

Standardization of Real Property Rights and Public Regulations

The Legal Cadastral Domain Model

JESPER M. PAASCH



**KTH Architecture and
the Built Environment**

Doctoral Thesis in Real Estate Planning
Stockholm, Sweden 2012



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Abstract

The objective of this thesis is to develop a conceptual model for classification of real property rights and public regulations. The model is called the Legal Cadastral Domain Model.

The model is intended to be a terminological framework for cross-border exchange of cadastral information. Parties exchanging cadastral information via the model do not require detailed knowledge of the legal system in which the right or regulation is created.

The model is based on the principle that real property rights and public regulations influence real property ownership by being either beneficial or encumbering for the real property owner.

The theoretical departure of the research presented in this thesis is in comparative legal theory and terminology. Real property rights and public regulations are important parts of real property legislation as they describe and secure the use and other exploitation of land, water and air.

The research is conducted through studies in real property legislation and associated literature. The model has been developed through case studies on real property rights in Portugal, Germany, Ireland, the Netherlands and Sweden and public regulations in Portugal and Sweden.

The generated results show that it seems possible to describe real property rights and public regulations regardless of their legal origin, at least in Western legal systems.

The thesis also includes a discussion of terminological aspects concerning definitions of three-dimensional (3D) real property.

The thesis consists of a summary and 6 papers.

Keywords: Cadastral domain, standardization, real property, real property rights, public regulations, real property ownership, land administration, modelling, terminology, comparative law.

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I am also indebted to the following for either co-authoring two of the articles presented in this thesis and/or answering questions in regard to my case studies or otherwise being helpful: Mr. Fergus Hayden at the Irish Land Registry in Dublin, prof. adjunto João P. Hespanha at Technology and Management Polytechnic School in Águeda, Portugal, prof., Dr. Manfred Holler at University of Hamburg, Germany, Dr. Mónica Jardim at University at Coimbra, Portugal, Dr. Barbro Julstad at Lantmäteriet, Dr. Jenny Paulsson at KTH, prof. Dr. Hendrik Ploeger at Delft University of Technology, the Netherlands, Dr. Markus Seifert at Land of Bavaria Agency for Surveying and Geographic Information in Munich, Germany and prof. Dr. Jaap Zevenbergen at University of Twente, the Netherlands.

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Last, but certainly not least, I want to express my sincere thanks and gratitude to my wife Anna for her endless patience, never ending encouragement and always constructive comments.

Gävle, May 2012

Jesper Mayntz Paasch

Content of thesis

Introduction

Summary of thesis

Paper 1

Paasch, J. M. (2005). Legal Cadastral Domain Model - An object-orientated approach. In *Nordic Journal of Surveying and Real Estate Research*, volume 2, number 1, 2005 (pp. 117-136).

Paper 2

Paasch, J. M. (2008). Standardization within the Legal Domain: A Terminological Approach. In Doganoglu, T., Holler, M. J. and Tiedeman, J. (eds.). *EURAS Yearbook of Standardization*, volume 6, 2008 (pp. 105-130). On-line publication.

Paper 3

Hespanha, J., Jardim, M., Paasch, J. and Zevenbergen, J. (2009). Modelling Legal and Administrative Cadastral Domain: Implementing into the Portuguese Legal Framework. In *Journal of Comparative Law*, volume 4, number 1, 2009 (pp. 140-169).

Paper 4

Paasch, J. M. (2011). *Classification of Real Property Rights - A Comparative Study of Real Property Rights in Germany, Ireland, the Netherlands and Sweden*. KTH Royal Institute of Technology. Stockholm, Sweden. TRITA-FOB Report 2011:1.

Paper 5

Paasch, J. M. and Paulsson, J. (2011). Terminological Aspects Concerning Three-dimensional Real Property. In *Nordic Journal of Surveying and Real Estate Research*, volume 8, number 1, 2011 (pp. 81-97).

Paper 6

Paasch, J. M. (2012). Modelling Public Regulations – A Theoretical Approach. Submitted for peer-review to *Nordic Journal of Surveying and Real Estate Research* in May 2012.

Introduction

The results presented in this thesis are a contribution to the ongoing research of the cadastral domain.¹ The aim of the thesis is to develop a conceptual model describing a standardized, terminological framework for classification of real property rights and public regulations influencing the owner's use of real property, the *Legal Cadastral Domain Model*.

The concept of standardization traditionally belonged to the technical/industrial manufacturing industry, securing the usability of technical products, specifications and measurements.² The concept has however over the years developed into other fields like organisation and information management.³ The aim of a standard is to create a framework for handling and exchange of goods, information and services through a common interface.

The theoretical departure of the research presented in this thesis is in comparative legal theory and terminology. Real property rights and public regulations are important parts of real property legislation as they describe and secure the use and other exploitation of land, water and air. A standardized classification would further cross-border exchange of information regarding these legal instruments, thus making international comparison easier.

Any comparison requires (some degree of) standardized terminology; otherwise the receiver is not capable of understanding the message. It is, apart from language barriers and the use of sometimes different terminology, difficult to exchange information on the content of national cadastres, since national cadastral domains are part of national legislation and may be deeply rooted in a country's historical and cultural traditions.

¹ The term cadastral domain covers a wide range of land management issues like the registration of real property rights, fiscal rights and other issues influencing the use, management and exploitation of land, water and air.

² The concept of standardization is old. Examples of e.g. standardized weights and goods are known from antiquity. Biblical and ancient Indian texts state the value of correct measurements. It is e.g. mentioned in an Indian text from about 400 BC that '[...] the king should inspect the weights and measures and have them stamped every six month and punish offenders and cheats'. Cited in Spivak and Brenner (2001, pp. 8-9).

³ In total, more than 19.000 international standards exist according to ISO, the International Organization for Standardization. Examples are the international standards for quality management – ISO 9000, and environmental management – ISO 14000. See www.iso.org.

Parties exchanging cadastral information via the Legal Cadastral Domain Model do not require detailed knowledge of the legal system in which the right or regulation is created. They can receive information about what type of right or regulation which influences real property ownership, which in this thesis is seen as the central right to real property.

Other aspects of cadastral research such as registration, visualization, taxation, etc. are equally important for the development of the cadastral domain, but without a legal basis there would be no rights or regulations to exchange information about.

I hope my research will contribute to an increased awareness of the importance of legislation and terminology in cadastral research.

Summary of thesis

Jesper M. Paasch

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1 The empirical setting

The cadastral community has during the last decades of the 20th century been producing digital cadastral data, replacing analogue records to further smoother and more cost effective land administration.⁴

The next phase is the exchange of digital cadastral information among national and international users. In the first decade of the 21st century a number of scientific publications, conferences, projects and other initiatives have shown an increased awareness towards the registration and exchange of cadastral data.

Examples are the annual FIG⁵ conferences, the Cadastral Data Modelling workshop in 2003, the Standardization of the Cadastral Domain conference in 2004, and the 1st and 2nd international workshops on three-dimensional (3D) real property in 2001 and 2011.⁶ Other initiatives are e.g. the European EULIS co-operation, the European COST research co-operation, the UNECE guidelines on real property identifiers, the European INSPIRE directive, the Core Cadastral Domain Model and the Land Administration Domain Model:

The EULIS (European Land Information Service) co-operation provide a facility for accessing online and updated information on land across European borders, focusing on mortgaging and conveying of real property. The aim is to improve opportunities for pan-European activities and to compare national practices.⁷

The European Cooperation in the field of Scientific and Technical Research (COST) has researched different aspects of real property transactions. One of the experiences is that terminology plays an important role and scientific investigation within a field where terminology is confused or not comparable is extremely difficult.⁸

⁴ An early example is the Swedish Real Property Register. A report stated almost 50 years ago that the aim of digitalisation was to “be fitting the separate registers into a uniform flexible net of information systems” (SOU, 1966, p. 310).

⁵ International Federation of Surveyors.

⁶ See www.fig.net, ITC-ESRI (2003), van Oosterom et al. (2004), van Oosterom et al. (2001) and van Oosterom et al. (2011) respectively.

⁷ Ploeger and van Loenen (2004; 2005), Laarakker and Gustafsson (2004). See www.eulis.eu.

⁸ Zevenbergen, Frank and Stubkjær (2007, pp. 18-20).

Another initiative to describe and compare cadastral information is the guidelines for real property identifiers produced by the United Nations Economic Commission for Europe, UNECE.⁹ The guidelines aim at supporting effective national land administration.

The directive on Infrastructure for Spatial Information in the European Community (INSPIRE) is demanding the creation of data specifications for exchanging digital information on a large number of spatial data themes in Europe.¹⁰ One of the themes is cadastral parcels.¹¹ The directive does, however, only require geometrical, not legal, cadastral information to be exchanged, but I think the directive indicates a growing international awareness towards the exchange of cadastral information (on a European level).

The Core Cadastral Domain Model is an initiative to further international understanding and exchange of cadastral information.¹² The model aims at creating a standardized terminological framework for creating cross-border information services, where semantics have to be shared between countries in order to enable translations of real property terms. The model has been submitted to ISO (International Organization for Standardization) for being further developed into an international standard for land administration, the Land Administration Domain Model, LADM.¹³ The LADM is scheduled to become an international standard in July 2012.

A common nominator for the initiatives listed here is that they in my opinion indicate the need for standardized terminology as basis for any effective exchange of cadastral information. The research presented in this thesis is a contribution to the development of such a standardized terminological framework.

2 Research structure

The research was conducted by publishing journal articles and a report, which are summarised and discussed in this summary as paper 1-6. Paper 1, 2, 3 and 5 are articles published in peer-reviewed journals. Paper 4 is a report published at KTH. Paper 6 is an article submitted for review to a peer-reviewed journal. An overview of the research structure is shown in figure 1.

⁹ UNECE (2004).

¹⁰ INSPIRE (2007).

¹¹ INSPIRE (2010a).

¹² van Oosterom et al. (2006).

¹³ ISO (2011).

Rights and regulations can be classified according to a number of characteristics, e.g. their spatial expansion, the value or type of the land they cover, etc. However, underneath all these geometrical, financial and other attributes real property rights and public regulations are legal instruments, regulating the use of real property. I have therefore chosen to base my research on legal comparison and terminology. Bogdan¹⁴ states that any comparison must be based on common issues in the legal systems subject for comparison. Legal rules cannot be compared word by word. The contexts of the rules have to be compared, since they constitute the basis for any legal activity. Bogdan also argues that a comparison must be of a certain value and we must be cautious not to make too simple comparisons. Regardless of any method of comparison, it is not enough to merely compare legal systems.

The first phase of the research is presented in paper 1, containing an investigation of the state of the art of research in cadastral modelling in order to isolate a problem to investigate. A research hypothesis was established stating that it is possible to categorize real property rights and public regulations influencing real property ownership, regardless of their origin in different legal systems.

Paper 2 added a theoretical dimension to the descriptions of the Legal Cadastral Domain Model by giving an introduction to conceptual legal modelling and developing the models terminology.

The model was thereafter in paper 3 and 4 tested in case studies on real property rights and public regulations in national legislations. The analysis in paper 4 revealed some inconsistencies in the real property right part of the Legal Cadastral Domain Model, which is updated in the paper.

3D property was subject of a terminological study in paper 5. The analysis of the concept(s) of 3D property does not fit directly into the development of the Legal Cadastral Domain Model, but is an attempt to discuss terminology of a specialised part of the cadastral domain on an international level.

The theory building for the public regulation part in the Legal Cadastral Domain Model in paper 1 and 2 is not as developed as the real property rights part. This inconsistency has been noted in paper 6, where a theoretical approach to the development of the public regulation classes is presented. The result is an extended version of that part of the model.

¹⁴ Bogdan (2004).

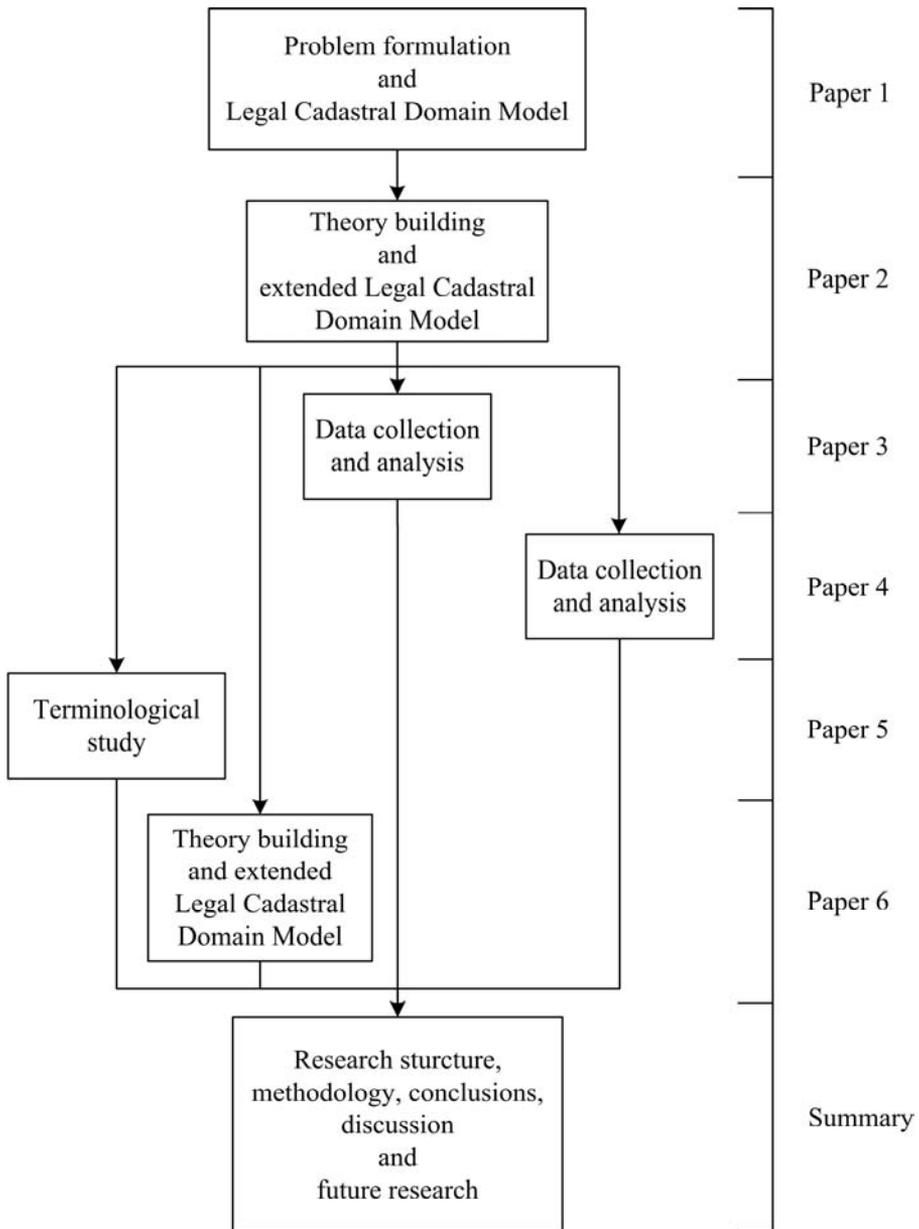


Figure 1. Research structure.

3 Research methodology

The research methodologies are described for each paper below. An overview of the design, data collection and validation methods for each paper is shown in table 1.

Paper 1

Paasch, J. M. (2005). **Legal Cadastral Domain Model - An object-orientated approach**

The research was conducted using qualitative research methods; literature studies, studies in Swedish real property legislation and supplemented with my own experience in the field of cadastral modelling, gained from participating in projects modelling Swedish real property rights and public regulations at Lantmäteriet.¹⁵ Swedish real property rights and public regulations are used to exemplify this first, preliminary version of the Legal Cadastral Domain Model.

Paper 2

Paasch, J. M. (2008). **Standardization within the Legal Domain: A Terminological Approach**

The research was conducted using a qualitative research method; literature survey in the fields of comparative law, legal history and terminology functioned as theoretical departure for the paper. International standards on terminology were used as basis for the development of the terminology of the Legal Cadastral Domain Model. The result is an expanded research hypothesis containing the characteristics, definitions, etc. for the model.

Paper 3

Hespanha, J., Jardim, M., Paasch, J. and Zevenbergen, J., (2009). **Modelling Legal and Administrative Cadastral Domain: Implementing into the Portuguese Legal Framework**

The article is co-authored with prof. adjunto J. Hespanha, Dr. M. Jardim and prof. Dr. J. Zevenbergen. Prof. Hespanha took the initiative to the article by approaching me after my presentation of my initial theories at the Standardi-

¹⁵ Paasch (2004a; 2004b).

zation in the Cadastral Domain Workshop in 2004.¹⁶

The research was conducted using a triangulation of qualitative research methods; research in legislation, literature research and discussions among the co-authors. Studies in Portuguese legislation and associated (Portuguese language) literature were conducted by prof. Hespanha and Dr. Jardim. Prof. Zevenbergen and I contributed with the application of our respective classification models and theoretical input on cadastral modelling.

An early draft version of the Land Administration Domain Model, LADM,¹⁷ was used as a conceptual base for the study.

All authors participated in the discussions, analysis and formulation of the results. Communication was done by e-mail. The participation of four authors is to be seen as both expert interviews and validation, since each author contributed to the result by applying his/her special knowledge and by participating in the discussions, analysis and formulation of the results.

Paper 4

Paasch, J. M. (2011). Classification of real property rights - A Comparative Study of Real Property Rights in Germany, Ireland, the Netherlands and Sweden

The research was conducted using a triangulation of qualitative research methods; research in the selected countries legislations supplemented with literature research and interviews with national experts.

The investigated legislations are all European, but have nonetheless been judged as being suitable as input for a first validation of the Legal Model. The reason for choosing European legislations is that much non-European legislation historically is based on or influenced by European legislations, which principles spread to other parts of the world due to e.g. the European colonisation initiatives in the past.¹⁸

The legislations were studied in their national languages, except Dutch, where English translations were used, when available. The interviews with the national experts functioned as quality assurance to verify my understanding of the legislation and associated literature. A problem when conducting

¹⁶ Paasch (2004c).

¹⁷ ISO (2008).

¹⁸ Zweigert and Kötz (1998).

expert interviews is to identify the “right” experts.¹⁹ The experts were chosen based on their expertise in the field of real property rights. They were either known to me through my international work at Lantmäteriet, recommended by my supervisors or Lantmäteriet, or identified by approaching public agencies in the studied countries.

The interviewees received information about my research before the interviews. The interviews were conducted in person or by e-mail. The interviews with the German experts were conducted by e-mail. The Irish expert was interviewed during a study visit in Dublin in 2009. The Dutch experts were interviewed during a study visit in Delft, which resulted in a report.²⁰ The report served as a basis for the Dutch case study. The Swedish expert was interviewed in person. All findings were followed up and validated through either extra personal meetings and/or e-mail communication.

I did not find it necessary to ask the experts to fill in questionnaires, but chose to use a direct interview approach. A questionnaire may limit the answers to the capacity of the interviewer, thus risking to “miss” important information otherwise provided by the expert. The national experts reviewed a draft of the parts of paper 4 containing their input before publication and/or were asked to confirm my interpretation of their answers by e-mail.

Paper 5

Paasch, J. M. and Paulsson, J. (2011). **Terminological Aspects Concerning Three-dimensional Real Property**

The article is co-authored with Dr. Jenny Paulsson.

The research is conducted using qualitative research methods; literature research and discussions among the co-authors. The co-operation of two authors is to be seen as both expert interviews and validation, since each author contributed to the result and participated in the discussions, analysis and formulation of the results by applying their special knowledge.

¹⁹ Flick (1998).

²⁰ Paasch (2005).

Paper 6

Paasch, J. M. (2012). *Modelling of Public Regulations. A Theoretical Approach*

The research is conducted using qualitative research methods; literature studies on a theoretical approach to analyse the basic functions of real property ownership and public regulations.

The use of Swedish public regulations as examples is not to be seen as a case study, but as a mean to exemplify the presented theory of the still preliminary version of this part of the Legal Cadastral Domain Model.

The model has to be subject for further analysis in different legal systems, which is outside the scope of this thesis.

Table 1. Design, data collection and validation methods used in paper 1-6.

Paper	Design	Data collection	Validation method
Paper 1	Qualitative	National legislation Literature research Author's experience	Literature comparison
Paper 2	Qualitative	Literature research	Literature comparison
Paper 3	Qualitative	Case study National legislation Literature research Input from co-authors	Literature comparison Discussions among co-authors
Paper 4	Qualitative	Case studies National legislation Literature research Expert interviews	Literature comparison Expert interviews
Paper 5	Qualitative	Literature research Input from co-authors	Literature comparison Discussions among co-authors
Paper 6	Qualitative	Literature research National legislation	Literature comparison

4 Presentation of papers

Paper 1

Paasch, J. M. (2005). **Legal Cadastral Domain Model - An object-orientated approach**

The article is published in *Nordic Journal of Surveying and Real Estate Research*. 2005, volume 2, number 1, pp. 117-136.

The scope is to develop (a preliminary version of) the Legal Cadastral Domain Model.

The model serves as a hypothesis, stating that it is possible to classify real property rights and public regulations regardless of their origin in different legal systems. Such classification would further an international comparison and exchange of cadastral information. The model is general and focuses on relations of real property rights and public regulations with the right of ownership. The right of ownership is in the hypothesis seen as the central right, being benefitted or restricted by other rights.

The development of the model begins with an introduction to cadastral modelling and continues with the construction of a preliminary model. Real property rights and regulations can be either beneficial or limiting to the real property owners' use of his²¹ property. The model is exemplified with Swedish real property rights and public restrictions regulating ownership. The Legal Cadastral Domain Model consists of two parts: A diagram showing the connections between the included categories and textual descriptions defining the content of the categories. The diagram is developed in this paper and based on a preliminary analysis of Swedish real property rights and public regulations. The definitions and descriptions are developed in article 2.

²¹ "His"/"he" is hereafter used as a synonym for "her"/"she" throughout this summary.

Paper 2

Paasch, J. M. (2008). *Standardization within the Legal Domain: A Terminological Approach*

The article is published in Doganoglu, T., Holler, M. J. and Tiedeman, J. (eds.) *EURAS Yearbook of Standardization*. 2008, volume 6, pp. 105-130. On-line publication.

The scope is to develop the terminology for the Legal Cadastral Domain Model presented in paper 1.

The article starts with an account on historical initiatives aiming at introducing standardized terminological frameworks to legal domain. The article then presents a terminological approach for describing and defining objects. The focus is then shifted towards the development of a legal terminology for the Legal Cadastral Domain Model.

The intention is that the model's terminological framework does not interfere with the different legal systems in existence, but create a standardized terminology for classification of real property rights and public regulations.

Paper 3

Hespanha, J., Jardim, M., Paasch, J. and Zevenbergen, J., (2009). *Modelling Legal and Administrative Cadastral Domain: Implementing into the Portuguese Legal Framework*

The article is published in *Journal of Comparative Law*. 2009, vol. 4, issue 1, pp. 140-169.

The scope is to compare the Legal Cadastral Domain Model with a model published by prof. Zevenbergen.²² Both models were applied on the Portuguese cadastral domain legislation.

The research identifies some differences between models. The article states that “[t]he main difference between the Paasch and Zevenbergen classifications of real rights relate to the legal doctrinal base. Zevenbergen's classification is built on the tradition of civil codes throughout Western and Southern Europe rooted in Roman law. Paasch's classification is more functional and should be able to fit the set of rights, restrictions and responsibilities regar-

²² Zevenbergen (2004).

ding land in any legal system of the world, but in a way that challenges the average expert of the legal system through the use of unfamiliar “neutral” terminology. In the Portuguese implementation presented here, Zevenbergen’s classification fitted better, but for a generic LADM the classification by Paasch should be more appropriate.”²³

The article is the result of discussions among the co-authors and e.g. “the class diagram in Figure 2 was obtained after lengthy discussions between the co-authors and should be regarded as a best fit and not a unanimously agreed result.”²⁴

Paper 4

Paasch, J. M. (2011). **Classification of Real Property Rights - A Comparative Study of Real Property Rights in Germany, Ireland, the Netherlands and Sweden**

The study is published as a report at KTH. TRITA-FOB Report 2011:1.

The scope is through case studies on real property rights in Germany, Ireland, the Netherlands and Sweden to test whether it is possible to classify national rights according to the Legal Cadastral Domain Model and thereby confirm, reject or further develop the model.

The case studies resulted in minor modifications to make the model capable of describing all investigated rights in the four countries. The case studies also showed that some terms used in the model are not consistent with their general (English) use in the cadastral domain. The report also proposes some changes in the terminology to make the model more clear and accessible.

Paper 5

Paasch, J. M. and Paulsson, J. (2011). **Terminological Aspects Concerning Three-dimensional Real Property**

The article is published in *Nordic Journal of Surveying and Real Estate Research*. 2011, volume 8, number 1, pp. 81-97.

The scope is to discuss terminological aspects concerning definitions of 3D

²³ Paper 3 in this thesis (pp. 168-169).

²⁴ Paper 3 in this thesis (p. 168).

real property. The selection of 3D definitions is based on Dr. Paulsson's research on 3D property rights.

The paper does not present a solution of how to develop and maintain a 3D terminology, but discusses existing definitions and point at the terminological aspects of creating a 3D real property definition. The paper highlight an existing definition stating that 3D property is legally delimited both vertically and horizontally, i.e. focussing on the legal aspects of real property. The paper is an input for further research regarding the nature and structures of 3D property.

Paper 6

Paasch, J. M. (2012). **Modelling of Public Regulations. A Theoretical Approach**

The article has been submitted for peer-review to *Nordic Journal of Surveying and Real Estate Research* in May this year.

The scope is to develop the public regulation part of the Legal Cadastral Domain Model presented in paper 1 and 2. The article analyses the concepts of regulations according to how they regulate the use of land and influence real property ownership.

The result is a more detailed version of the public regulations part of the model, classifying regulations into prohibitions, obligations or advantages influencing the ownership right to real property.

5 Conclusions

The research presented in paper 1, 2, 3, 4 and 6 in this thesis show the development of the Legal Cadastral Domain Model.

History has shown that earlier attempts have been made to describe the legal domain. These attempts have failed due to too ambitious plans to describe "everything".²⁵ The research presented in this thesis show that it is seems possible to describe a limited part of the legal domain and create a standardized, terminological framework for exchange of real property rights and public regulations regardless of the legal systems they are created in.

²⁵ See paper 2 in this thesis for references.

Paper 3 states that the model may be difficult to access due to its use of an unfamiliar, neutral terminology not based on any legal system. It is however concluded that the model is suitable for a generic classification of real property rights and public regulations.

The model is further developed in paper 4 and show that the model seems to be suitable for classifying real property rights. At least rights and restrictions in western legal systems which were subject for the case studies in paper 3 and 4. The model did however have to be slightly modified to encompass all encountered real property rights in the four analysed legislations.

Paper 5 does not directly contribute to the development of the Legal Cadastral Domain Model, but discusses existing definitions and point at the terminological aspects of creating a 3D real property definition. The paper however contributes indirectly to the development of the model by illustrating the importance of terminology in legal, cadastral research.

The public regulation part of the Legal Cadastral Domain Model has been further developed in paper 6. The part is however only based on Swedish legislations and has to be regarded as a preliminary model in need of further testing in other legal systems.

An important aspect of the Legal Cadastral Domain Model is the attempt to abolish specific terms rooted in a nation's legal tradition when communicating internationally. They have no place in a standardized legal model functioning as a terminological framework and system for classification. However, the model does not recommend any change of national terminology. National terms should remain in use in national legislations. This research does not indicate otherwise. The proposed model is not a judgement against other legal classifications such as Common Law and Civil Law, but an attempt to further the international exchange of information belonging to the cadastral domain.

The result of my research is the updated Legal Cadastral Domain Model shown in figure 2. The definitions of the classes are listed in appendix 1.

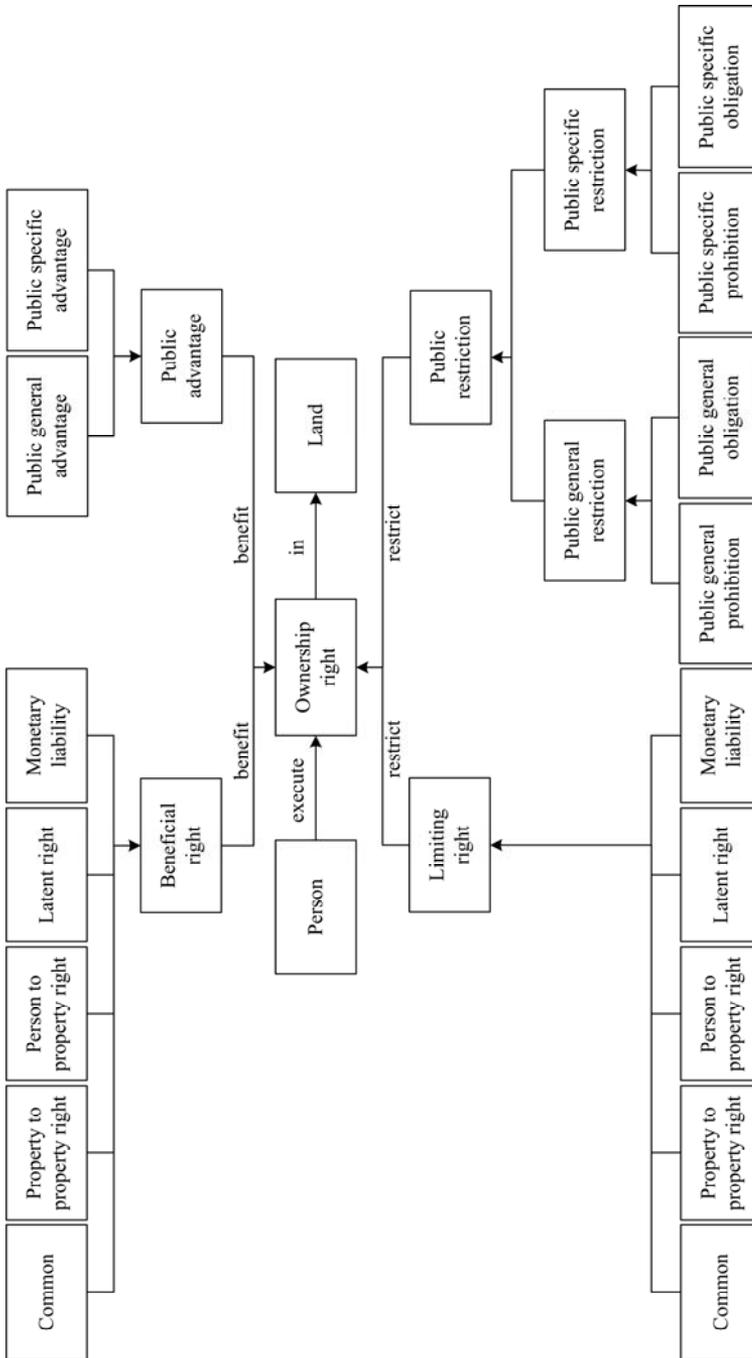


Figure 2. The Legal Cadastral Domain Model.

6 Discussion

The Legal Cadastral Domain Model seems to be suitable for classifying real property rights and public regulations. There are however some issues to be addressed.

The classification in the real property rights part of the model is for the *Common*, *Property to property right* and *Person to property right* classes based on *who* is executing the relation to real property ownership, i.e. if a real property owned by another real property, a property to property relation or a person to property relation. The *Monetary liability* class is based on *what* the relation consist of, i.e. an economical content and not who is executing the relation. The *Latent right* class is based on a temporal condition stating that the rights are not executed yet.

A deeper analysis of who is influencing real property ownership has not been conducted. The rights are only “mirrored” in the model depending on their positive or negative influence on real property ownership, i.e. if the rights are beneficial or encumbering to real property ownership.

The public regulation classes are, however, based on how they influence real property ownership, i.e. what actions are prohibited, obligatory or voluntary to perform on a real property by the owner.

I was aware of these conceptual differences when writing paper 6, but my initial attempts to classify the public regulation classes according to who was executing the regulations did not succeed. It would limit the model to how public administration is structured into administrative units (e.g. municipalities, counties, etc.) and not what type of relation the regulation executes.²⁶

The model is therefore not homogenous in describing the nature of the relations influencing real property ownership. It may be argued that the model would benefit from being consistent in the structure of the relations influencing real property ownership. However, that would involve competence in e.g. organisational and management theory to investigate if the model could be changed to describe either *who* is influencing ownership, *what* does the influence consist of or *how* is real property ownership influenced.

²⁶ A classification of administrative units already exists, at least within the European Union. The classification is based on an existing classification of territorial units for statistics. See INSPIRE (2010b, annex B).

Paper 1 uses the term public restrictions as a general term for public regulations. This is however not correct since restrictions are part of public regulations. This terminological inconsistency has been corrected in paper 6.

7 Future research

The validation of the Legal Cadastral Domain Model has so far been conducted by testing the model on Western legal systems. It is therefore not possible to determine whether the model is suitable for classifying real property rights and public regulations not covered in the case studies, even if they are judged as sufficient for validating this version of the model. Research in non-Western legal systems is therefore needed to further test and develop the model.

There are other research issues which could further develop the model in the future, e.g.:

The model describes the “highest level” of rights and public regulations, i.e. without any deeper specialisation. Further research could aim at expanding the model by e.g. adding sub-classes to specialise the rights extension in time or if the rights or regulations are covering the entire real property or part(s) of it. It would also be of interest to analyse the financial content(s) of rights belonging to the *Monetary liability* class to investigate if they contain structures which could be used for further specialisation of the class.

The case studies in paper 3 and 4 focus on formal rights, whereas so-called informal rights have not been discussed. Informal rights are important in developing countries as an instrument of land management and have gained increased attention in academic circles in recent years.²⁷ Such informal relations should also be incorporated in future research activities.

The case studies in paper 4 have touched upon the concept of rights in rights, which also is an interesting subject for further research.

Another subject for future research activities is to apply the conceptual thinking of the Legal Cadastral Domain Model on existing national registers, i.e. an investigation of the financial, technical and organisational impacts an implementation of the model would have on (re)structuring the content of national registers.

²⁷ E.g. Ubink (2008) and Zevenbergen (2002). See also Lemmen (2010) on the importance of securing social rights in developing countries.

Paper 5 presents a terminological research on three-dimensional (3D) real property. It would be of value for the future development of the Legal Cadastral Domain Model if similar research was conducted on the terminological aspects of the legal components of real property rights and public regulations.

Paper 6 presents a preliminary model of public regulations exemplified with Swedish regulations. It would therefore be of value if this part of the model could be tested on other national legislations to validate, reject or further develop the model.

The research presented in this thesis aims at being in accordance with the Land Administration Domain Model, LADM. I have however chosen not to directly incorporate the LADM in my research, except for paper 3, since the standard is still under development. I hope that my research may be an input to further develop the legal part of the LADM in the future.

8 Svensk sammanfattning (Swedish summary)

Denna avhandling är resultatet av min forskning inom standardisering av markreglerande rättigheter och offentligrättsliga regleringar på Kungliga Tekniska Högskolan, KTH, Stockholm.

Syftet med forskningen har varit att undersöka om det är möjligt att utveckla en modell som möjliggör internationella jämförelser avseende markanknutna rättigheter och offentligrättsliga regleringar som påverkar äganderätten till fast egendom. Modellen som tagits fram benämns *Legal Cadastral Domain Model*.

Avhandlingen består av en sammanfattning (summary) och 6 publikationer, presenterade som paper 1-6 i denna avhandling. Paper 1, 2, 3 och 5 är artiklar publicerade i referentgranskade vetenskapliga tidskrifter. Paper 4 är en rapport publicerad på KTH. Paper 6 är en artikel som har skickats till en vetenskaplig tidskrift för referentgranskning.

Modellen och den därtill hörande teoribildningen är utvecklad i paper 1 och 2. Därefter genomfördes fallstudier med syftet att testa modellen genom att klassificera rättigheter och regleringar i portugisisk lagstiftning, samt rättigheter i tysk, irländsk, nederländsk och svensk lagstiftning. Fallstudierna finns beskrivna i paper 3 och 4.

I paper 3 jämförs min modell med en annan konceptuell modell för klassificering av rättigheter och regleringar som bygger på annorlunda principer. Resultat är att båda modellerna är användbara, men min modell kan vara krävande att ta till sig eftersom den inte är baserad på redan etablerade termer inom juridiken. Det verkar å andra sidan som om min modell har större potential som utgångspunkt för en ”neutral” klassificering av rättigheter och regleringar, oberoende av rättsliga system.

Resultatet från fallstudierna i paper 4 visar att modellen kan användas för klassificering av existerande rättigheter och regleringar, med undantag av några enstaka rättigheter som inte uppfyllde alla krav för inplacering i rättighetsgrupperna. Analysen är redovisad i paper 4. Modellen har därför modifierats för att kunna klassificera alla rättigheter som påträffats vid undersökningen. Dessutom visade det sig att några engelska termer inte var lämpliga att använda för att beskriva markanknutna rättigheter. Även dessa har uppdaterats i paper 4.

Paper 5 innehåller en terminologisk analys av begrepp som används internationellt för tredimensionell (3D) fastighetsindelning.

Paper 6 innehåller en analys av det konceptuella innehållet i offentlighetsrättsliga regleringar rörande markanvändning. Resultatet används för att vidareutveckla den del av modellen i paper 1 och 2 som beskriver offentlighetsrättsliga regleringar.

Forskningsprojektet har visat att det är möjligt att strukturera en begränsad del av ett rättsligt område, och att konstruera en neutral modell för att klassificera markanknutna rättigheter och offentlighetsrättsliga regleringar, oberoende av vilka (västeuropeiska) rättsliga system de skapats i. Modellen behöver testas på andra rättsliga system för att säkerställa att den kan tillämpas på global nivå. Modellens grafiska del kan ses i figur 2 i avsnitt 5. Definitionerna av klasserna som ingår i modellen finns i appendix 1.

9 References

Bogdan, M. (2004). On the Value and Method of Rule-Comparison in Comparative Law. In *Festschrift für Erik Jayme* (pp. 1233-1242). European Law Publishers, Munich. 2004.

INSPIRE (2007). Directive 2007/2/EC of the European Parliament and of the Council of 14 March 2007 establishing an Infrastructure for Spatial Information in the European Community (INSPIRE) 14.03.2007. In *Official Journal*

of the European Union L 108/1.

INSPIRE (2010a). *D2.8.1.6 INSPIRE Data Specification on Cadastral Parcels – Guidelines*. INSPIRE Thematic Working Group Cadastral Parcels. European Union. Version 3.0.1. 2010-04-26

INSPIRE (2010b). *D2.8.1.4 INSPIRE Data Specification on Administrative Units – Guidelines*. INSPIRE Thematic Working Group Administrative Units. European Union. Version 3.0.1. 2010-04-26.

ISO (2008). *Working Draft 19152. Geographic Information - Land Administration Domain Model (LADM)*. Draft International Standard. Lysaker, Norway. International Organization for Standardization (ISO). ISO/TC 211 Sekretariat, Standards Norway. Non-public document.

ISO (2011). *ISO/DIS 19152. Geographic Information - Land Administration Domain Model (LADM)*. Draft International Standard. Lysaker, Norway. International Organization for Standardization (ISO). ISO/TC 211 Sekretariat, Standards Norway. Non-public document.

ITC-ESRI (2003). *Proceedings of the Workshop on Cadastral Data Modelling*. March 17-18 2003. ITC, Enschede, the Netherlands.

Laarakker, P. and Gustafsson, S. (2004). European Land Information Service (EULIS). In van Loenen, B. and Kock, B. (eds.). *Spatial Data Infrastructure and Policy Development in Europe and the United States*. 2004, pp. 47-58. Delft University Press, the Netherlands.

Lemmen, C. (2010). *The Social Tenure Domain Model. A Pro-Poor Land Tool*. FIG publication no. 52. The International Federation of Surveyors (FIG), Copenhagen. 2010.

Flick, U. (1998). *An Introduction to Qualitative Research*. 4th ed. 2009. Sage Publications, London.

van Oosterom, P., Stoter, J.E. and Fendel, E.M. (2001) (eds.). *Proceedings Registration of Properties in Strata –International Workshop on “3D Cadastres”*. 2001. Delft, the Netherlands.

van Oosterom, P., Schlieder, C., Zevenbergen, J., Hess, C. and Lemmen, C., Fendel, E. (2004) (eds.). *Proceedings of the Standardization in the Cadastral Domain Workshop*. 9-10 December 2004, Bamberg, Germany. 2nd ed. 2006. International Federation of Surveyors, Copenhagen.

van Oosterom, P., Lemmen, C., Ingvarsson, P., van der Molen, P., Ploeger, H., Quack, C., Stoter, J. and Zevenbergen, J. (2006). The Core Cadastral Domain Model. In *Computers, Environment and Urban Systems*, vol. 30, no. 5, 2006 (pp. 627-660). Elsevier, Amsterdam.

van Oosterom, P., Fendel, E., Stoter, J. and Streilein, A. (2011) (eds.). *Proceedings of the 2nd International Workshop on 3D Cadastres*. 16-18 November 2011, Delft, the Netherlands. International Federation of Surveyors (FIG), Copenhagen.

Paasch, J. M. (2004a). A Cadastral Domain Model. In *Proceedings of the 12th International Conference on Geoinformatics*, 7-9 June 2004 (pp. 820-823). University of Gävle, Sweden.

Paasch, J. M. (2004b) Modelling the Cadastral Domain. In *Proceedings of the 10th EC-GI Workshop*, Warsaw, Poland, 23-25 June 2004 (pp. 31-32). European Union, Joint Research Centre.

Paasch, J. M. (2004c). A Legal Cadastral Domain Model. In *Proceedings of the "Standardization in the Cadastral Domain" Workshop*, Bamberg, Germany, 9-10 December 2004. 2nd ed. 2006 (pp. 145-148). International Federation of Surveyors (FIG), Copenhagen.

Paasch, J. M. (2005). *Modelling Dutch Rights and Restrictions for Real Property Transactions. Short Term Scientific Mission at Delft University of Technology, the Netherlands*. October 2-7 2005. Report, COST, Action G9. Reference number COST-STSM-G9-1613.

Ploeger, H. and van Loenen, B., (2004). EULIS – At the Beginning of the Road to Harmonization of Land Registry in Europe. In *European Review of Private Law*, vol. 3, 2004 (pp. 379-389).

Ploeger, H. and van Loenen, B. (2005). Harmonization of Land Registry in Europe. In *Proceedings of the FIG Working Week 2005 and 8th International Conference on the Global Spatial Data Infrastructure (GSDI-8)*, 16-21 April 2005, Cairo, Egypt. International Federation of Surveyors (FIG), Copenhagen.

SOU (1966). *Fastighetsregistrering*. Statens Officiella Utredningar 1966:63. Justitiedepartementet, Stockholm, Sweden. 1966.

Spivak, S. M. and Brenner, F. C. (2001). *Standardization Essentials: Principles and Practice*. Marcel Dekker Inc., New York. 2001.

UNECE (2004). *Guidelines on Real Property Units and Identifiers*. Working Party on Land Administration (WPLA). United Nations Economic Commission for Europe (UNECE). ECE/HBP/135. 2004.

Ubink, J. M. (2008). *In the Land of the Chiefs. Customary Law, Land conflicts, and the Role of the State in Peri-Urban Ghana*. Leiden University Press, the Netherlands. 2008.

Zevenbergen, J. (2002). *Systems of Land Registration. Aspects and Effects*. Delft University of Technology, the Netherlands. 2002.

Zevenbergen, J. (2004). Expanding the Legal/administrative Package of the Cadastral Domain Model – from Grey to Yellow? In *Proceedings of the "Standardization in the Cadastral Domain" Workshop*, Bamberg, Germany, 9-10 December 2004 (pp. 139-144). International Federation of Surveyors (FIG), Copenhagen.

Zevenbergen, J., Frank, A. and Stubkjær, E. (2007). Modelling Real Property Transactions. In Zevenbergen, J., Frank, A. and Stubkjær, E. (eds.) *COST Action G9 Real property transactions. Procedures, transaction costs and models*. IOS Press, Amsterdam. 2007, pp. 3-24.

Zweigert, K. and Kötz, H. (1998). *Introduction to Comparative law*. 3rd. edition. Clarendon Press, Oxford, England. 1998.

Internet sources(All sources were accessed 2012-05-15.)

Paper 2	https://uni.uni-hamburg.de/onTEAM/grafik/1164287680/Paasch.pdf
European Land Information System (EULIS)	www.eulis.eu
International federation of Surveyors (FIG)	www.fig.net
International Organization for Standardization (ISO)	www.iso.org

Appendix 1

Definitions of the classes in the Legal Cadastral Domain Model.

The definitions are arranged according to as they appear in the model in figure 2, describing the beneficial right and public advantage classes, the Person – Ownership – Land relation and the limiting right and public restriction classes. The definitions are taken from paper 2, 4 and 6 in this thesis.

Class name	Definition
Real property right classes beneficial to real property ownership	
<i>Common</i>	Real property to land relation executed in land legally attached to two or more real properties. Owners of the participating real properties execute co-ownership rights in the land at issue (Paper 4, p. 100).
<i>Property to property right</i>	Right executed by the owner of real property in another real property, due to his ownership (Paper 4, p. 108).
<i>Person to property right</i>	Right executed by a person to use, harvest the fruits/material of, rent or lease the real property in whole or in part, including the claim against a person (Paper 4, p. 107).
<i>Latent right</i>	Right not yet executed on a real property (Paper 4, p. 102).
<i>Monetary liability</i>	A latent, financial security for payment (Paper 4, p. 104).
<i>Beneficial right</i>	Right beneficial for the use and enjoyment of real property (Paper 4, p. 99).

Class name	Definition
Public regulation classes beneficial to real property ownership	
<i>Public general advantage</i>	Change in legislation beneficial for certain types of real property at a general level, e.g. properties within urban areas, properties being subject for industrial forestry or properties containing cultural monuments. Beneficial to real property ownership (Paper 6).
<i>Public specific advantage</i>	Publicly granted permission to perform activities for a limited and defined set of real properties, otherwise regulated by a <i>public specific obligation</i> or <i>public specific prohibition</i> , thereby restoring parts of the owners use right (Paper 6).
<i>Public advantage</i>	Publicly imposed action which is beneficial to ownership and use of real property (Paper 2, p. 127).

Class name	Definition
Person – Ownership right – Land classes	
<i>Person</i>	Human or legal person, state, municipality and other private or governmental authority who owns real property according to legislation (Paper 2, p. 123).
<i>Ownership right</i>	Right to own real property according to legislation (Paper 4, p. 105).
<i>Land</i>	Part of Earth which is regulated through ownership. Land is the surface of the Earth and the materials beneath. Note: Water and the air above land might also be considered land in some legislation (Paper 2, p. 124).

Class name	Definition
Real property right classes limiting to real property ownership	
<i>Limiting right</i>	Right limiting the use and enjoyment of real property (Paper 4, p. 103).
<i>Common</i>	Real property to land relation executed in land legally attached to two or more real properties. Owners of the participating real properties execute co-ownership rights in the land at issue (Paper 4, p. 100).
<i>Property to property right</i>	Right executed by the owner of real property in another real property, due to his ownership (Paper 4, p. 108).
<i>Person to property right</i>	Right executed by a person to use, harvest the fruits/material of, rent or lease the real property in whole or in part, including the claim against a person (Paper 4, p. 107).
<i>Latent right</i>	Right not yet executed on a real property (Paper 4, p. 102).
<i>Monetary liability</i>	A latent, financial security for payment (Paper 4, p. 104).

Class name	Definition
Public regulation classes limiting to real property ownership	
<i>Public restriction</i>	Publicly imposed restriction prohibiting or mandating certain activities on real property. Limiting to real property ownership (Paper 6).
<i>Public general restriction</i>	Publicly imposed restriction prohibiting or mandating certain activities on certain types of real property at a general level, e.g. properties within urban areas, properties being subject for industrial forestry or properties containing cultural monuments. Limiting to real property ownership (Paper 6).
<i>Public specific restriction</i>	Publicly imposed restriction on doing certain activities or demanding certain obligations for a limited and defined set of real properties, based on specific legislation. Limiting to real property ownership (Paper 6).
<i>Public general prohibition</i>	Publicly imposed prohibition affecting certain types of real property at a general level, e.g. properties within urban areas, properties being subject for industrial forestry or properties containing cultural monuments. Limiting to real property ownership (Paper 6).
<i>Public general obligation</i>	Publicly imposed restriction demanding certain activities on certain types of real property at a general level, e.g. properties within urban areas, properties being subject for industrial forestry or properties containing cultural monuments. Limiting to real property ownership (Paper 6).
<i>Public specific prohibition</i>	Publicly imposed restriction prohibiting certain activities for a limited and defined set of real properties, not to be performed by the real property owner. Limiting to real property ownership (Paper 6).
<i>Public specific obligation</i>	Publicly imposed restriction demanding certain activities from the real property owner, for a limited and defined set of real properties, based on specific legislation. Limiting to real property ownership (Paper 6).