioned definition of property is not of importance.



**Fig. 6** The different understandings of the term Property.

In this context it is the physical object that is of importance.

A committee has been adjourned to find a solution of this “confusion”, - and note that it has not been a problem up until now, because the terms are well-defined in the respective law. It is a problem due to the data-structure that the term is not conclusive.

The committee has worked out a “property-reference” – the name for the smallest object in common for the different variations of the property-term, NCS (2006). The property-reference is an administrative key-reference that makes the lacking connections between the property-terms possible. The first step is to implement the key for the properties registered in the cadastre and for flats (only private property). Next step is to introduce the property-reference to real estate on rented land and to land-parcels not registered in the cadastre. This will make it possible to create the property-terms used today. It is not possible today to register the property-reference by coordinates, but it is the aim on a longer basis. The committee-work makes it possible to continue the advancement of SOA and thereby services on the internet.

It is a problem that there is no discussion of the term “property”. As sketch out earlier the term property is a result of the historic evolution. This term is insufficient today. The essential criterion for a “property” is the identification, but secondly the criterion could be “transferable rights”. The property term has been used for taxation and for registering rights or restrictions to a property. Today there is a new need, which could be fulfilled by making a new definition of the property term. A new definition should also include the sea-area, and take care of the fact that there can be a “layer” of transferable rights in the object today defined as a property.



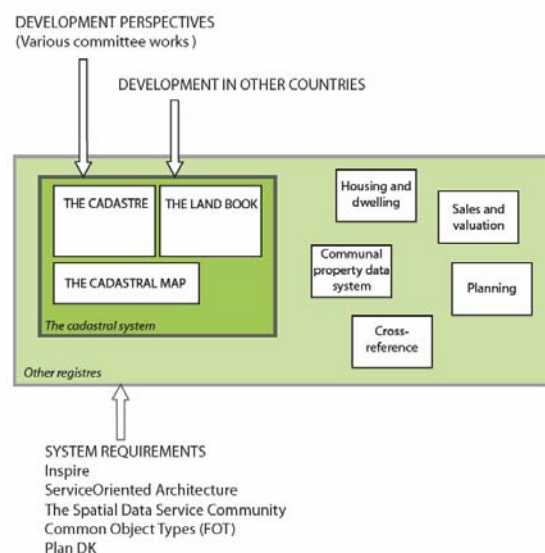
For instance the map on the right side is an example of the restrictions on land-use in Denmark. The restrictions are registered on basis of the cadastral-map. The cadastral map is digitalized from old maps. In the old maps the absolute accuracy was not of importance. The maps showed the shapes and belonging dimensions and/or coordinates, so that each parcel could be geographically placed. So, in accordance with the purpose to identify each land-parcel, the map was adequate. Today the relative accuracy in the map is a problem. As shown in the example on the previous page it is misleading (at least for the non-professionals) that the limits of the restrictions zones does not fit with the topographical lines of the map. Do the restrictions not apply the cost-line in the shown map?

### 3. Conclusion

The cadastre has a great future as basis for registrations and visualizations on the web. Still there are many issues that need to be addressed to make the use of the cadastre as reference-data for other registers successful. As it is right now the various issues are handled “forced” by the development. The problems are overcome by making smaller adjustments and not larger alterations of the existing systems. It is obvious that it is difficult to make large-scale adjustments because of the complicity and importance of the data, but the questions is whether it can be avoided to meet the demands “of tomorrow”. The FIG-statement of the future cadastral system (Cadastre 2014) supports this (påstand), FIG (1994).

1. “Cadastre 2014 will show the complete legal situation of land, including public rights and restrictions!
2. The separation between ‘maps’ and ‘registers’ will be abolished!
3. The Cadastral mapping will be dead! Long live modeling!
4. ‘Paper and pencil-cadastre’ will have gone!
5. Cadastre 2014 will be highly privatizes! Public and private sector are working closely together!
6. Cadastre 2014 will be cost recovering!”

The thoughts in this paper will be the focus of my PhD. thesis, which will address the issues from the model presented in figure 5 (and sketched out more detailed in figure 8).



**Fig. 8** The elements of the PhD. Thesis.



## REFERENCES

Enemark, S., 2005, The Danish Way, Expert Group Meeting on incorporating Sustainable development objectives into ICT enabled Land Administration Systems, Centre for Spatial Data Infrastructures and Land Administration University of Melbourne, Australia, 9-11 November 2005.

Kaufmann, J. et. Al. Cadastre 2014, 1998, FIG.

Jacobi, O. et. al., 1997, GIS i Danmark, page 176-178, Teknisk Forlag.

Jensen, H.H., 2004, Service-Oriented Architecture, Copenhagen, Litera.

NCS (The National Survey and Cadastre), 2005, Fælles principper for systemarkitektur ved brug af geodata.

NCS (The National Survey and Cadastre), 2006, Fælles identifikation af mindste enheder i ejendomsregistrene.

## BIOGRAPHICAL NOTES

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