Assessment of the Core Cadastral Domain Model from a Cadastre 2014 point of view

Jürg KAUFMANN, Switzerland

Key words: Cadastre 2014, land rights and restrictions, lean data modeling, simple models for a complex topic

SUMMARY

On the basis of a comparison of the statements of the two papers 'A modular standard for the Cadastral Domain' [Lemmen et al., 2003] and Cadastre 2014 [Kaufmann, Steudler, 1998] the commonalities and differences between the two approaches are analysed.

The result is that there is consensus in view of the importance and usefulness of the standardization of cadastral data with the help of data models and in view of the necessity to have models as transparent and simple as possible.

Differences exist on the level of the concepts. While the Core Cadastral Domain Model follows in principle the traditional 'parcel-centric' approach and tries to open it, Cadastre 2014 stipulates a totally new cadastral system, which might be called 'land object-centric'. A parcel is one certain appearance of a land object.

Cadastre 2014 aims at completeness of the legal information on land. The land object approach makes this possible because a simple model results. The conceptual background of the Core Cadastral Domain Model at the moment needs complex objects to be able to create a correct real property based model. This approach tends to be complex.

This means, that the concepts differ despite both approaches are much in favor of modeling and standardization. So first a discussion on the concepts or the development of an ontology is necessary to resolve the communication problems.

So it is recommended to go on with an open-minded and precise ontology discussion, taking into consideration the efficiency of the possible solutions.

SUMMARY German

Die zwei Publikationen 'A modular standard for the Cadastral Domain' [Lemmen et al., 2003] und Cadastre 2014 [Kaufmann, Steudler, 1998] untersucht, um die Gemeinsamkeiten und Differenzen zu analysieren.

Die Auffassungen betreffend die Bedeutung von Datenmodellierung und Standardisierung stimmen dabei sehr gut überein.

Differenzen bestehen betreffend das konzeptionelle Gerüst, das in Falle des Core Cadastral Domain Models parzellen-zentriert, im Falle von Cadastre 2014 Landobjekt –zentriert ist.

Die konzeptionelle Diskussion ist so offen und präzis wie möglich weiterzuführen.

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1. INTRODUCTION

I was invited to comment the latest (third) version of the core cadastral domain model as published in the report 'A modular standard for the Cadastral Domain' on the occasion of the 3rd International Symposium on Digital Earth in September 2003 – Information Resources for Global Sustainability – by Lemmen et al. from the point of view of 'Cadastre 2014 – A Vision for a future Cadastral System'. I do this with great pleasure, because I see in the development of the core cadastral domain model, that elements of Cadastre 2014 have been included. I am convinced that the Cadastre 2014 approach will help to answer many questions raised in the paper.

The first statement in the introduction to this Joint 'COST Action G9' and 'FIG Commission 7' Workshop on Standardization in the Cadastral Domain is:

'One of the big problems in the cadastral domain is the lack of a shared set of concepts and terminology. International standardization of these concepts (that is, the development of an ontology) could possibly resolve many of these communication problems.'

Such statements are not only valid for the cadastral domain. Often there is a lack of concepts and terminology, although the standardization process can force the stakeholders to clarify the terminology and to come to shared views. But I don't believe, that standardization alone is the 'development of an ontology', which is defined as *a particular theory about the nature of being or the kinds of existents'.* There is a need to reflect the nature of a phenomenon, before being able to standardize. Cadastre 2014 is the result of reflections on the nature of existing and future cadastral systems. The respective statements and recommendations were intended to contribute to a simple and comprehensive standardized model of the cadastral domain. To have an ontology is a precondition for standardization.

The following discussion will not be about modelling and standardization, but shall contribute to an ontology. The basis for my comments is the report 'A modular standard for the Cadastral Domain' by Lemmen et al. and the Publication 'Cadastre 2014'. I will compare the statements of the reports and comment the similarities and differences.

2. COMPARISON OF THE STATEMENTS OF THE REPORT WITH THOSE OF CADASTRE 2014

The report is an excellent paper and I am very grateful that our colleagues made the effort to carefully document the problems and their proposals to overcome obstacles.

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Important statements from the report are compared with statements and principles of Cadastre 2014.

Section of report	View of the report (p 399)	View of Cadastre 2014 (p 20)
Preface	Standardized core cadastral domain model serves to: • avoid reinventing and re-implementing the same functionality again and again • enable involved parties to communicate based on a shared ontology implied by the model	Modelling is substantial for Cadastre 2014 **Statement 3: Cadastral mapping' will be dead! Long live modelling!** The result of this process is a data model of the real world. The modern cadastre has to provide the basic data model.
Comment:		

Both approaches emphasize the importance of standardization by modelling the objects belonging to a cadastral system. It is proved that standardized data models avoid duplication of efforts and saves human and financial resources. A Swiss study on 'Reflections on the benefits and potential economies of geographic data standards'. [Kaufmann/Dorfschmid, 2001] tries to quantify the economies obtained by standardization.

Standardized models contribute significantly to the communication on the objects of a certain domain and it is true, that a model implies an ontology. But the ontology must be clarified before creating a model. The report and Cadastre 2014 differ in the ontology. While the report starts from the traditional cadastral systems and develops it further, Cadastre 2014 designs a new system, respecting basic principles of the traditional system.

Section of report	View of the report (p 399)	View of Cadastre 2014 (p 43)
Preface	One of the main preconditions of the model development is to keep the model as transparent and simple as possible in order to be useful in practise.	**4.5 Need for Flexibility and Effectivity** In order to cope with the great diversity of needs, the Bogor Declaration [United Nations, 1996] states that cadastral systems should: • be simple and effective; • ….. Cadastre 2014 with its concept of complete area coverage, with its straightforward information structure, and following the principle of legal independence, can meet these requirements.
Comment:		

The issue of cadastre and land information is complex. It is therefore necessary to reduce complexity by simple and straightforward models. There is no difference in opinion between the report and cadastre 2014.

Introducing land objects (p 23), Cadastre 2014 traces back all object-subject relations to the same schema. This is transparent and simple. While based on the principle of legal independence, the Cadastre 2014 is never complete. It moves according to the legislation process in a given jurisdiction.
The report speaks of a 'complete' core cadastral model. When restricting the cadastre to its traditional content, this may be true, but this would contradict the basic idea of Cadastre 2014. Cadastre 2014 is aimed at improving the legal security about land rights as stated in chapter 3.3.2 Mission and Content on p 28. *While legal security in a cadastre-based land registration system is close to or even more than 100% for private law rights, it is near 0% for public law restrictions. Cadastre 2014 must correct this situation, which is becoming more and more precarious. It must document, in a safe manner, all legal aspects of land.*

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Section of report	View of the report (p 399)	View of Cadastre 2014 (p 23, 28)
Introduction	Cadastral systems are all based on the relationships between persons and land via (property) rights Land administration systems are not 'just handling only geographic information' they represent a lawfully meaningful relationship amongst people and between people and land.	A land object is a piece of land in which homogeneous conditions exist within its outlines. Examples of legal land objects are: • private property parcels; • areas where traditional rights exist; • administrative units such as countries, states, districts, and municipalities; • zones for the protection of water, nature, noise, pollution; • land use zones; • areas where the exploitation of natural resources is allowed.

Comment:

For Cadastre 2014 the property right is one example of the different rights on land.

Section of report	View of the report (p 400)	View of Cadastre 2014 (p 23, 28)
Introduction	Land administration systems are not 'just handling only geographic information' they represent a lawfully meaningful relationship amongst people and between people and land.	Cadastre 2014 is a methodically arranged public inventory of data concerning all legal land objects in a certain country or district, based on a survey of their boundaries. **Such legal land objects are systematically identified by means of some separate designation. They are defined either by private or by public law.** The outlines of the property, the identifier together with descriptive data, may show for each separate land object the nature, size, value and legal rights or restrictions associated with the land object.

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Comment:

From the viewpoint of Cadastre 2014 the legal aspect is a basic characteristic of the cadastre. It is the cadastre which documents the legal situation of the land. Land administration work is fulfilled with the help of the lawfully relevant information extracted from the cadastre. The processes can be compared with normal business administration as it was explained 1999 by Kaufmann at the International Conference on Land Tenure and Cadastral Infrastructures for Sustainable Development in Melbourne:

Business	Land business
Strategy/policy	Land policy
Management	Land management
Administration	Land administration
Accounting	Cadastre

Section of report	View of the report (p 400)	View of Cadastre 2014 (p 41, 42)
Introduction	Having a policy is one thing, having instruments to enforce the policy is another. Therefore governments need instruments like regulations concerning land tenure security, the land market, land use planning and control, land taxation, and the management of natural resources. It is within this context that the function of land administration systems can be identified : a supporting tool to facilitate the implementation of a proper land policy in the broadest sense.	**Statement 1 on Cadastre 2014** **Cadastre 2014 will show the complete legal situation of land, including public rights and restrictions!** 4. JUSTIFICATION FOR CADASTRE 2014 4.1 Need for Support of Sustainable Development 4.2 Creating Political Stability 4.3 Omit Conflicts of Public and Private Interests 4.4 Support of Economy

Comment:

Land administration basing on the information from the cadastre is the important tool for 'the implementation of a proper land policy'. But only if the information on the legal situation of land is complete, the land policy can be supported in the broadest sense.

Cadastre 2014 shall give this complete overview.

Section of report	View of the report (p 400)	View of Cadastre 2014 (p 22)
Introduction	Without availability of information systems it is believed it will be difficult to guarantee good performance with respect to meeting changing customer demands.	**Statement 4 on Cadastre 2014 (p 22)** **'Paper and pencil - cadastre' will have gone!** Geomatics technology will be the normal tool for cadastral work. Real low cost solutions are only possible when this technology is used in combination with lean administrative procedures. Developed, developing, and transitional countries need models of the existing situation to resolve the problems of population, environment and reasonable land use.

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> **Comment:**
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> The new possibilities of IT make it possible to design solutions which work efficient and reliable. Only with these technologies the design and implementation of transparent and simple models is possible.

Section of report	View of the report (p 400)	View of Cadastre 2014 (p 33)
Introduction (p 400)	Standardization is a well-known subject since the establishment of cadastral systems. Open markets, globalisation, and effective and efficient development and maintenance of flexible (generic) systems ask for standardization.	Geographic information is sent over the data highways. The Internet and its ability to facilitate worldwide data networks is playing an important role in the exchange of cadastral data. The exchange of data models will become common practice in the distribution of cadastral information.

> **Comment:**
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> Cadastral data modelling is an essential part of the standardization. It has proved to be the most effective method for standardization.

Section of report	View of the report (p 402, 403)	View of Cadastre 2014 (p 38)
2. Cadastral Domain Model	Core of the Cadastral Domain Model: Person, RightOrRestriction, RealEstateObject One should not look at the whole model at once as the colours are representing UML 'packages' or coherent parts of the model. …. It is likely that more packages will be developed. Besides being able to present/document the model is comprehensive parts, another advantage of using packages could be that it is possible to develop and maintain these packages more or less in an independent way.	Cadastre 2014 puts the legal land object into the center and adjudicates the right to the land object. … The right referring to the parcel, the title, is registered together with the indications about the rightful claimant in relation to the land objects..... The process of adjudication of rights to legal land objects in the case of public law corresponds to the creation of a title in the name of the society as claimant.

> **Comment:**
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> While the report recommends to create individual models for different matters of facts, Cadastre 2014 opens the view by handling all legal land objects in the same manner. The extension of the content of the models is not a new package, but the addition of a new legal independent layer model.

Section of report	View of the report (p 403)	View of Cadastre 2014 (p 38)
2. Cadastral Domain Model (p 403)	The principles of Cadastre 2014 are integrated in our approach.	The principle of legal independence is a key item in the realization of Cadastre 2014. The principle stipulates that: • legal land objects, being subject to the same law and underlying a unique adjudication procedure, have to be arranged in one individual data layer; and • for every adjudicative process defined by a

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	certain law, a special data layer for the legal land objects underlying this process has to be created. Cadastre 2014 is therefore based on a data model, organized according to the legislation for the different legal land objects in a particular country or district.

Comment:

The report concentrates first on real estate objects and tries then to open the focus on restrictions. So there is a need to introduce specialization classes as Parcel, ParcelComplex, Part of Parcel, VolumeProperty, RestrictionArea, ApartmentUnit, etc.

All these specializations cause an increase of complexity which is not transparents and resource consuming.

Cadastre 2014 does not need these specializations, while working consequently with legal land objects.

Section of report	View of the report (p 405)	View of Cadastre 2014 (p 31)
2.2. Surveying Classes	A cadastral survey is documented on a SurveyDocument which is a legal source document made up in the field.	One of the most important things was the craft to represent measured objects in a comprehensible map. With the utilization of information technologies, the process substantially changes. The determination of object co-ordinates becomes easier with GPS and remote sensing methods, and the direct drafting of objects on a map is superseded by the creation of objects in an information system.

Comment:

Cadastral surveying is not explicitly treated in Cadastre 2014. But every land object must base on a legal documentation containing also the survey results for the registration of a legal land object in the cadastre system.

Section of report	View of the report (p 415)	View of Cadastre 2014 (p 36)
2.5 History	History **and** dynamic aspects There are two different approaches when modeling the result of dynamic systems (discrete changes in the state of the system): event and/or state based modeling: § In event based modeling, transactions are modeled as separate entity within the system (with their own identity and set of attributes). § In state based modeling, only the states (that is the results) are modeled explicitly: every object gets (at least) two dates/times, which indicate the time interval during which this object is valid.	**Identical Procedures for Private and Public Land Objects** The procedure of the definition is similar for land objects created under private and public law. After the agreement between land owners about a transfer of rights, a deed or a title are created. The transaction of rights becomes legally effective by the registration of either deeds or titles in an official land register The determination of public rights and restrictions follow well-defined procedures prescribed by public law. Once the adjudication process is completed, the right normally becomes valid. Cadastre 2014 expects that every right adjudicated to a legal land object will be registered officially.

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> **Comment:**
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> The nature of cadastre is by tradition event based. Creation and transaction of land objects are the result of events as signing contracts or adopt laws and regulations. Also future enlarged cadastres have to deal with the events. Cadastre 2014 would prefer event based modelling.

Section of report	View of the report (p 412)	View of Cadastre 2014 (p 23)
3D questions	Current cadastral registration systems, based on 2D topological and geometrically described parcels, have shown limitations in providing insight in (the 2D and 3D) location of 3D constructions…. In the previous section the volumetricProperty was introduced, but this requires a significant change in the legislation in most countries.	A land object is a piece of land in which homogeneous conditions exist within its outlines. These conditions are normally defined by law. Every society creates the rules for the co-existence of its members. These rules, normally in the form of laws, define how a society will understand the phenomena within the area in which it lives. In the same manner the rights and the duties of the members of a society are defined. These duties are, in most cases, defined by restrictions of the freedom of individuals.

> **Comment:**
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> Cadastre 2014 handles the geometry of an object as an attribute. Technically the objects may be 2D or 3D depending on the rights and restrictions connected with the object. Legally no respective steps have been undertaken. As soon a law defines 3D land objects, they can be taken into consideration in cadastre 2014 by describing them with 3D-coordinates without changing or re-inventing the basic concept. To identify the effect of a law in the 3rd dimension feasible algorithm are to be developed.

3. CONCLUSION

The basic considerations made in the context of the core cadastral model and those behind Cadastre 2014 do not differ much. Standardization is crucial for both approaches. But beyond, the ontology needs to be harmonized.

The core cadastral domain model initiative, trying to model existing occurrences of cadastres, is confronted in every step with new questions. The development of the core cadastral domain model shows that with every step more elements of Cadastre 2014 are included. A trend in direction of Cadastre 2014 can be identified.

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Cadastre 2014 is a totally new approach to cadastre. Including all legal land objects of a certain jurisdiction and according to its laws and handling them according to the proven and successful principles of the traditional cadastre, is a new approach made possible by the development of IT. This new approach makes it necessary to throw overboard some traditional practises as the parcel-centric approach. Thinking in land objects is the future in modern cadastral systems. The nature and the fundamental truths of the cadastre are remaining the same, but its content is changing significantly.

These differences have nothing to do with the modelling, they are in the field of the ontology. The ontology discussion, initiated by the standardization efforts, has to be continued. The important question is: What is the real nature of the cadastre?

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BIOGRAPHICAL NOTES

NAME: Jürg Kaufmann

DATE OF BIRTH: August 22, 1942

EDUCATION: Department for Rural Engineering and Surveying of the Swiss Federal Institute of Technology with additional studies in economics and commerce.

PROFESSIONAL APPOINTMENTS: After many years of surveying practice in Switzerland, he founded his own company KAUFMANN CONSULTING, working for public and private institutions in the field of cadastre and geomatics on a national and international level.

PROFESSIONAL EXPERIENCE: Among many other involvements in public and private consulting projects, Jürg Kaufmann was a main consultant to the management board of the reform project of the Swiss cadastral surveying system from 1982-1994. Since 1995, he got involved in international projects in

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Liechtenstein, Belarus, Ukraine, Georgia and Kosovo. From 1994-1997, he was main consultant for the implementation of a modern cadastral system in Belarus, commissioned by the Swiss Federal Office for Foreign Affairs (FOFEA). Since 1998, he is commissioned by UN-DESA as Chief Technical Advisor for the cadastral project in Georgia.

Since 1985, Jürg Kaufmann represents Switzerland in the FIG-Commission 7, where – between 1994-2002 – he twice chaired working groups resulting in the publications 'Cadastre 2014' and 'Benchmarking Cadastral Systems'.

Since 2003, Jürg Kaufmann is the president of geosuisse, the Swiss Association of Geomatics and Landmanagement.

Mother language: German
Foreign languages: English, French, Italian (spoken), Russian (basic knowledge)

FIELDS OF INTEREST: Design and conceptualization of space data infrastructures. Implementation and management of cadastral systems and space data infrastructures. Evaluation of systems and projects.

CONTACTS

Dipl. Ing. ETH Jürg Kaufmann
KAUFMANN CONSULTING/FIG
Hauffeld 109
CH-8455 Rüdlingen
SWITZERLAND
Tel. + 41 1 867 14 36
Fax + 41 1 867 34 89
Email: jkcons@swissonline.ch
Web site: homepage.swissonline.ch/jkcons

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