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Legal Cadastral Domain Model – An Object-oriented Approach

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Abstract. *The different existing definitions of cadastre make a common understanding of the cadastral domain difficult and are a major barrier to effective information interchange and standardisation. A legal approach focussing on the classification of real property rights and restrictions in a legal cadastre model centred on the right of ownership might be a way to improve the common understanding of the cadastral domain and a step towards an improved standardisation of the domain. This article is intended to serve as an introduction to the construction of a model describing a legal cadastral domain.*

Keywords: *cadastre, legal cadastre, legal ontology, legal cadastral domain, standardisation, land register, modelling, object-orientation, land information, real property information.*

1 Introduction

This article is a contribution to the on-going research on cadastral modelling and standardisation. The aim is to produce a description of legal real property information focussing on ownership. The article excludes informal rights and restrictions to land, as they are not a part of the legal framework. Other vital components of the cadastral domain, such as owners and geometrical presentation, are not addressed in detail in this study.

The cadastral domain is a vital component in managing spatial and non-spatial legal real property information. A cadastre must be reliable and up-to-date, otherwise the information systems will use incorrect data and the result will end in disaster due to the incorrect data and inaccurate deductions based on it (Au and

Nittinger 1991, p. 93). That is why the content of the legal cadastral domain needs to be described in order to ensure the correctness of legal aspects regarding rights and restrictions in real property, including rights of ownership. It is a necessity when dealing efficiently with real property and is part of the information that needs to be interchanged in connection with e.g. real property transactions [1].

Theories of the emergence of real property rights as well as general descriptions of current cadastral core models are not the subject of this article, since this is already sufficiently covered by others. For example, theories regarding the emergence of property and real property rights due to social, political and economic factors have been presented during the last decades (e.g. Alchain and Demsetz 1973; Demsetz 1964, 1967; Libecap 1989; Sened 1997; and Umbeck 1981). A general description of property rights and restrictions in relation to physical objects (land) has been presented in a Core Cadastral Domain Model and seems to be known all over the world due to numerous presentations in recent years (Lemmen and Oosterom 2003a; Lemmen and Oosterom 2003b; Lemmen, *et al.* 2003).

This article will instead focus on modelling of ownership rights and restrictions, and granted rights regulating ownership, including both official and privately imposed regulations. The aim is to establish a general categorization and description of rights and restrictions regulating the ownership of real property. The outcome is a basic legal model of the cadastral domain centred on real property ownership.

The model serves as a hypothesis, which enables the categorization of ownership rights and restrictions regardless of their emergence in different legal traditions. A better understanding of the legal aspects of ownership could possibly increase the possibilities of producing standards towards the legal cadastral domain.

The development of the model begins with the construction of a preliminary model, based on a theoretical, legal approach to the legal content of the cadastral domain. This preliminary, theoretical model is then tested and developed by applying it on the rather complex body of Swedish real property legislation with the existence of a variety of different kinds of rights and restrictions regulating ownership.

In order to classify both private and public ownership rights and restrictions in a general, legal cadastral domain model, it is necessary to formulate a definition of the legal cadastral domain to be used within the framework of this article. The definition encloses all formal rights and restrictions connected to the ownership of real property as belonging to the legal cadastral domain.

In this article, the legal cadastral domain is used as a common term for rights and restrictions that build up the content of a traditional cadastre, a multipurpose

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[1] See e.g. Arruñada (2001) and Stubkjær (2003) for an introduction to real property rights and real property transactions.

cadastre and land register storing legal real property information, regardless of any national differentation between these registers. In this way, it is perhaps possible to leave the different and rather confusing definitions of cadastre and land register that have been described and discussed by numerous authors. See e.g. Dale (1976); FIG[2] (1995; 2002); Hawerk (1997); Hegstad (2003); Kaufman and Steudler (1998); Larsson (1991); Silva and Stubkjær (2002); Simpson (1976); Williamson (2001); WPLA (2004); Zevenbergen (2002).

2 Real property rights

If all of mankind has unlimited access to land, we can talk of *open access*. Open access might affect ecological stress on the land if mankind is allowed to do anything in the name of development and economical or personal gain. However, this is luckily seldom the case, since open access only exists in theory, at least if land and water have an economic value.

The opposite to open access is the right of access to an area or piece of land where the right of ownership or use is regulated. We can talk of *limited access*, in contrast to open access. Limited access can be stated by a legal authority that has the legal right to impose such restrictions and transfer them to individual persons, companies (e.g. mining rights), etc. A complete transfer is transfer to ownership rights[3].

Fundamentally, a right entitles one or more persons to use the land while others are excluded from doing so. The land is individualised (Mattsson 2003, p. 23). Ownership rights in real property often differ from other rights in human society and many rights in land are not found in goods. Naturally they also often last longer (Simpson 1976, p. 6). The access to land can also be regulated by means of privately agreed upon rights or officially imposed regulations (Mattsson 2003, 2004).

We can say that rights are a link between the legal owner of the right and the areas of land in question. Focussing on the rights as a link between what is in figure 1 called the Subject and Object has the advantage of bringing the rights in correct relation between the owner and the land. An area of land will nearly always have one or more rights attached to it. Ownership is a very strong right commonly connected with land and is executed by the legal owner (i.e. person), e.g. the government, a company or one or more private individuals, according to the legislation in the country in question. However, it is not the piece of land or the resource itself that is owned, but the rights connected to the use the land or resource (Alchain and Demsetz 1973, p. 17). The different relations between subject and object are illustrated in figure 1.

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[2] The International Federation of Surveyors, see www.fig.net .

[3] Ownership even entails obligations. As the German constitution eloquently puts it: “ownership obliges” [Eigentum verpflichtet], (Grundgesetz für die Bundesrepublik Deutschland , section 14).

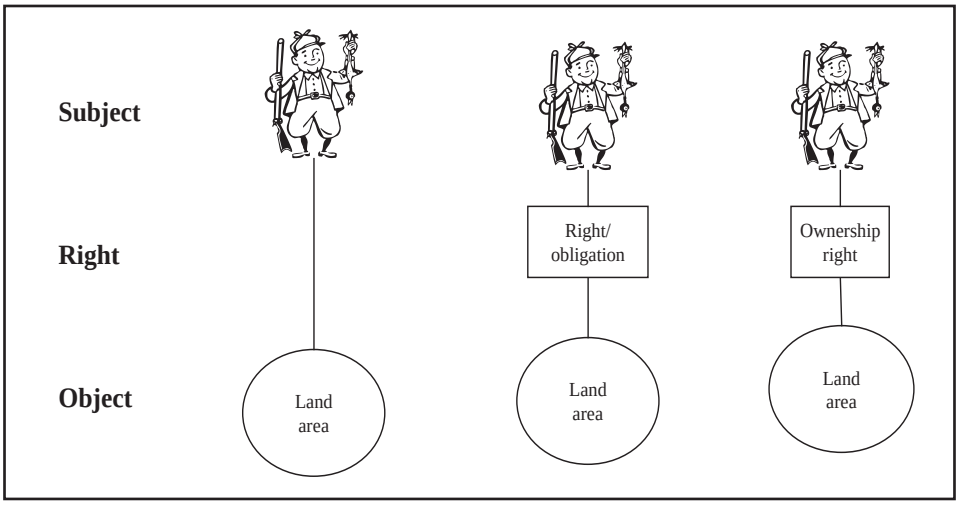

Figure 1. *Theoretical connections between man (subject) and land (object) through rights. 1. Direct connection (open access) 2. Connection through Right/obligation (limited access) and 3. Connection through Ownership right (limited access). (Mattsson 2004).*

There hardly exists any direct connection between subject and object. The connection is most often through a right. Bearing that in mind, connection no. 1 in figure 1 is probably extremely rare except for cases concerning the open sea. Connection no. 2 is probably more or less always connected with areas of low land values, if maintained within a particular country. It can also be areas with customary rights in many non-western societies. Even if the land is "claimed" by the state, it is not related to the concept of ownership as used in this article. The state, for example, does not claim ownership of the economic zones in the sea, but the use of them can be regulated nonetheless (Mattsson 2004).

Connection no. 1 and 2 in figure 1 are omitted in the following legal discussions concerning the rights associated to real property as they do not focus on the ownership right concept. Connection no. 3 is dominant in legal systems where land is private through ownership rights. This third relationship is what we normally call real property, parcel, freehold, etc. Defining real property is very difficult (see e.g. Zaibert and Smith (2003)) and it is perhaps for our purpose easiest to say as Mattson (2003) that real property is what a national legislation defines as real property. However, in this article, to be able to make a theoretical approach, I use the concept of real property as a *combination* of person, ownership right and land.

As the Core Cadastral Domain Model presented by e.g. Lemmen et al. (2003) is referred to so often in connection with cadastal models, I have to point out some similarities and differences in the terms used in their and my following model. Person is used as a term for the Subject throughout the article and it is also used in the Core Cadastral Domain Model. However, I do not use the terms "RightOrRestriction" and "RealEstateObject" used in the core cadastral domain

model as I see them as being too general when focussing on ownership and separate rights and restrictions in the model developed in this article. “Land” is in my model used instead of “RealEstateObject” as a general term for any physical plot / parcel on the ground / 3D space, buildings / apartments or any other physical entity. “RealEstateObject” has, in my opinion, a too strong relation to real property and does not fit into my definition of real property. “Land” is a more neutral term in this stage of modelling. Of course, the terms might have to be reconsidered if the models are to be amalgamated in the future.

3 Object-oriented legal modelling

Technology has functioned well in the western countries, without the need of special legal or political considerations when implementing new technology because the interaction between the legal apparatus and technology already existed (Hegstad 2003, p. 81). However, the legal apparatus and technology process is not complete without control over the information to be implemented and managed in a technical system. In other words, the information needs to be described or modelled. One way to discuss the legal cadastral domain is to focus on the ownership rights between person and land, described in an object-oriented manner. Such object-oriented modelling is not a new method describing information, but has its roots in system development. Models are originally made to improve the understanding of the complexity of computer systems[4].

The legal information, regardless of its actual representation in a legal document or a title based cadastre or land register, can be modelled by object-oriented methods. The administrative and legal context must in such a case be included in a formal (computer) model (Frank 1996). However, modelling is more than the construction of computer models. The description of formal models includes the description of ontology and description of the legal aspects of the domain in a principal way[5].

Blackwell (2000) calls the use of applying object-oriented analysis and design on legislation for “finally adding method to madness”, and states that

> Once the problem domain has been adequately described, the object-oriented legislative drafter can move into the design phase of the drafting project. In creating a logical solution to the problem based upon the results of the analysis phase, the drafter will begin to create interaction diagrams that illustrate how objects in the resulting statute will interact to fulfill the requirements of the problem domain (Blackwell 2000, p. 283-284).

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4 See e.g. Bubenko and Lindencrona (1984); Eriksson and Penker (1998); and Booch, Rumbaugh and Jacobson (1999) for an introduction to modelling.

5 See e.g. Wahlgren (1992) for an introduction to automation of legal reasoning and e.g. Uschold and Gruninger (1996); Sure (2003) and Uitermark (2003) and Visser and Schlieder (2003) for an introduction to ontology.

Blackwell focuses on the adequate description of the problem domain. An adequate description must be based on communication. It might be needless to say that any successful communication requires a language that is based on common concepts. The description, classification and hierarchy of objects and the difficulties of standardisation must not be underestimated, which also has been adressed by e.g. Molenaar (1991)[6]. Focussing on the legal aspects and constructing a model categorizing ownership is a way of applying ontology principles to the domain and can be a step towards a future standardisation process.

In this article, modelling is not used to give a detailed description of all theoretically possible relations between ownership, persons and land. The concept of modelling is only used to illustrate the most general relations between different rights and restrictions regulating the right of ownership.

The relations between the different parts of the model produced in this article are illustrated using UML[7] (Unified Modelling Language) notations, e.g. "0..*" should be read as "zero-to-many". However, the models are not genuine UML "class diagrams", as they are very simplified. An attempt to illustrate all relations between person, ownership right and land would lead to a very complicated, complex and probably unreadable model (see e.g. Paasch (2004a, 2004b)) and is therefore omitted. Furthermore, object-oriented modelling normally implies that the classes are illustrated with their attributes and functions. The diagrams in this article are shown without any attributes or functions, as including them would also lead to an unnecessary complication of the general model.

4 Legal cadastral domain model

Without a legal basis, it would be very difficult to establish and maintain a cadastre (Au and Nittinger 1991, p. 89). A legal cadastre model must therefore be as general as possible to be able to function as a core model which is expandable to fit the specific needs of a local cadastre. At the same time, it has to contain the main groups of rights and restrictions related to real property ownership.

Ownership of real property is, however, what is defined as ownership in a nation's legal systems. In its simplest form, ownership states that a piece of land is owned by a person. The model in this article is centred on the right of ownership, as ownership is the central right in relation to person and land as seen in connection no. 3 in figure 1.

The model is designed to incorporate the definition of real property used in this article (i.e. the combination of person, ownership right and land) and also personal property related to ownership. From a modelling point of view, at least at this stage, those terms are equivalent to the continental legal terms "immovable property" and "movable property".

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6 Molenaar (1991) is referring to geographical data, but the problem is the same when defining legal or any other information that has to be defined.

7 See *www.uml.org*.

The relations between person, ownership right and land can be described in a conceptual schema (class diagrams), as illustrated in figure 2. This is a a basic model that shall be further developed by introducing other rights and restrictions (see figures 3, 4 and 5). The model will thereafter be developed further by applying Swedish real property legislation. Any alterations in the preliminary model will result in an altered, general cadastral domain model. However, the model needs to be tested on several other national legislations in the future to make it as general and useful as possible.

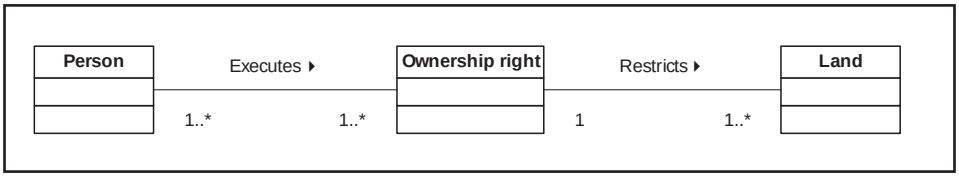

Figure 2. *A real property model describing a relation between person, ownership right and land.*

Figure 2 describes the relation between person, right and land. It is a legal description of the relation between the owner(s) and a piece of land to which a right can be attached. Ownership rights are executed by one or more persons. The relations are illustrated by 1..*, in the model, which is the UML notation for a one-to-many relationship. The *Ownership right* class has a 1..* relation to the *Land* class. Land, in this basic model, cannot exist without any rights since we have abolished open access (connection number 1 in figure 1) from the model. The *Land* class has a 1 ("one") relation to the *Ownership right* class.

The model differs from the Core Cadastral domain Model (see e.g. Lemmen, et. al. 2003) by having the *Ownership right* class between the *Person* and *Land* classes, where the Core Cadastral Domain Model has the *RightOrRestriction* class as an association class between the *Person* and *RealEstateObject* classes. In order to produce a model focussing on ownership rights it is necessary to replace the *RightOrRestriction* class with *Ownership right* class illustrating the different rights and restrictions regulating ownership rights.

Although *Land* is a class in the model in figure 2, the model does not develop the geometrical aspects (size, extension, description through co-ordinates etc.) of legal rights. Modelling of these relations can be studied in Lemmen et al. (2003). It might be argued that the *Land* class could be named e.g. Real Property Unit, but that would not be acceptable in this general model. The composition of real property could be seen as being the unification of real property ownership rights attached to one or more physical entities (*Land*). These rights are "owned" and executed by a *Person*. A piece of land cannot, in a legal cadastral context, exist without any ownership (see connection 3 in figure 1). To describe *Land* as equal to a unit of real property would therefore be a rather simplified approach.

Furthermore, the model does not separate different types of persons, such as

natural and legal. Is in this general model a person defined as an individual human being, a company, an organisation and also government.

Absolute ownership right does not exist in most societies and the ownership concept must be made clearer in the model and assets and restrictions must be imposed. The right of ownership is an asset (for the owner of the real property) and a burden (for all others). Other rights and restrictions can also be seen as assets or burdens in relation to ownership.

The model illustrated in figure 3 is an extension and specialisation of the simplified model described in figure 2. The extended model is still centred around the ownership right and attached with classes that benefit or limit the right of ownership. The *Person* and *Land* classes and their relations have been toned down somewhat in the model in figure 3 and the forthcoming models to illustrate that they are not focused upon in this article. However, any further modelling would have to describe *Person* and *Land* in detail and also show how *Person* and *Land* can have relations to other types of rights and restrictions besides ownership rights.

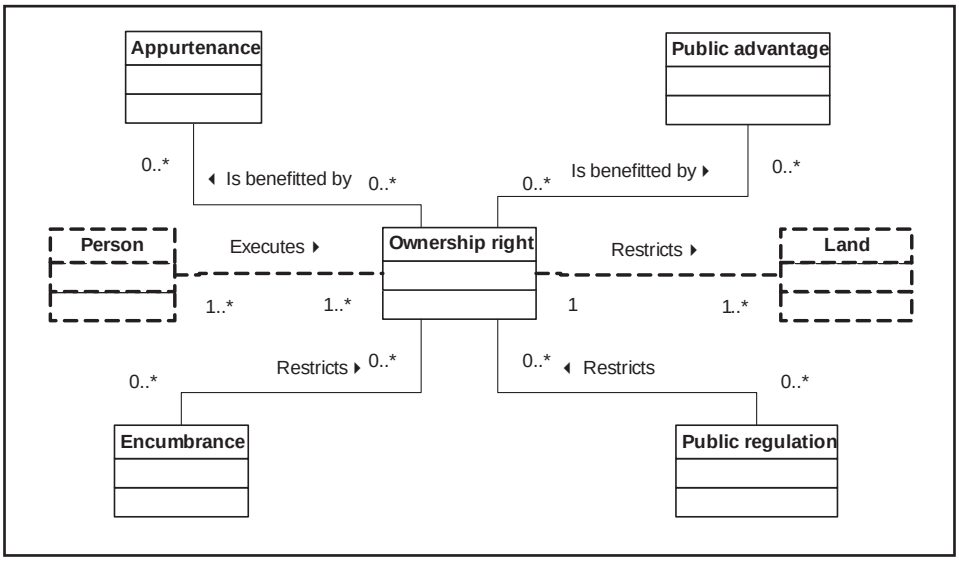

Figure 3. *A basic legal cadastre model focussing on ownership right, describing the relation to the Appurtenance, Encumbrance, Public advantage and Public regulation classes.*

The model in figure 3 is based on the fact that there are certain "rules" (assets or limitations) attached to the Ownership right class from the *Appurtenance*, *Encumbrance*, *Public advantage* or *Public regulation* classes. All classes have relations to the *Ownership right* class, since they are benefiting or limiting the ownership right and thereby, according to the definition used in this paper, regulate the real property as such. The content of these classes are defined below.

Appurtenance[8] (Friedman 1984, p. 21) is a beneficial right and is something outside the property itself, but is considered a part of the property and adds greater enjoyment to it, such as the right to cross another's land (i.e., easement or right of way). It is a privilege or right that regulates the use of another property.

An encumbrance (Gifis 1984, p. 154) is a burden on a title or a charge on property and any right to or interest in land (Friedman 1984, p. 89) that affects the property´s value or use.

A public advantage is a state related right that is beneficial to ownership. It can e.g. be a dispensation from existing planning rules regulating the use of neighbouring real properties.

A public regulation is a burden imposed on ownership by the state or its representative.

If we to take a closer look at the *Appurtenance* and *Encumbrance* classes and extract their content we see that they contain different legal expansions or limitations to ownership as illustrated in figure 4. The figure is a legal categorization of appurtenances and encumbrances and, in this case, the two groups are treated as the opposite of each other. Public advantages and public restrictions will be dealt with in figure 5.

There is a certain logical legal structure in appurtenances and encumbrances and they can be modelled with several classes in common. The model in figure 4 does not only describe the different rights and restrictions regulating ownership rights, but also their legal content. That is why a class seems to appear in" two places" in the model (as specialisation of appurtenances and encumbrances). It might seem redundant to have the same class in "two places" in the model, but the classes might have different attributes (which makes them unique) and, as explained earlier, the class diagrams are intended to give a rather simplified and explanatory introduction to the categorization of rights and restrictions in relation to *Person* and L*and*.

The main classes in figure 4 are called "*Common right*", "*Real property right*", "*Personal right*", "*Latent right*" and "*Lien*". All rights can be an appurtenance or an encumbrance to ownership. However, they do not necessarily have to exist. This is illustrated by the 0..* relations between the *Ownership right* class and the *Appurtenance* and *Encumbrance* classes. A short description of the appurtenances and encumbrances is given below.

In this model, *common right* does not describe the situation where several people own a piece of land together. Instead ownership right executes a common right in land and not the owners. The right belongs to the real property and when

[8] Appurtenance must not be misplaced with "appurtenant" which is a term for something attached to something else. Gifis (1984, p. 26) illustrates appurtenant by referring to it as e.g. a burden, which is attached to land and benefits or burdens the owner of such land in his use of it.

the property is sold, the common right follows the property as it belongs to it, not to the owner[9].

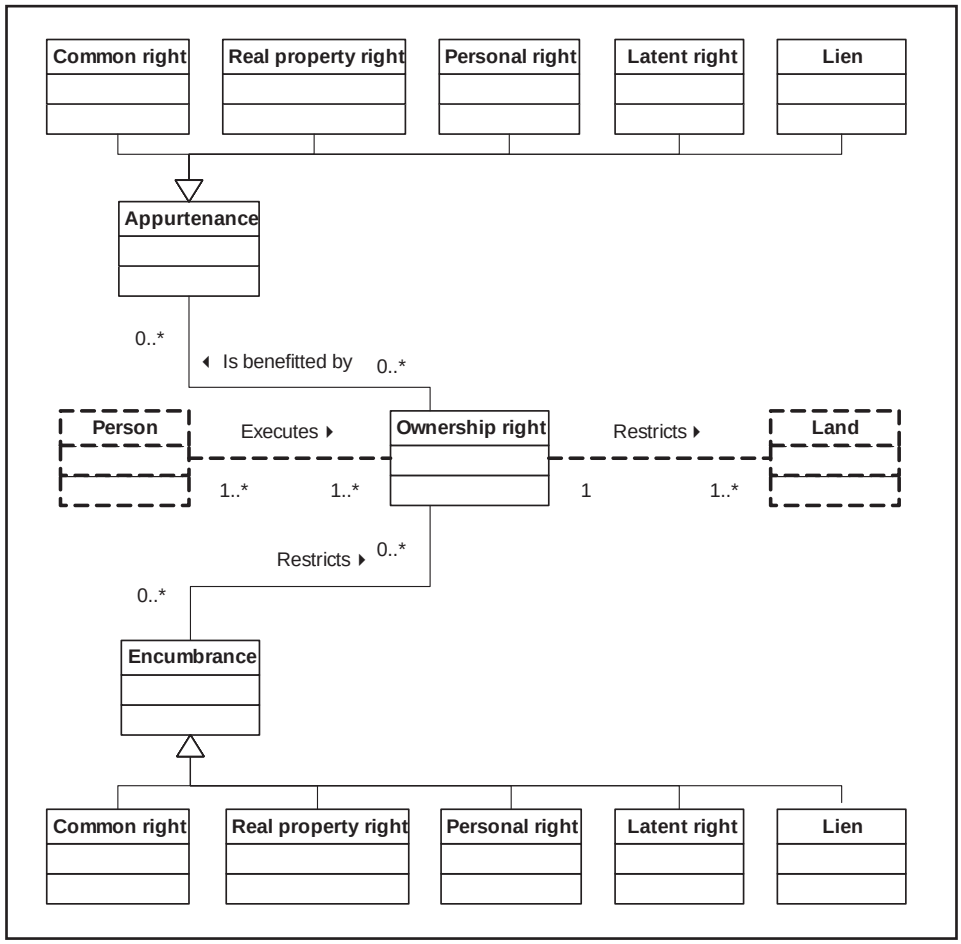

***Figure 4**. Specialisation of appurtenance and encumbrance in the legal cadastral domain model.*

A real property right is a right that can benefit or restrict an ownership right. It is a real property that is related to another real property through this right, e.g. an easement. The right can be specified to be located on the whole property, can be localized to a part of a property or it can be unspecified[10]. Property ownership is of course also a type of real property right, but executed in the real property itself.

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9 It is unclear if there are examples where this land related right can be an encumbrance to ownership.

10 An example of an unspecified right is an easement stating that a property has the right to drill a well on another property, but the actual location of the future well is not described.

A person has the right to limit or expand the ownership right of real property, e.g. for rent or lease, or a person might (in theory) belong to the property as an asset. This is luckily not the case any more, since it would be the same as serfdom! A personal right can be given to a person on a time-limit basis, for the person's lifetime or forever.

A latent right is a right imposed on ownership, but which is not yet executed, e.g. in an expropriation situation where the government has given permission for expropriation, but the expropriating party has not fulfilled the procedure by seeking a court decision for taking possession. Another example is a pre-emption right for a neighbour's property, which can be both an appurtenance and encumbrance to ownership.

Lien is equal to security for payment. Lien is an economical/financial right, which can be executed on real property and thereby regulates the ownership. An example is mortgage, which is a financial security granted by an owner of a real property to a person, normally a bank or another financial institution, to enforce, e.g. the sale of the property if the mortgagee does not fulfil the specified financial obligations. A lien might be seen as a latent right, but is in this general legal model described as a separate class.

Appurtenances and encumbrances are rights that can be a benefit or restriction to ownership. They can be created by private agreement or with help of a decision by an authority or court. However, state imposed regulations can also be a benefit or restriction to ownership. They can be divided into two classes, *Public advantage* and *Public regulation*, as illustrated in figure 5.

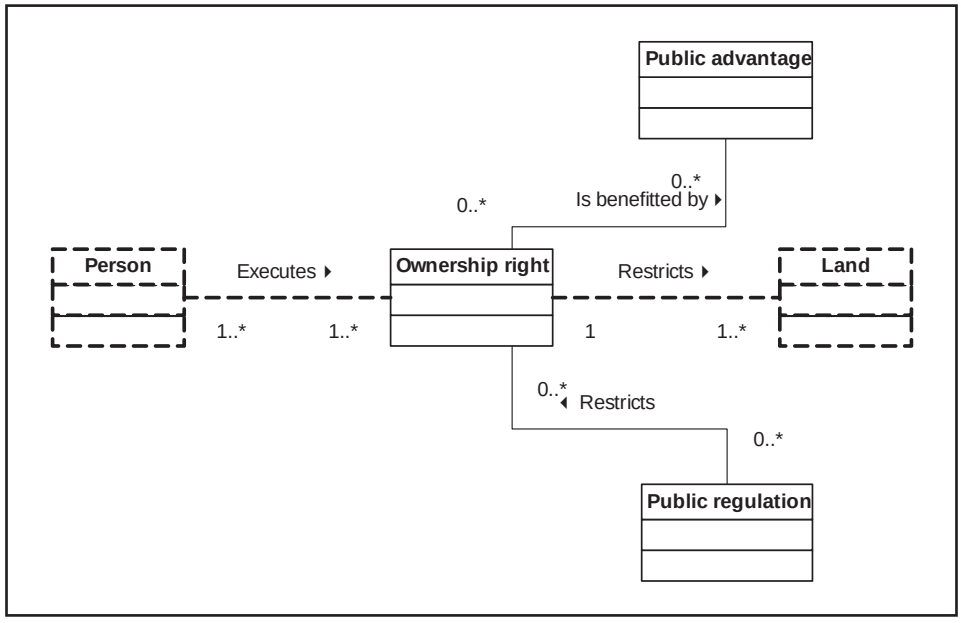

Figure 5. *The Public advantage and Public regulation classes in the legal cadastre model.*

A public advantage is a possible asset to ownership right and a positive result of legally imposed burdens. An ownership right might be benefited by one or more public advantages in form of legislative regulations, but it does not have to be. This is illustrated by a 0..* relation between the *Ownership right* and *Public advantage* classes in figure 5. A regulation might be altered or taken away on one or several parts of real property, by official decision (e.g. granting of a dispensation), benefiting the ownership when compared with the original regulation which is still encumbering the ownership on the neighbouring areas.

The *Public regulation* class contains restrictions which might regulate the ownership right. This is illustrated by a 0..* relation between the *Ownership right* and *Public regulation* classes in figure 5. A public regulation is e.g. a planning regulation of what colour to use when painting buildings in a specific town or area. Regulations can however also be general rules in legislation, regulating the ownership of all existing real properties. This general case is meaningless to cover in the model.

Until this state, the model described above is a theoretical product, even if practical examples have been given. However, the model is of no practical use unless it is tested on real-world real property legislation. In order to finish the modelling process, the model will be exposed to Swedish legislation in the next chapter. At the same time, the author's knowledge is limited to Danish and Swedish law, and therefore the model needs to be tested by others who have their backgrounds in another nation's cadastral legislation.

5 Swedish real property legislation

Swedish ground and water is divided into real properties, which form a geometrical pattern over the country. The ownership of these real properties are benefited or limited by different rights and restrictions, according to a quite large body of acts, statues and regulations. The legislation shall not be analysed in detail, which is beyond the aim of this article, but will be analysed with the classification of rights and restrictions regulating the ownership in mind. The legislation is applied to the suggested classes already described: *Common right*, *Real property right*, *Personal right*, *Latent right*, *Lien*, *Public advantage* and *Public regulation* as illustrated in figure 4 and 5.

Common rights exist in Swedish legislation in the form of a common property unit (*samfällighet*), where several real properties own a share in the common property unit[11]. The common right is in this case land or water solely

[11] Common properties are called "common-pool resources" by Ostrom (1990, p. 30) and refer to a natural or manmade recourse system organised to exclude potential beneficiaries from obtaining benefits from its use. The Swedish common property unit equals the British "commons", which are areas of open land in England or Wales over which adjacent owners and occupiers have certain rights in common (Isaacs and Monk 1986, p.110). It must be noted that the Swedish common property term is not exactly the same as the British term "common areas", which describes areas of a property that are used by all owners or tenants (Friedman 1984, p. 52) and Gifis (1984, p. 80). Lemmen et al. (2003) use the term "ServingParcel" for a commonly hold area.

owned by other properties, which can e.g. use it for grazing domestic animals or extracting natural resources, like timber or fish. If one of the shareholder properties is sold, the share in the common ownership right in the common real property unit automatically follows with the sale.

In Sweden, real property does not have to be directly attached to a piece of land[12], as it is sufficient with an ownership share in a common property unit[13]. The 1..* relation between *Ownership right* towards *Land* in the general model in figure 3 can therefore be changed to a 0..* relationship, which states that an ownership right might be attached to land, but does not have to, because real property can exist without any physical extension. Instead, the owner (i.e. person) is connected with a common right to a piece of land via the ownership right. This is illustrated in the final version of the model in figure 6 in the next chapter. Furthermore, common real property units have a physical extension on the ground, but do not execute any ownership rights of their own in the Swedish legal system, as the rights are executed by the "shareholders". The 1 relation from *Land* towards *Ownership right* must therefore be changed to a 0..1 relation. The changes are illustrated in figure 6. It must be noted that this scenario has nothing in common with connection no. 1 and 2 in figure 1. The ownership right is still the link between person and land.

A common right is not seen as an encumbrance to ownership in the Swedish legal system and is therefore toned down somewhat in the model in figure 6.

Real property rights are e.g. easements *(servitut)* according to Swedish legislation. An easement is a right for the owner via ownership of one dominant property to use or restrict use (i.e. the ownership) of another servant real property.

Another important example is joint facility (*gemensamhetsanläggning*), which is estalished through an official decision. A joint facility can for example be a private road, bathing jetty or a parking area where owners via ownership of several properties have a mutual interest in using or maintaining the facility. If the property is sold, the share in the joint facility follows automatically with the sale.

The nature of joint facilities makes them a hybrid between common right and real property right. The physical space for the joint facility is granted in one or several properties like an easement. A joint facility can therefore be classified as a real property right in the model.

Other rights that can be characterized as *personal rights* regulating ownership. The most dominant rights are Right of User *(nyttjanderätt)* and Utility Easement (*ledningsrätt*). Another, for Sweden rather uncommon right, is Profit à prendre (*avkomsträtt*).

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[12] Physical objects with no relation to land which can be mortgaged (e.g. boats and airplanes) are not covered in this model as they are not part of the definition of real property used in this article.

[13] A so-called shared property (andelsfastighet) does not have any physical extension of its own, but has a share in a common property. Nevertheless, a shared property is treated as a separate property.

Right of User is a personal right granted by private agreement by the owner(s) of real property to a person and regulates the ownership right via a legitimate interest. It is a right for someone other than the holder of the ownership right to obtain access to and use of real property (i.e. limit the ownership right) for a specific purpose and a specific period. Tenure (*hyra*), leasehold (*arrende*) and site leasehold (*tomträtt*) are the most common Right of User.

A Utility Easement allows the construction and maintenance of an installation, e.g. an electric cable or a pipeline for water supply. It burdens the ownership right and is normally beneficial for a juridical person and is then considered movable property.

Profit à prendre[14] is a right to take something from another person's land. The object being taken is either the soil, the natural produce of the land, or wild animals living on it. The right to take water is normally not included in Profit à prendre, since it is regarded as an easement. Right to Electric Power (e*lkrafträtt*) is a specialisation of Profit à Pendre. Profit á pendre is an example of older legislative rights which in such are no longer granted. However, they still exist and limit the ownership right in real property and they are examples of "historic" rights that might exist due to older legislation, etc. and have to be handled when performing e.g. real property transactions.

There are not personal rights classified as appurtenances in the Swedish legal system and the class is therefore toned down somewhat in the model in figure 6.

An example of a *latent right* is expropriation, as earlier described. There are no latent rights categorized as appurtenances in the Swedish legal system. The class is therefore toned down somewhat in the model in figure 6.

Swedish property legislation allows security for payment through mortgaging, thereby imposing on the ownership right of the real property in question. Real property can also have a financial claim in another real property. A *lien* can therefore be both an appurtenance and encumbrance for ownership.

A public advantage is e.g. the granting of a dispensation from public regulations. One example is the granting of permission to build a house in restricted areas around a lake or river (*strandskydd*). Such a dispensation can be seen as an appurtenance to ownership.

Public regulations can e.g. be planning regulations which are restrictions imposed by the state or its representative. Examples are regulations in detailed plans governing e.g. the use, height or colour of specific buildings. Another example of restriction is related to activities along shorelines (*strandskydd*). Such a regulation is an encumbrance imposed on ownership.

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[14] See Tewson (1967, p. 104-105) for a general description of Profit à prendre.

6 Conclusions

Standardisation of the cadastral domain is frequently discussed today and recommendations are produced by different organisations[15]. A standardised approach towards a legal cadastral domain model can be based on a standardised categorization of ownership rights. In the beginning of this article it has been necessary to introduce a definition of the legal cadastral domain and real property in order to be able to construct a model focussing on rights. However, a proper definition of real property and other legal and non-legal parts of the cadastral domain have to be produced. Otherwise, any modelling and standardisation attempt is doomed to fail.

The model developed in this article has been developed from the first, simple model in figure 2, via a more complete model in figure 3, 4 and 5, ending in an elaborated model developed in figure 6. The reason is that the studied Swedish legislation demonstrates the existence of numerous rights and restrictions attached to the right of ownership, which has to be described in a general model. At the same time, the analysis of the Swedish legislation is the first test of the model.

The elaborated model is a classification of rights and restrictions that can be attached to the ownership right from a theoretical point of view. However, the figure does not describe who or what is executing the encumbering rights and restrictions and who or what is benefitted by the appurtenances. This can be a task for further development of the model. It might seem strange that land theoretically might exist totally without any ownership right. This is because Swedish legislation allows the existence of common property units, which is a piece of land that only exists as a right through other real properties' shares in the common property.

The development from the simple model in figure 2 to the more elaborated model in figure 6 illustrates the difficulties encountered when revealing the complexity of a nation's legal system. These difficulties have to be solved before e.g. conducting cross-border transactions of cadastral information on a detailed level. The model in figure 6 is a step towards a general categorization of ownership rights and restrictions and seems to allow the implementation of a multitude of rights and restrictions into a theoretical legal framework. It must be stressed that Swedish legislation is just one of many national legislations, and the model therefore needs to be tested on other real property legislation on an international basis and adjusted if necessary.

Real property has been recognised as vital for the development of infrastructure and good land administration (UNECE 1996). The model produced in this article visualises the complexity of the part of the cadastral domain connected to ownership rights. However, the cadastral domain model does not refer to any nation's specific body of legislation, even if it is tested on Swedish

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15 See e.g. the FIG Guide on Standardisation (FIG 2002).

legislation. The model is general and focuses on the different aspects and relations of real property related rights and restrictions with the right of ownership as a central right. When implemented into a national body of legislation, it might be necessary to specialise some classes in order to fit them into the legislative framework, but the core structure of a general model will probably remain intact and function as a basis for describing a nation's different rights and restrictions regulating the ownership of real property.

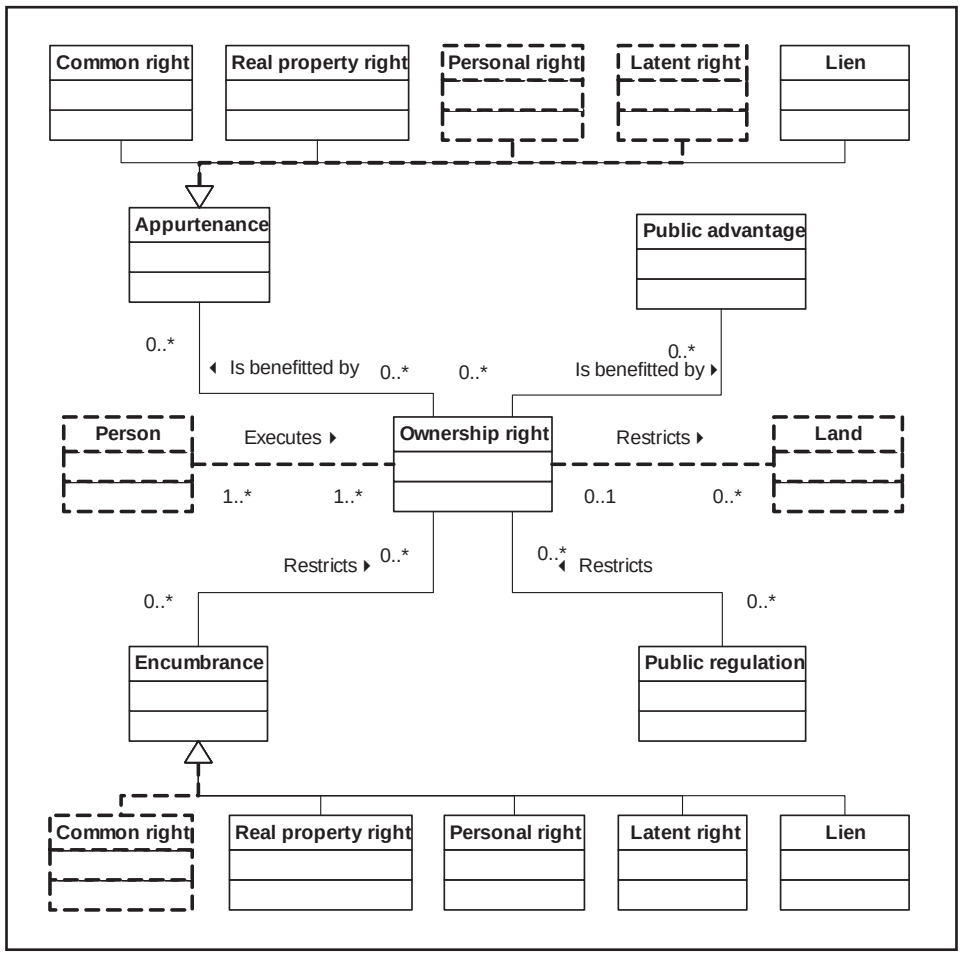

Figure 6. *The legal cadastral domain model after alterations due to Swedish real property legislation.*

Modelling the legal cadastral domain is knowledge management. Any knowledge management system may only function satisfactorily if it is properly integrated into the organisation in which it is operational (Sure 2003, p. 117). The organisation must be seen on a larger scale, incorporating all organisations

handling information described in a legal cadastral domain model. If not, a legal cadastre model will only express a biased view of the content of the cadastre with the risk of focussing on the definitions of a part of the legal complex, limited by the views of the organisation(s) participating in constructing the legal model.

It is possible to illustrate the logic of law in a general model, but it might be very difficult, even impossible, to come to a mutual agreement regarding completely harmonised rights and restrictions in cadastral legislation on an international level and the use of the same real property terms. However, such harmonisation might not be needed, as improved understanding of real property ownership and rights and restrictions regulating ownership might be a way to build a common bridge between organisations and nations towards a standardized approach describing the legal cadastral domain.

It is not important what we call the different rights and restrictions in our respective, national legislation, but if we construct a common international semantic framework much will be achieved. A semantic framework would make it possible to categorize and describe any real property right. It is my hope that the categorization of ownership rights and restrictions outlined in this article might be a step in the right direction.

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